Nutritional research at North-West University 1998-2018: Impact, scope and reach through evidence mapping

M Grundlingh

orcid.org / 0000-0002-8570-2129

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Supervisor:	Dr C Taljaard-Krugell
Co-Supervisor:	Prof J. C. Jerling
Co-Supervisor:	Dr A. Booth

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Student number:	20029179

Emaciated faces, aged long before their time,

Malnutrition of so many, while others wine and dine.

So many going hungry, while others look away,

Too many gluttonising, try to forget our heart's decay…

Visions, missions, goals and targets.

We meet and plan and dream and talk,

For governments and organisations

To be the leaders, no, the folk!

Build not in vain without the **B**uilder,

Gard as watchmen, but not for naught.

Fight for what's right where your hand finds its purpose.

Serve those around you, with **L**ove your highest thought.

In loving memory of my father, Dors Venter

1957-02-21 to 2019-08-27

Thank you Dad, for always encouraging me.

ACKNOWLEDGEMENTS

We are but sojourners instructed to do what our hands find to do and to love those we encounter. However, we are stewards of borrowed time and eternal treasures. Therefore, may the **L**ord look favourably upon the following people for serving and loving me during this time. May the work of their hands be confirmed and may He grant them entrance into **H**is kingdom, today and forever! To **J**esus, the one true king and authority, all the honour and glory, forever.

My Other Self and Greatest Fan, My Husband

André Grundlingh – even from the DRC, you know me

My Lovely Daughter

Ammi Lorraine Ester Grundlingh – Born for a time such as this!

My Mother and Siblings

Annette Venter – Thank you for caring so much

Willem Venter – Thank you for helping where you can

Buks Venter – Thank you for listening

Marina Van't Zand – Thank you for being my wonderful beautiful sister

My Esteemed Supervisors

Dr Christine Taljaard-Krugell

Prof Johann Jerling

Dr Andrew Booth

My Friends

Martin, Hariet & Nadia van der Walt; Susan Conradie; Jean & Marie du Toit Fransa, Eddie & Vida Vorster, Marida, Dian & Wian van Eeden; Nina, Jannie & Harm Brink.

ABSTRACT

Background and objectives

The growing evidence base of nutrition research provides ample evidence that could potentially inform public health nutrition related policies. Universities contribute significantly towards evidence production, often relying on student research. Research findings are often disseminated in peer-reviewed publications and utilised within the greater scientific community as well as the policy-making community. Barriers to evidence-utilisation by policy-makers require scientists to adapt presentation of available research data, of which evidence mapping is currently emerging. The aim of this study is to determine the scope, evaluate the impact, and assess the reach of nutrition research conducted by post-graduate students at the North-West University (NWU) between 1998-2018 in the context of the World Health Organisation (WHO) nutrition-related publications and the South African nutrition-related policies and programmes. Evidence maps are produced to present the results in an interactive online format.

Methods

Nutrition-related documents from the WHO and the South African government were collected to determine the nutrition landscape and categorised according to predominant themes as retrieved from the WHO. All the NWU's Nutrition and Dietetic masters and doctoral student publications (theses, dissertations and articles) from 1998 to 2018 were collected and matched to the themes to determine the scope. Citations to student publications were collected and analysed to determine the reach on international, national and government level. From the citation analysis, relative citation counts (indicating impact) were normalised to publications corresponding in sub-field and publication year. Corrections were made for time since publication and self-citation. Evidence mapping methodologies were adapted to present findings on an interactive online platform.

Results

NWU student publication performance often reached and exceeded world averages. Of degrees obtained between 1998 till 2018 post-graduate students disseminated 60.56% of degree results in the form of journal articles. Student publications corresponded to WHO and South African nutrition-related documents and exceeded the public health nutrition scope. Not only did 90.35% of student articles impact the scientific community, but 32.9% reached world average impacts for publications in corresponding sub-fields and publication dates. Owing to limited citation of source documents by the government, impact and reach of student publications could not be determined.

The results were presented, together with explanatory videos, on an online platform in the form of evidence maps (http://bit.ly/2nUDs9m_CEN1EM) for viewing and use.

Conclusion

The nutrition-related research conducted by post-graduate students at the NWU holds considerable potential in contributing to public health nutrition evidence. Nonetheless, barriers to evidence-utilisation still remain. Evidence mapping offers a means to overcome some barriers by visually presenting evidence and evidence impact. Existing evidence can be made accessible to stakeholders and decision-makers through the presentation of available evidence bases. In addition, evidence mapping methodologies can be adapted to stakeholder needs and similarly implemented in other applied fields.

Key terms: Evidence-mapping; Scientometrics; public health nutrition; nutrition policies; evidence-utilisation.

OPSOMMING

Agtergrond en doelwitte

Die toename in die voeding-navorsingbasis voorsien genoegsame uitsette wat potensieel openbare gesondheidsvoeding-beleide kan beïnvloed. Universiteite dra grootliks by tot die produksie van navorsingsuitsette, en maak gereeld op studente navorsing staat. Navorsingsuitsette word gereeld versprei deur middel van publikasies in portuurbeoordeeldetydskrifte en van daar word dit deur die breër wetenskaplike en beleidmakings gemeenskappe gebruik. Hindernisse tot die gebruik van navorsingsuitsette deur beleidmakers vereis dat wetenskaplikes die voorstelling van beskikbare navorsingsuitsette moet aanpas, waarvan navorsingsuitlegging deur middel van elektroniese kaarte tans ’n ontluikende middel is. Die doel van hierdie studie is om die omvang te bepaal, die impak te evalueer, en die reikwydte vas te stel van die voedingsnavorsing wat deur die nagraadse studente van die Noordwes Universiteit (NWU) gedoen is gedurende 1998-2018, in die konteks van die voedingsverwante dokumente van die Wêreld Gesondheid Organisasie (WGO) en Suid-Afrikaanse beleide en programme. Elektroniese kaarte is geproduseer om die resultate in ’n interaktiewe aanlyn formaat voor te stel.

Metodes

Voedingsverwante dokumente van die WGO en van die Suid Afrikaanse regering is bymekaargemaak om die voedingslandskap te bepaal, en is volgens die dominante temas verkry vanaf die WGO gekategoriseer. Die NWU se Voeding en Dieetkunde meesters en doktorale studente, vanaf 1998 tot 2018, se publikasies (verhandelinge, proefskrifte en artikels) is bymekaargemaak en teen die voedingstemas gepas om die omvang van die studies te bepaal. Aanhalings na studentepublikasies is bymekaargemaak en geanaliseer om te bepaal tot waar die publikasies gereik het, internasionaal, nasionaal of die regeringsdokumente. Die aanhalingsanalise het ’n relatiewe aanhalingstelling bepaal (wat impak aandui) wat genormaliseer is tot publikasies wat in subveld en jaar van publikasie ooreenstem. Aanpassings is gemaak vir tyd vanaf publikasie en vir self-aanhaling. Metodologieë van navorsingsuitlegging deur middel van elektroniese kaarte is aangepas om die bevindinge van die studie op ’n interaktiewe aanlyn platform voor te stel.

Hoof bevindinge

NWU studente publikasies het gereeld gelykstaande aan wêreld gemiddeld presteer en selfs die gemiddeld oorskry. Van die nagraadse grade verwerk tussen 1998 en 2018 is 60.56% van die uitsette versprei in die vorm van joernaal artikels. Die omvang van studente publikasies het

gekorrespondeer met die WGO en voedingsdokumente van die Suid-Afrikaanse regering, maar het die ook buite die bestrek van openbarevoeding geval. Op impak vlak het 90.35% van die studente artikels die wetenskaplike gemeenskap bereik, en 32.9% het die wêreld gemiddeld van impak, van ooreenstemmende publikasies binne subveld en jaar van publikasie, bereik of oorskry. As gevolg van die beperkte verwysings na bronne deur die staat kon hierdie studie nie bepaal of die studente publikasies die staat bereik het of ’n impak op beleide gehad het nie. Die resultate, met meegaande video’s ter verduideliking, is op ’n aanlyn platform geplaas in die vorm van elektroniese kaarte vir besigtiging en gebruik (http://bit.ly/2nUDs9m_CEN1EM).

Gevolgtrekking

Die voedingsverwante navorsing wat deur die nagraadse studente van die NWU uitgevoer is hou aansienlike potensiaal in om tot die navorsing rakende openbare voeding by te dra. Nietemin bestaan daar steeds hindernisse vir navorsingsuitsette-gebruik. Navorsinguitlegging deur middel van kaarte kan help om van hierdie hindernisse te oorkom, deur navorsing en navorsing-impak visueel voor te stel. Bestaande navorsing kan dan bekombaar gemaak word vir belanghebbendes en besluitmakers deur hierdie voorstelling van beskikbare navorsingsbasisse. Verder kan die metodologie van navorsingsuitlegging in elektroniese kaartformaat met gemak aangepas word volgens die behoeftes van die belanghebbendes en in soortgelyke wyse in ander toegepaste velde geïmplementeer word.

Sleutelterme: Navorsingsuitlegging deur middel van elektroniese kaarte; studie van die kwantitatiewe eienskappe van wetenskap en tegnologie in kommunikasie; openbare gesondheidsvoeding; voedings-beleide; navorsingsuitset-gebruik.

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ABBREVIATIONS

3ie	International Initiative for Impact Evaluation
ANI	Accelerating nutrition improvements in Sub-Saharan Africa
AUTHeR	Africa Unit for Transdisciplinary Health Research
CEN	Centre of Excellence for Nutrition
DoH	Department of Health
DST-NRF	Department of Science and Technology of the National Research Foundation
EBDM	Evidence-based decision-making
FAO	Food and Agriculture Organization
INP	Integrated Nutrition Programme for South Africa
MDG	Millennium Development Goals
MRC	Medical Research Council
NCD	Non-communicable diseases
NDP	National Development Plan 2030
NWU	North-West University
PEM	Protein Energy Malnutrition
PolList	List of South African public health policies, programmes and guidelines
PubData	CEN post-graduate student publication database
SA	South Africa
ScHARR	School of Health and Related Research, University of Sheffield
SDG	Sustainable Development Goals
SUN	Scaling Up Nutrition
TB	Tuberculosis
TReNDS	Training and Research in Nutrition and Dietetic Solutions
UN	United Nations
UNICEF	United Nations Children's Fund
WFP	World Food Programme
WHA	World Health Assembly
WHO	World Health Organization

GLOSSARY

Bibliometrics: "The application of mathematical and statistical methods to books and other media of communication" (Pritchard, 1969:349).

Citation analysis: "Involves counting how many times a paper or researcher is cited" (Meho, 2007:1).

Citation impact indicators: "Indicators of scientific impact that are based on an analysis of the citations received by scientific publications" (Waltman, 2016:366).

Citation impact normalisation: "The ratio of the actual number of citations of the publication and the expected number of citations of a publication" (Waltman, 2016:375).

Colloquial evidence: "evidence about resources, expert and professional opinion, political judgement, values, habits and traditions, lobbyists and pressure groups, and the particular pragmatics and contingencies of the situations" (Lomas *et al.*, 2005:1)

Context-free scientific evidence: "medically oriented, universal truths on "what works" and its effectiveness (Lomas *et al.*, 2005:3)

Context-sensitive scientific evidence: "social science-oriented, focussing on "how or whether it works" in a particular circumstance (Lomas *et al.*, 2005:3)

Department of Health: Referring to the South African National Department of Health

Epistemology: "The theory of knowledge, especially with regard to its methods, validity, and scope, and the distinction between justified belief and opinion" (Lexico, 2019a).

Evidence: "findings from research and other knowledge that may serve as a useful basis for decision making in public and health care" (Lomas *et al.*, 2005:3)

Evidence Gap Mapping: "systematic search of a broad field to identify gaps in knowledge and/or future research need that presents results in a user-friendly format" (Miake-Lye *et al.*, 2016:2)

Evidence-based public health: Note here the implicated meaning that evidence-based practices include 'evidence-informed public health: the "process of distilling and disseminating the best evidence from research, context, and experience (political, organisational) and using that evidence to inform and improve public health practice and policy". (Brownson *et al.*, 2009)

Expected number of citation of a publication: "The average number of citations of all publications in the same field (and from the same year and of the same document type)" (Waltman, 2016:375).

Health Policy and Systems Research: a multi- and interdisciplinary blend of sciences with the purpose of understanding how health systems respond and adapt to health

policies, and how health policies are and can be shapes by the health systems and broader determinants of health (WHO, 2011l).

Historical landscape analysis: the analysis of public health nutrition documents since 1994 influencing the nutrition agenda.

Knowledge economy: "using human intelligence to create value" (Agyemang, 2019:37)

Knowledge society: is based on a cycle in which "people apply available knowledge to accomplish their goals. This practical application in turn provides experiential data from which new theories can be formulated to guide future action. New theories and principles then lead to new methods and tools that translate theory into practical know-how, the pursuit of new goals, and new experience – and the cycle continues" (Senge & KIm, 2013).

Massification: "the action of promoting or enforcing uniformity in a society" (Lexico, 2019b)

Ontology: "The branch of metaphysics dealing with the nature of being" (Lexico, 2019c).

Research impact: "The contribution of research output to further scientific and technical advancement" (Abramo, 2018:595)

Scientific community: For the purpose of this study, the scientific community will be viewed as the community of researchers, both in and outside of academia, who publish in peer-reviewed academic journals or in higher education theses or dissertations.

Scientometrics: "The study of the quantitative aspects of science and technology seen as a process of communication" (Mingers & Leydesdorff, 2015:1).

Self-citations: "Citations for which the citing and the cited publication have at least one author in common" (Waltman, 2016:373).

CHAPTER 1: INTRODUCTION

1.1 Background and motivation

1.1.1 International influence on local nutrition and public health endeavours

Both scientific research and governmental endeavours are influenced by prevailing local and global issues, especially when it comes to public health and nutrition. A multitude of international bodies produce guidelines for this very purpose. When the United Nations (UN) member states pledged to meet the Millennium Development Goals (MDG) in 2000, South Africa (SA) was a signatory. At the World Health Organisation (WHO) Ministerial Summit on Health Research in Mexico City in 2004, SA contributed, along with ministers of health and representatives of 51 countries, in discussing ways in which research could contribute and strengthen health systems, especially in order to reach the MDGs (WHO, 2005b). The lessons and shortcomings experienced throughout the implementation of the MDGs were incorporated in the post-2015 Sustainable Development Goals (SDG). SA committed not only to the declarations of the MDGs and SDGs, but also to those made in the National Development plan pertaining to research, health, nutrition and policies (National Planning Commission, 2013b). It is therefore reasonable to expect these global and local issues to be addressed by local scientific research as well as governmental nutrition and health endeavours. Both researchers and policy-makers are expected to utilise evidence for such purposes.

1.1.2 Evidence and evidence-based/informed practice

The concept of *evidence* is perceived in the light of the definition presented by Lomas *et al.* (2005:3) as “findings from research and other knowledge that may serve as a useful basis for decision making in public and health care”. The WHO conceptualised three forms of evidence: colloquial, scientific evidence on context, and scientific evidence on effectiveness (Lomas *et al.*, 2005:3):

- Colloquial evidence consists of “evidence about resources, expert and professional opinion, political judgement, values, habits and traditions, lobbyists and pressure groups, and the particular pragmatics and contingencies of the situations” (Lomas *et al.*, 2005:1).
- Scientific evidence on context is context-sensitive, social science-oriented evidence focussing on “how or whether it works” in a particular circumstance (Lomas *et al.*, 2005:3).
- Scientific evidence on effectiveness consists of context-free, medically oriented, universal truths on “what works” and its effectiveness (Lomas *et al.*, 2005:3).

In the absence of scientific evidence, either on context or effectiveness, users revert to the use of colloquial evidence. Researchers and policy-makers are two separate but interdependent

communities expected to utilise scientific evidence over colloquial evidence (Lomas *et al.*, 2005). To overcome use of colloquial evidence, scientific evidence is both synthesised and utilised, resulting in growing the body of knowledge, affecting policy, and improving practice. Despite the diversity of views on what constitutes evidence, within the scientific community the utilisation of evidence occurs according to the accepted scientific process (Gilson, 2012:35) – a process that should be replicable, observable, credible and verifiable, or basically supportable (Lomas *et al.*, 2005:8). The evidence-based practice of the scientific research process is irrefutable.

1.1.3 The use of evidence for decision-making in governmental endeavours

Evidence synthesis underpins the utilisation of evidence in both medicine and policy-making. Just as scientific evidence synthesis should be evidence-based, the same should be true of public health (Brownson *et al.*, 2009:1567). The drive for evidence-based/informed practice has received an additional thrust from the multidisciplinary and interdisciplinary blend of sciences of Health Policy and Systems Research. It focusses on understanding how health systems respond and adapt to health policies, and how health policies are and can be shaped by the health systems and broader determinants of health (WHO, 2011l). Active contributors to the field comprise medical researchers, including those researching nutrition, public health and policy science, and epidemiology. The diversity of the Health Policy and Systems Research multidisciplinary team results in evidence being viewed and defined in several different ways; yet the principle of evidence-informed practice is undisputed and is evident also in health policy-making.

Despite the major role that scientific evidence plays in the policy-making processes, researchers acknowledge that scientific evidence does not drive the decision-making process (Brownson *et al.*, 2009:1576). However, both the UNICEF Triple A (UNICEF, 1990) and the Public Health Nutrition (Gibney *et al.*, 2004) cycles guide policy-makers in making evidence-informed decisions. A great deal of evidence has been produced for the alleviation of health issues, yet evidence-informed policy remains a major challenge, with limited utilisation of evidence (Atienzo de la Cruz *et al.*, 2016; Juma & Kaseje, 2017; Makkar *et al.*, 2016). The influence of scientific evidence on the policy-making process cannot, however, be ignored and barriers influencing uptake of scientific evidence in the policy process should be addressed.

1.1.4 Locally produced scientific evidence and post-graduate student contributions

Several barriers continually hinder evidence uptake in public health documents, requiring researchers to adapt their delivery of influential evidence to policy-makers. Within the South African context, several research entities provide scientific evidence on context and effectiveness with regard to public health issues. On a local tertiary institution level, the North-West University (NWU) has produced research publications that are available and might have assisted in the

decision-making processes in the past. Master's and doctoral students are being trained in research programmes with the purpose of producing scientific evidence. Post-graduate supervision is a core activity of universities and research outputs of post-graduate students often contribute in a greater way to the institutions' research outputs. The research agenda of NWU's Centre of Excellence for Nutrition (CEN) dictates the type and the potential impact of research with regard specifically to public health nutrition policy, although not limited to this field. Since 1998, the NWU has graduated nearly 120 masters and 50 doctors of Nutrition and Dietetic students. Consequently, the NWU has published internationally acknowledged work and collaborated with several different research entities on nutrition research. With scientific evidence produced to date focussing on the South African population, we would expect to see students producing high-impact scientific evidence which is subsequently featured in health policies. However, the impact of scientific evidence produced by the NWU student researchers in nutrition, i.e. master's and doctoral students, remains unevaluated, the scope undetermined, and the reach unassessed.

1.1.5 Evidence utilisation analysis

Available scientific evidence can generally be accessed through the peer-reviewed journals or university publication repositories where citation metrics are often utilised to evaluate research impact. Owing to the rapidly growing body of scientific literature, evaluation of research impact has developed into a science – bibliometrics – with scientific indicators assisting in the evaluation process (Waltman, 2016:366). These scientific indicators acknowledge evidence utilisation through, for example, uptake of and citation to research evidence. Citations are, therefore, often used as a proxy measure for the impact of research (Abramo, 2018:9; Hicks *et al.*, 2015:431). Citation analysis, within the subfield of scientometrics, is a key method of evaluating research performance. Within bibliometrics – "the application of mathematical and statistical methods to books and other media of communication" (Pritchard, 1969:349) – scientometrics concentrates on scientific research publications. It investigates "the quantitative aspects of the process of science as a communication system" (Mingers & Leydesdorff, 2015:1). By exploring and evaluating scientific research publications (Mingers & Leydesdorff, 2015:14), it centres on the core notion of citations (Mingers & Leydesdorff, 2015:2). Citation analysis as scientometric practice involves the counting of citations, assuming that important work is cited more often (Meho, 2007:32), resulting in impact classification based partly on citation counts.

Until now, no formal, standardised method, such as scientometrics in bibliometrics, has emerged as a tool to measure, reliably and with validity, the impact of scientific evidence on policy-making, (Bornmann, 2016:776; Khazragui & Hudson, 2014:59). Two methods of measuring the impact on society of scientific evidence, based on a citation equivalent, have emerged: citations in patents

(Bornmann, 2016:776; Schneider, 2007) and in clinical guidelines (Bornmann, 2016:776; Lewison & Sullivan, 2008; Thelwall & Maflahi, 2016). These methods provide a specific advantage: that patents and guidelines, like policies, are relatively freely accessible and can be evaluated with a reasonable amount of effort. Despite ambiguity, citations within public health documents could therefore similarly be assessed to indicate a level of research impact (Newson *et al.*, 2018:11). Applying such methods might assist in the analysis of the uptake of scientific evidence by public health documents.

1.1.6 Evidence mapping as a tool for overcoming barriers to evidence uptake

In spite of publicly available scientific research evidence, many South African policy-makers report scientific evidence as being unavailable, inaccessible, not applicable or time consuming (Naude *et al.*, 2015:7). The reported "difficult and vexed" process of policy-making might be asking for an alternative research presentation (Naude *et al.*, 2015:7). A new visually engaging method called Evidence Mapping or Evidence Gap Mapping has been described as a "systematic search of a broad field to identify gaps in knowledge and/or future research needs that presents results in a user-friendly format" (Miake-Lye *et al.*, 2016:2). Some examples of these evidence maps can be found online. One group, the International Initiative for Impact Evaluation (3ie), is an international initiative for impact assessment and has produced several evidence maps, including agricultural innovation, social, behavioural and community engagement interventions. Although much scrutiny is needed to assess this method of research (Miake-Lye *et al.*, 2016:2), it has been used in several fields, but especially in order to inform policy-makers. In South Africa, the government department of Planning, Monitoring and Evaluation (2016) has already started using these maps in order to better support their policy-makers. Mapping available scientific evidence on nutritional health policies might be an indication of the evidence uptake within the South African context.

1.2 Problem statement

Since the start of democracy in South Africa, the drive for social justice has contributed to addressing previous inequalities relating to public health and nutrition. Several governmental initiatives have been implemented to address many of the nutrition-related issues. To help with such endeavours, the international health community has been identifying and providing guidance to governments. Concurrently, research by South African universities and research entities has been expanding on the wealth of knowledge relating to public health and nutrition, providing evidence for interventions within the South African context. However, inequalities of the past are still being rectified while new nutritional issues arise. Malnutrition in South Africa, especially undernutrition, still persists (Department of Health, 2017c; International Food Policy Research Institute, 2016:120; Said-Mohamed *et al.*, 2015:7), while overnutrition and non-communicable

diseases (NCD) are on the rise. Nutrition interventions addressing these issues are assumed to be more effective where relevant scientific evidence is utilised in decision-making. Utilisation of scientific evidence, however, is difficult to measure, but when defined as uptake within documents and properly cited, citation analysis can be implemented to determine a level of research impact. Research impact is here perceived as "the contribution of research outputs to further scientific and technical advancement" (Abramo, 2018:595).

The NWU has been guiding post-graduate nutrition students in contributing to the body of research evidence addressing nutrition-related issues either directly or indirectly; however, it is not clear to what extent the post-graduate student publications have impacted subsequent scientific research and government publications.

1.3 Thesis statement

Mapping the impact scope and reach of post-graduate research evidence on prevailing nutrition-related public health questions in a user-friendly format will provide valuable information regarding gaps in, and shortcomings of, produced evidence and utilisation of relevant evidence. In order to do this, the impact will need to be evaluated and the reached assessed by means of evidence uptake in scientific and public health documents. In addition, it could also indicate the extent to which higher education is achieving its purposes of supervising post-graduate students and producing influential research evidence.

Such mapping could assist in strategically redirecting the research agenda of the post-graduate students of CEN towards providing local support for policy processes as part of their tertiary studies, instead of primarily relying on international data. Therefore, determining the nutritional health landscape over the past two decades would indicate the background against which research and policy could have developed at the NWU. Plotting published evidence on the landscape would indicate the scope of the evidence produced by the students. By means of scientometric citation impact analysis, the students' published works could be evaluated. Finally, assessing research evidence uptake by means of citation analysis within policy documents might provide an indication of the reach of evidence. Presenting findings in a user-friendly, visually stimulating way might guide a bigger audience in understanding and utilising available research, or determine gaps to be filled with further scientific research.

1.4 Study aim

The aim of this study is to determine the scope, evaluate the impact, and assess the reach of nutrition research conducted by post-graduate students at the NWU between 1998-2018 in the

context of the WHO nutrition-related publications and the South African nutrition-related policies and programmes. For an overview of the objectives, see **Figure 1-1**.

1.5 Objectives of the study

1. Identify, per annum since 1994, WHO and South African nutrition-specific guidelines, policies and programmes, performing a historical nutrition landscape analysis.
2. Following on objective 1, categorise the documents according to the predominant themes as determined by the WHO nutrition themes.
3. Identify and catalogue, since 1998, all nutrition research outputs of students obtaining an MSc or PhD degree in Nutrition or Dietetics at the NWU. Nutrition research outputs will be grouped in 1) theses and dissertations, and 2) peer-reviewed journal articles.
4. To determine the scope of the research, categorise the research outputs per group (as identified in objective 3) according to the research theme (as identified in objective 2) they addressed.
5. To evaluate the impact and assess the reach, conduct a citation analysis on all research outputs (as identified in objective 3) and tabulate citations by 1) the scientific community and 2) South African nutrition-related policies and programmes.
6. Map all research outputs to predominant research priorities/areas since 1998, indicating citation results (as identified in objective 5).

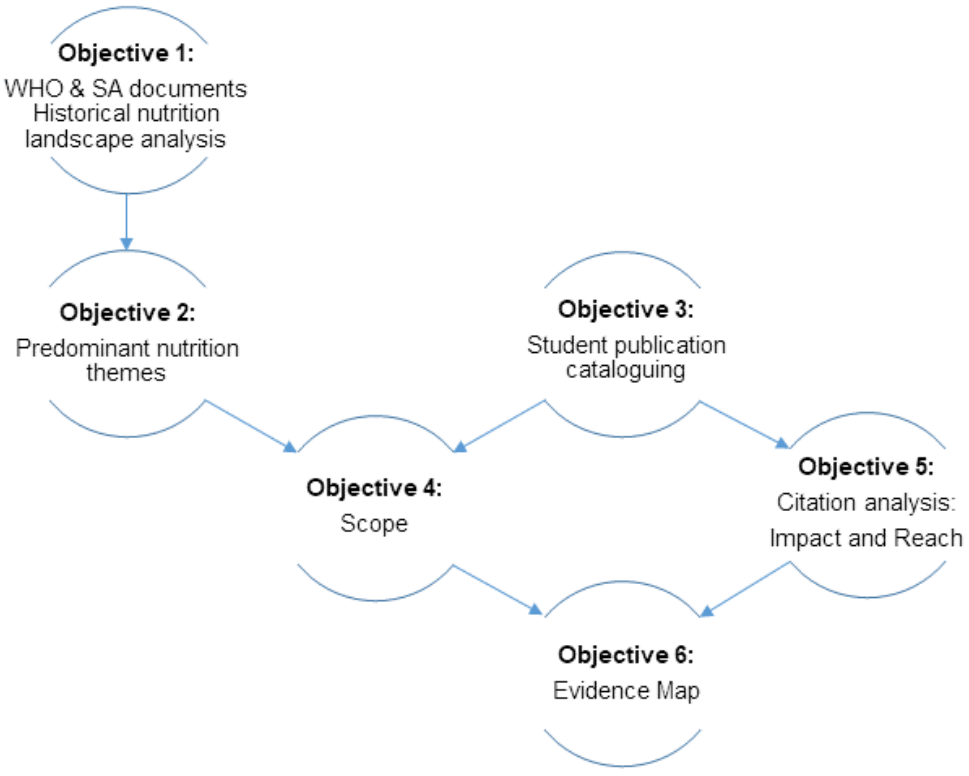


Figure 1-1: Diagram of study objectives

1.6 Research team

Table 1-1: Research team, supervisory persons, and consultants

Individual	Affiliation	Role
Mrs M Grundlingh, (MSc candidate)	CEN – NWU	Developing the evidence mapping idea, and planning and executing the study. Performing the landscape analysis, data collecting and cataloguing, performing the scientometrics analysis and visualising the results. Writing the mini-dissertation.
Dr C. Taljaard-Krugell	CEN – NWU	Study supervisor who conceptualized the idea of locally creating an EM
Prof JC Jerling	CEN – NWU	Co-supervisor
Dr A. Booth	ScHARR	Co-supervisor

CEN - Centre for Excellence for Nutrition; NWU - North West-University; ScHARR - School of Health and Related Research, University of Sheffield; UWC - University of the Western Cape

1.7 Structure of this mini-dissertation

This mini-dissertation serves in part as the completion of the MSc degree in Dietetics. It is written in chapter format, presented in five chapters, with the addition of interactive electronic maps and videos to guide the reading of the maps. In **chapter one** the background and motivation for the study are presented, along with the aim and objectives. The research team is identified and the structure of the dissertation described. **Chapter two** presents the literature review for evidence utilisation. Firstly, a historical overview of the nutrition agenda is presented, as influenced by nutrition research throughout recent history. Thereafter, a brief history of the nutrition agenda in the South African context is given followed by a brief look at nutrition research by institutions of higher education. Secondly, utilisation of nutrition research evidence is discussed in the light of Health Policy and Systems Research. The context of Health Policy and Systems Research is given, followed by an outline of what research evidence is and how it is utilised by public health decision makers as well as individuals of the scientific community. The empirical study of evidence utilisation by means of publication citation counts is then unpacked. The field of scientometrics is presented. Lastly, an alternative form of evidence presentation is discussed – that of evidence mapping. In **chapter three,** the research methods are presented. The methods for the completion of each objective are discussed: the extraction and collection (objective 1-3) and cataloguing (objective 4) of data as well as the citation analysis (objective 5) and the compiling of the evidence map (objective 6). Thereafter, **chapter four** provides the results of the different objectives. Since an Evidence Map has the purpose of presenting data in a user-friendly format, the results are presented in electronic format at the following online URL: http://bit.ly/2nUDs9m_CEN1EM. However, in order to present the data in printed format, the data presentation differs slightly.

Chapter five concludes with a discussion and conclusion to the study, as well as recommendations for future research. Finally, because of the large number of documents cited within this study, especially those included in the analysis, one single bibliography will be presented at the end of this document.

1.8 Ethical considerations

During this study no contact with living individuals were made. A minimal risk was estimated from this single study as the results might have an impact of the reputation of CEN. However, the study protocol was submitted to the Health Research Ethics Committee of the Faculty of Health Sciences of the North West University, Potchefstroom, South Africa. Ethical clearance was given with an assigned ethical reference number NWU-00319-20-A1.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter will be looking into the current dynamics of nutrition research, evidence synthesis and research publication, evidence utilisation, and evidence communication. It will probe these aspects by means of a literature review relating to evidence utilisation. First, an historical overview will present a narrative for the nutrition agenda, followed by the nutrition agenda on SA and the contributions made by its institutions. Second, the utilisation of nutrition research evidence will be discussed in the light of Health Policy and Systems Research, followed by an outline of what research evidence is and how it is utilised. The empirical study of scientometrics and citation counts is then unpacked. Lastly, evidence mapping provides the possibility of presenting a very broad overview of the available evidence base.

2.2 Public Health: The Nutrition Agenda

2.2.1 Nutrition Science and its Role in Public Health: A History

Religion, emergencies and crises, war, transitions, famine, poverty, and even affluence, are reasons why people consume food in certain ways. Some of these can be avoided, but none of these should be a cause for people to suffer or even die because of malnutrition. History presents some of these cases which tragically result in the deaths of many people. Despite many efforts, people today still suffer from malnutrition. In an effort to curb the number of people suffering from malnutrition, many have sought ways to address it. Nutrition research has played its role over time to assist in addressing malnutrition. Currently, the emphasis on development and sustainability across the globe has guided some governments to change their strategies regarding addressing malnutrition and public health (Quantz *et al.*, 2017:e260). Again, nutrition research has contributed to this change by revealing certain underlying conditions. The following section will show the history of nutrition research and the influence it has had on the public health agenda.

2.2.1.1 Ancient and modern nutrition science

Although nutrition research, practised as a science to address ill health, goes back to ancient civilisations, modern nutrition science is surprisingly young. As early as 2500 BC, Babylonian history records nutrition advice to avoid onions for three days if “one was suffering from pain inside” (Payne-Palacio & Canter, 2011:3). Around 400 BC, Hippocrates admonished, “Let thy food be thy medicine and thy medicine be thy food”. It was only at the time of the enlightenment in 1746, when Dr James Lind observed scurvy, that some of the first systematic research in the field of nutrition was conducted (Carpenter, 2003a:643). The concept of metabolism was discovered

in 1770 (Carpenter, 2003a:638) and the components of food and their possible association with health, by the 19th century. During the same time, evidence-based medicine had its philosophical origins and became the precursor to evidence-based (and later evidence-informed) decision-making (Sackett, 1997:3). The role of good nutrition was accepted in the United States by the late 19th century and by 1919, after World War I, dietitians were included in hospital staff. By 1936, the League of Nations, predecessor of the UN, appointed the Mixed Committee on Nutrition (Van Rensburg & Harrison, 1995). This international committee was set up under the 1935 assembly to study the problem of nutrition, and consisted of agriculture, economic and health experts and included representatives of the Advisory Committee on Social Questions, the International Labour Organisation and the International Institute of Agriculture (League of Nations, 1937). At that time, it recommended national nutrition councils to all countries for the coordination of all nutrition aspects.

2.2.1.2 Vitamins, macronutrients, and fortification

Nutrition research increased exponentially from the start of the 20th century. The era of vitamins, 1910-1950, was shaped by worldwide deficiencies caused by wartime food limitations alongside the Great Depression (Mozaffarian *et al.*, 2018:1). The knowledge attained during this era resulted in deficiency diseases being addressed, and by the end of this era, the first Recommended Dietary Allowances were created in the United States (Mozaffarian *et al.*, 2018:1). The discovery and isolation of vitamins resulted in the concept and practice of supplementation and fortification (Carpenter, 2003b:30). Between the 1950s and 1970s, nutrition science focussed on the fortification of foods, alongside the question of fat versus sugar as a cause of heart disease (Mozaffarian *et al.*, 2018:2). Ultimately, the emphasis on fat resulted in staple foods being refined to increase caloric content and fortified to increase micronutrient content. Progress in research methodology and the scope of nutrition evidence in informing nutrition research resulted in staggering numbers of publications from as early as 1961 (Mozaffarian, 2017:2). Consequently, between 1970 and 1990, the public health and nutrition research agenda in developing countries focussed on hunger, micronutrient deficiency and related fortification strategies, while developed countries also included chronic diseases.

2.2.1.3 Initial organisations concerned with nutrition

As nutrition research continued to reveal forms of malnutrition, organisations were established to address, investigate, guide, or legislate on nutrition-related public health affairs. The UN played a significant role in the establishment of many of these organisations. In 1945 the Food and Agriculture Organisation (FAO) was established by the UN to eliminate hunger and improve nutrition and standards of living by increasing agricultural activity (Mingst, 2006). In 1946, the

United Nations International Children's Emergency Fund (now United Nations Children's Fund, UNICEF) was established to provide relief to children after World War II. Shortly thereafter, its efforts were directed to the general improvement of children's welfare, particularly in developing countries or in emergency situations (Mingst, 2019). By 1948, the World Health Organization (WHO) was established by the UN to further the assistance of international public health conditions. Priority was given to communicable diseases such as malaria and tuberculosis (TB), but also to the health, sanitation and nutrition of women and children. By 1960, nutrition research had shifted from vitamins to protein deficiency in the diet and the FAO indicated that it was "the most serious and widespread problem in the world" at that time (Carpenter, 2003c:336). In a further effort to alleviate world hunger, the UN established the World Food Programme (WFP) in 1961 (Mingst, 2011). Organisations like these were thus established to expose and address nutrition-related public health issues. Nutrition research often both informed and was informed by the choices and statements of such organisations.

2.2.1.4 International nutrition concerns, initiatives and role players over the past three decades

The nutrition agenda has undergone further drastic changes over the past four decades. Within developed countries, dietary guidelines were in place by the 1980s to address not only nutrient deficiencies, but also chronic diseases (Mozaffarian, 2017:4). By the turn of the 20th century, food patterns instead of single nutrients were identified and researched to further address these chronic diseases in developed countries. Conversely, the agenda of developing countries became increasingly burdened. At the start of the 1990s, hunger, together with micronutrient deficiency, was the primary focus and received global attention. The Micronutrient Initiative (now Nutrition International) was established in 1992 to address micronutrient malnutrition (Nutrition International, 2017), and in 1995 the Ottawa Forum was held to discuss food fortification (Micronutrient Initiative, 1996:4), while in 1997, the global Vitamin A Initiative was born (UNICEF, 1997:3). Adding to the hunger and micronutrient deficiency of developing countries was the burden caused by infectious diseases, including HIV, AIDS and TB. By 2000, the effects of demographic transitions were evident in the increased prevalence of lifestyle-related NCD.

By the year 2000, the UN and world leaders took action and adopted the UN Millennium Declaration, where countries committed themselves to reducing extreme poverty. This resulted in the eight Millennium Development Goals (MDG), with targeted deadlines by 2015 (United Nations, 2015). These also included certain nutrition-related issues, including addressing malnutrition by working towards eradicating extreme poverty and hunger, reducing child mortality and improving maternal health by addressing undernutrition and improving the general health of those living with diseases. However, during this time the increase in nutrition-related NCD was of

great concern. In 2013 a systematic review on global overweight and obesity prevalence in children and adults during 1980-2013 indicated 47.1% and 27.5% increases in overweight/obesity for children and adults respectively (Ng *et al.*, 2014:770). The coexistence of obesity and other diet-related non-communicable chronic diseases with undernutrition is termed a double burden of disease. In 2014 the WHO declared that the double burden of disease was an important public health issue, especially as the obesity epidemic spread worldwide (Min *et al.*, 2018:57).

The growing double burden of malnutrition led to the endorsement in 2012 by the World Health Assembly (WHA), the decision-making body of the WHO, of the Comprehensive Implementation Plan on Maternal, Infant and Young Child Nutrition. It consisted of six areas of concern: stunting and wasting of children under 5, the obesity epidemic, anaemia in women of reproductive age, low birth weight of babies, and low rates of exclusive breastfeeding (Branca *et al.*, 2015:55). The following global targets for 2025 were consequently set by the WHA for improving maternal, infant and young child nutrition (WHO, 2014e:7-9):

1. A 40% reduction in the number of children under 5 who are stunted.
2. A 50% reduction of anaemia in women of reproductive age.
3. A 30% reduction in low birth weight.
4. No incidence of childhood obesity.
5. An increase in the rate of exclusive breastfeeding in the first 6 months of up to at least 50%.
6. The reduction and maintenance of childhood wasting to less than 5%.

These nutrition-specific targets of the WHA, along with the efforts to achieve the MDGs, contributed to the effort to alleviate world malnutrition. *Adjustments to these targets have been suggested in light of the SDG and new data available (Branca et al., 2015:12)*. Yet despite the unprecedented efforts to meet the needs of the world's poorest (United Nations, 2015), many countries still suffered a single, double or triple burden of malnutrition. **Figure 2-1** provides some figures for countries which, by 2017, were facing a single, double and triple burden of malnutrition.

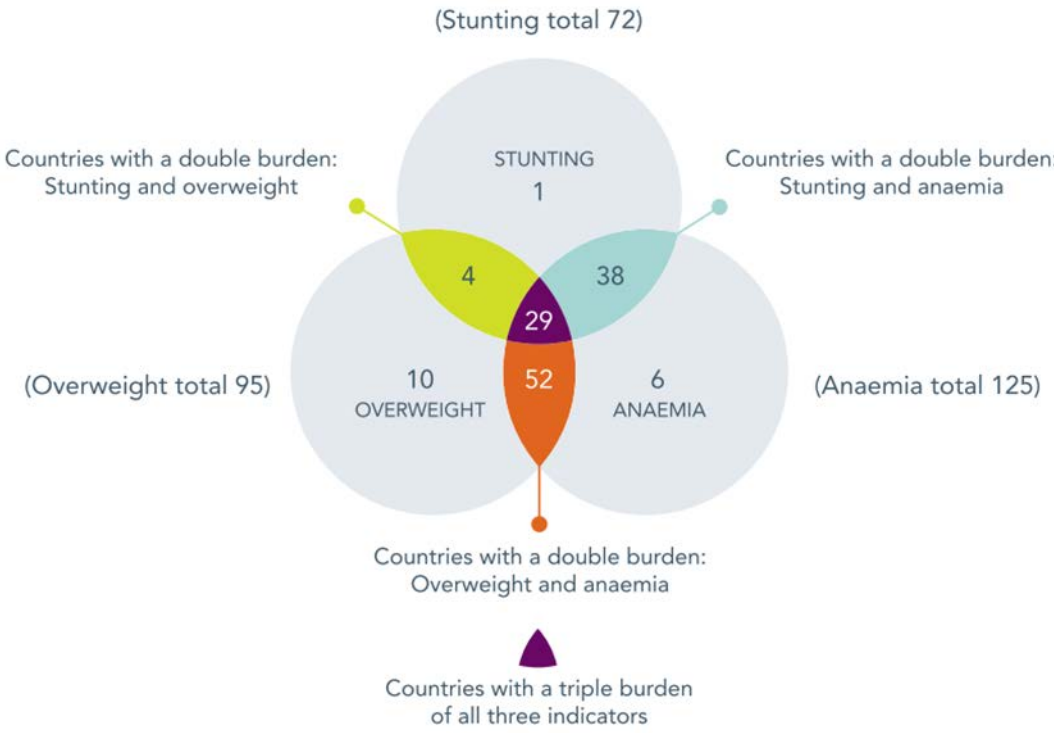


Figure 2-1: Number of countries in 2017 which faced a single, double or triple burden of malnutrition (adapted from Development Initiatives (2017:17))

To build on the momentum generated by the MDGs, world leaders adopted 17 SDGs in 2015, with 169 targets to be reached by 2030 (United Nations, 2018). The SDGs aim to “end all forms of poverty, fight inequalities and tackle climate change, while ensuring that no one is left behind” (United Nations, 2018). Improved nutrition is essential in reaching the SDGs, as it lies at the heart of these goals. **Figure 2-2** shows how central nutrition is to the goals.

Because nutrition plays such an integral part in achieving the SDGs, the UN General Assembly agreed on a resolution and proclaimed the UN Decade of Action on Nutrition 2016-2025. The resolution specifically aimed to “trigger intensified action to end hunger and eradicate malnutrition worldwide, and ensure universal access to healthier and more sustainable diets – for all people, whoever they are and wherever they live” (WHO, 2016f). Governments were called upon to plan and work towards achieving national nutrition targets for 2025 based on internationally agreed indicators, the Global targets 2025 of the WHA.

Figure 2-2: Nutrition at the heart of the Strategic Development Goals (adapted from Sight and Life (2015:8))

During the same time as the MDGs and SDGs were taking effect, the persistent undernutrition which obstructs the reach of these goals (Shekar *et al.*, 2006:ix) caught the attention of the World Bank and its key partners and governments. As a result, in 2010 the Scaling Up Nutrition (SUN) Movement was launched at the World Bank in order to contribute to the vision that by 2030 the world would be free of malnutrition in all its forms (SUN Movement, 2015). The World Bank Group commits itself to supporting client countries by "building the knowledge base, providing technical assistance for policy/program design and prioritization, and financing the scale-up evidence-based nutrition interventions" (The World Bank, 2018). The SUN movement, led by the countries' governments, "unite people – from civil society, the UN, donors, businesses and researchers – in a collective effort to improve nutrition" (SUN Movement, 2015). The WHA Global targets 2025 have also been adopted by the SUN movement. Many countries of the world, developed and developing, transitioning and industrialised, are working to improve public health.

Looking back, it is clear that public health nutrition has developed from individuals investigating nutrition-related phenomena to organisations involved in evidence-based/informed policies and guidelines and now into a global nutrition agenda which can no longer be ignored. Whether malnutrition affects one person or a whole population, nutrition research enlightens and guides

policymakers to address it for the improvement of public health. This is as true now, in a time of globalised focus on development and sustainability as it was when scurvy plagued the sailors, when nutrient deficiencies caused blindness during the war, and when millions of children died due to protein-energy malnutrition (PEM).

In **Figure 2-3**, a summary is given of the development of nutrition science, of the initial international role players, as well as of subsequent events and the initiatives currently driving the nutrition agenda.

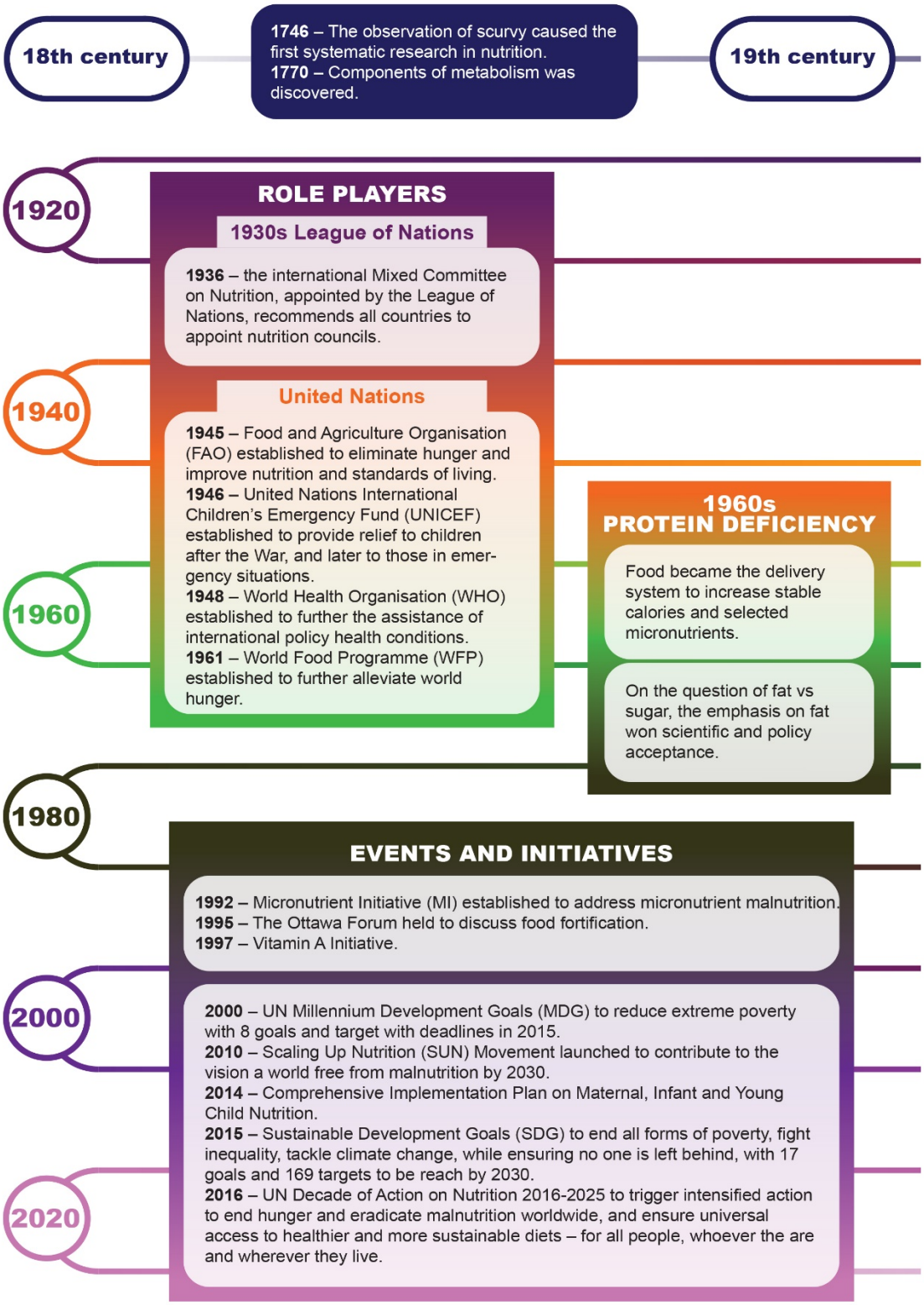
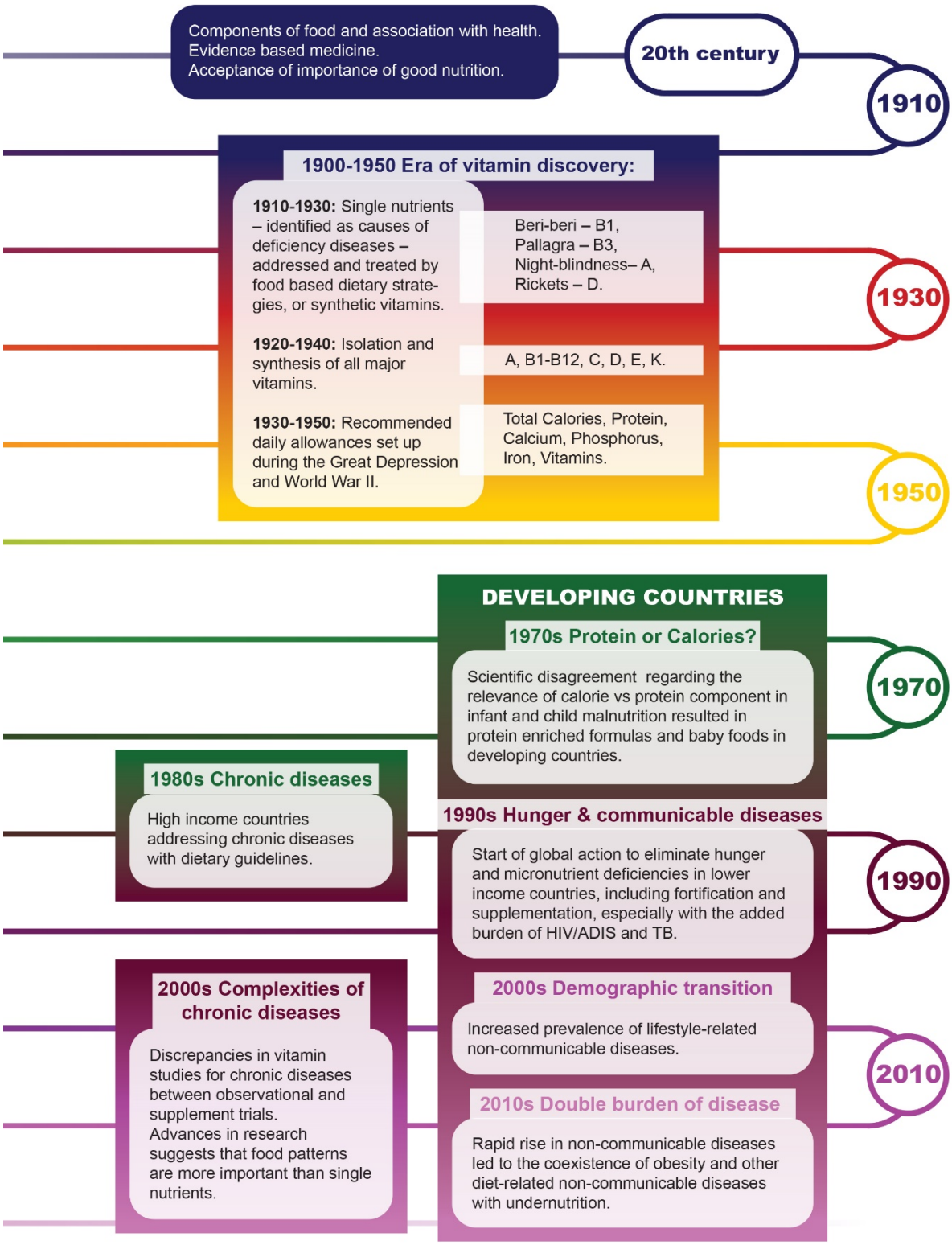


Figure 2-3: A global nutrition timeline and involved UN role-players (adapted from Mozaffarian *et al.* (2018:2))


Components of food and association with health.
Evidence based medicine.
Acceptance of importance of good nutrition.
20th century
1910
1900-1950 Era of vitamin discovery:
1910-1930: Single nutrients – identified as causes of deficiency diseases – addressed and treated by food based dietary strategies, or synthetic vitamins.
Beri-beri – B1,
Pallagra – B3,
Night-blindness– A,
Rickets – D.
1930
1920-1940: Isolation and synthesis of all major vitamins.
A, B1-B12, C, D, E, K.
1930-1950: Recommended daily allowances set up during the Great Depression and World War II.
Total Calories, Protein, Calcium, Phosphorus, Iron, Vitamins.
1950
DEVELOPING COUNTRIES
1970s Protein or Calories?
Scientific disagreement regarding the relevance of calorie vs protein component in infant and child malnutrition resulted in protein enriched formulas and baby foods in developing countries.
1970
1980s Chronic diseases
High income countries addressing chronic diseases with dietary guidelines.
1990s Hunger & communicable diseases
Start of global action to eliminate hunger and micronutrient deficiencies in lower income countries, including fortification and supplementation, especially with the added burden of HIV/ADIS and TB.
1990
2000s Complexities of chronic diseases
Discrepancies in vitamin studies for chronic diseases between observational and supplement trials.
Advances in research suggests that food patterns are more important than single nutrients.
2000s Demographic transition
Increased prevalence of lifestyle-related non-communicable diseases.
2010s Double burden of disease
Rapid rise in non-communicable diseases led to the coexistence of obesity and other diet-related non-communicable diseases with undernutrition.
2010

2.2.2 National Nutrition Agenda: South Africa

The nutrition agenda in SA had a slow start and, despite the radical interventions during the 1990s, it is still failing to reach the goals of eradicating hunger and malnutrition. The comings and goings of nutrition departments and councils, schemes and interventions, programmes and policies, all contribute to changing perceptions of the significance of nutrition, health, hunger and malnutrition (Van Rensburg & Harrison, 1995:4). Some historic events are mentioned below.

The earlier South African nutrition schemes, interventions and efforts had a limited scope in addressing public nutrition-related issues (Behr, 2008:36) despite sufficient cause for concern. About 80 years ago, in 1938, epidemiological research initiated by the then Deputy Chief Medical Officer of the South African Union provided baseline evidence on the majority of the South African Bantu children. The evidence exposed the severity of the children's nutritional condition. In the words of the researchers: "the thin, round-shouldered, flat-chested, pot-bellied child with spiny legs was such a common sight… many were on the borders of starvation" (Kark & Le Riche, 1940). "The problem is thus not only one of providing this or that particular food factor, but rather a need for a general increase of all foodstuffs… averting starvation as well as the many more specific deficiency diseases" (Kark & Le Riche, 1940).

In the same year, the country implemented the 1936 League of Nations Committee on Nutrition's recommendation for national nutrition councils (Van Rensburg & Harrison, 1995:3). Subsequently, the National Nutrition Council conducted investigations, undertook research and implemented diverse strategies for the promotion and improvement of nutrition. However, the black citizens were often excluded from these strategies and schemes and thus their nutrition health needs were not addressed. In 1951, the Ministry of Health established a Department of Nutrition which aimed at improving food production and diet quality. Unfortunately, by 1960, both the Department of Nutrition and National Nutrition council were terminated, partly reflecting the fact that malnutrition was no longer perceived as a significant political concern (Van Rensburg & Harrison, 1995:4).

Research continued in the background as the then government conveniently ignored the growing public health concern. A. R. P. Walker, Tom Bothwell and others continued between the 1950s and 1970s to conduct nutrition research specifically pertaining to the changing nutritional status of the South African population (Ehrlich *et al.*, 2015:9). In 1957, SA saw the birth of its nutrition society, the NSSA (The Nutrition Society of South Africa, 2018), still active today. Its mission, "to provide leadership and mentorship, based on appropriate research, in policy formulation, education and training, and practice of nutrition through advocacy and dissemination of information", still drives the society today (The Nutrition Society of South Africa, 2018). The

research-based foundation of the society highlights acknowledgement of the value of evidence-based/informed practice. It did, however, take a significant period of time to influence public health practice. In addition, much of the epidemiological research up until the 1980s steered away from confronting the social disease of apartheid. Epidemiological studies since then have displayed a strong social orientation with comparisons between population groups and social classes.

Meanwhile, in the 1970s, international focus on hunger prompted the South African Department of Health (DoH) to take action. It initiated the PEM scheme, yet provided assistance primarily to the white population (Behr, 2008:36). Between the 1970s and 1980s the DoH used nutrition education as the dominant nutrition-related intervention, specifically focussing on lifestyle diseases of the affluent white population. By the 1980s, several studies exposed the way the apartheid policies had shaped the health of different population groups (Ehrlich *et al.*, 2015:9). This included gross health resource inequalities, immunisation differences, and other health status differences. Activist researchers behind exposing these inequalities contributed to the 1990 Maputo Conference, marking the change in direction towards the planning of a new public health system in SA (Critical Health & The Maputo Conference Co-ordinating Committee, 1990:21).

It was only after 1990 that public health became an acknowledged and supported field of practice and that the government began to address poverty more comprehensively. Specific public health research areas have emerged at universities, the Medical Research Council (MRC) and elsewhere. Simultaneously, the government addressed poverty, initially and primarily by means of the Nutrition Development Programme and National Nutrition (NNSDP) and Social Development Programme in 1991 (Behr, 2008:36). These relief programmes were integrated with others in the 1992 NNSDP, a programme which actively incorporated community participation (Behr, 2008:37) and included citizens of all groups.

By the end of Apartheid in 1994, Nkosazana Dlamini-Zuma, the Minister of Health, appointed the Nutrition Committee for the development of a nutrition strategy (Department of Health, 1997), and poverty became a key government issue (Behr, 2008:38). Along with the democratic government came other interventions, like a school nutrition programme, salt iodisation, food fortification, growth monitoring and promotion and several other. These interventions focussed on previously unaddressed yet evident public health issues.

These and other interventions have been implemented, changed and some scientifically assessed to evaluate effectiveness. For instance, by 1996, malnutrition intervention programmes included the NNSDP, the PEM Food Scheme for children 0-5 years and the Primary School Nutrition Programme (PSNP). Shortly after this, all three of these were replaced by the more inclusive Integrated Nutrition Programme (INP) for SA (Behr, 2008:39). The different key

performance areas of the INP have been evaluated and assessed by several researchers over time (Brits *et al.*, 2017; Iversen *et al.*, 2012; Steyn & Labadarios, 2002).

2.2.2.1 Persistent malnutrition as evidence-based public health problem

Other examples of the interaction between scientific evidence and the addressing of nutrition and public health issues can be found in persistent undernutrition and the simultaneous rise of NCDs in SA in the years that followed.

At the start of the South African democracy, the main nutrition issue seemed to be undernutrition. Vorster *et al.* (1997), as part of the Nutrition Research Group of the Potchefstroom University for Christian Higher Education, presented a narrative review of the nutritional status of SA from 1975-1996, identifying possible causes of the then prevalence of malnutrition. The shortcomings of data during that time (1975-1996) were a limitation of the review and highlighted the lack of government and research focus on instances of malnutrition. It did, however, show the nutrition problems occurring in specific vulnerable groups and in certain geographical areas. Stunting, due to chronic undernutrition in pre- and primary school children, along with micronutrient deficiencies in all age groups was prevalent, with rural black and coloured communities shown to be the most vulnerable (Vorster *et al.*, 1997:ii). During this time, undernutrition became a main focus of government interventions and, by the year 2000, 171 433 (1.4%) deaths were due to PEM (Bradshaw *et al.*, 2003:685). The Bradshaw research team, consisting of researchers from the MRC and the University of Cape Town, identified the unique quadruple burden of disease experienced in SA (Bradshaw *et al.*, 2003:687). They concluded that the quadruple burden consisted of a combination of poverty-related conditions and pre-transition diseases, the emergence of chronic diseases, injuries, and HIV/AIDS. Changing political, social and economic factors contributed to increased urbanisation, as well as changes in health and dietary behaviours. During the early stages of the transition from apartheid to democracy, urbanisation drastically increased the incidence of NCD. As early as 2000, researchers from the Potchefstroom University and the University of Southampton linked hypertension to urbanisation (Van Rooyen *et al.*, 2000). Shortly thereafter, researchers from the Potchefstroom University showed an increase in NCD in Black South Africans in the process of urbanisation (Vorster, 2002:240).

Nearly a decade later, during the time of the MDGs in 2007, it was shown by Faber and Wenhold (2007:398) from the MRC and University of Pretoria in their review on nutrition in contemporary SA that chronic malnutrition, rather than acute malnutrition, was still the major problem. In their review of the then-available anthropometric studies of the South African population, Faber and Wenhold (2007:394) indicated that malnutrition starts prior to the introduction of complementary feeding, even as early as pre-conception, increasing the risk of stunting and underweight by the

age of two, resulting in an increased risk of overweight and obesity in later life. Micronutrient malnutrition had affected children in rural areas, while adult female obesity was shown to be high in both urban and rural areas (Faber & Wenhold, 2007:394). This occurred despite government strategies to increase food security[1], to provide emergency relief[2], to reduce infection[3] and deficiencies[4] in infants, and to educate the public on food choices[5]. In addition, the universities of Cape Town, KwaZulu Natal, Witwatersrand and the MRC indicated that the increased burden on the health care system due to the rise in NCDs required improved integrated care interventions (Mayosi *et al.*, 2009).

In 2018, a further decade later, malnutrition persisted, as SA was on track for only two SDGs (Development Initiatives, 2018:132). Reports from the Global Nutrition Report 2016 and the DoH 2017 respectively indicated that children under 5 were still stunted (23.9%, 27%), underweight (12%) and wasted (4.7%, 5%) (Department of Health, 2017c; International Food Policy Research Institute, 2016:120; Said-Mohamed *et al.*, 2015:7)**.** Although the country was on course in 2016 in addressing wasting, this was not the case with stunting (International Food Policy Research Institute, 2016:121), and the malnutrition of children remains an issue.

The causes of malnutrition in children have been shown to be connected with food insecurity. The Children Programme of Research at the Department of Science and Technology of the National Research Foundation (DST-NRF) Centre of Excellence in Food Security noted that this included inadequate access to food as a result of high levels of poverty and inequality; low levels of dietary diversity, education and breastfeeding; poor nutrition; and unhealthy environments (Devereux & Waidler, 2017). Devereux and Waidler (2017), also from the DST-NRF Centre of Excellence in Food Security, found only a minimal improvement in children's nutritional status since 1990, indicating that food insecurity in SA persists.

Between 1993 and 2008, food security might have improved, but "the nutrition status of children has stagnated or improved only marginally" (Devereux & Waidler, 2017). Devereux and Waidler deduced that stunting rates were most probably higher in 2008 than in 1993 (Devereux & Waidler, 2017). From the recent General Household Survey of 2017, Statistics South Africa reported that, despite the country having food security on a national level, it is still food-insecure at a household level (Statistics South Africa, 2019:24). During 2017, almost 20% of South African households

[1] like the 1998 Child Support Grant, the 2002 Integrated Food Security Strategy, and the 2002 Integrated Food Security and Nutrition Programme
[2] like the Emergency Relief Programme, and the provision of food parcels
[3] like the 2002 Prevention of Mother to Child Transmission
[4] 2002 Vitamin A supplementation
[5] 2003 Food-Based Dietary Guidelines

had inadequate or severely inadequate access to food while 1.6 million households experienced hunger (Statistics South Africa, 2019:24).

Despite many efforts since the start of democracy, efforts by government, academia and other research entities, SA continues to experience several forms of malnutrition. Yet some progress has been made, progress evident as a result of nutrition research which demonstrates the interaction between different role players within society. As can be seen, the international nutrition community has been influencing South African public health nutrition from the start. In an effort to address public health issues, local government, research entities and universities have all contributed to the creation of relevant research evidence. Of these, universities have an important role to play, especially in the light of the changing global economy. In the following section, South African higher education is discussed, especially in the context of the increasingly important role it will need to play in the future of both the economy and public nutrition.

2.2.3 Nutrition Research at Institutions of Higher Education

2.2.3.1 South African Higher Education

To better understand how institutions of higher education in SA hold the potential to influence the nutritional status of the people of South Africa, the context of higher education in SA will be discussed. Tertiary institutions within SA face a double burden: that of overcoming the existing social injustices of the past in the developing democratic society and of overcoming the challenges arising from the constructing of a knowledge economy (Naidoo, 2003; Shanyanana & Ndofirepi, 2015). The concern is whether the institutions of higher education can adapt and shape the education system in such a way as to effectively address these multi-faceted problems.

Since the end of Apartheid in the 1990s, higher education in SA has been a means of bringing about social justice, aimed at equality, efficiency, democratic participation and development (Hazelkorn, 2015:177). The current Department of Higher Education and Training (established in 2009) includes in its mandate aspects of skills development through education and training. Universities are influenced by its mission to “develop capable, well-educated and skilled citizens who are able to compete in a sustainable, diversified and knowledge-intensive international economy, which meets the development goals of our country” (Department of Higher Education and Training, 2019). The Council on Higher Education, on the other hand, is the quality council for higher education and is responsible for quality promotion and assurance as well as advising the Minister of the Department of Higher Education and Training on all higher education issues (Council on Higher Education, 2016). The futures of individual students, as well as of SA as a country, are therefore affected by higher education.

Students are being educated to take part in a future built on sustainable development within a knowledge economy. The South African National Development Plan 2030 (NDP) aims to eliminate poverty and inequality by 2030 (National Planning Commission, 2013b:14). The NDP's integrated priorities include active citizenry to strengthen development, building a developmental state, society working together to solve problems, and bringing about faster economic growth (National Planning Commission, 2013b:18). However, external drivers of change include global economic shifts, technology, globalisation, climate change and African economic growth. This includes the growing understanding of knowledge economies, where knowledge production is seen as the most important determinant of a society's development (Council on Higher Education, 2016). The positive relationship between levels of education and economic and social development has become widely accepted (Council on Higher Education, 2016:17). Already in 2002, the World Bank encouraged tertiary education to acknowledge and build towards the construction of knowledge societies (Salmi *et al.*, 2002). In addition to sustainable development as aims for higher education, the development of knowledge societies is acknowledged and encouraged.

In an effort to bring about social justice, the South African higher education has followed the trend of massification seen in developing countries (Salmi *et al.*, 2002:75). Massification can be defined as the action of promoting or enforcing uniformity in a society (Lexico, 2019b). According to the Council on Higher Education, the National Development Plan (2011) attributed to universities three main functions (Council on Higher Education, 2016:17). Firstly, universities have the self-evident responsibility of education and training to answer the wide range of employment needs. Secondly, they need to produce new knowledge and implement existing knowledge. And thirdly, universities provide opportunities for social mobility, to strengthen equity, social justice and democracy. Because of massification, the education system has been hampered in its efforts to comply with the expected functions. This is primarily because massification caused several changes in the higher education system (Council on Higher Education, 2016:10). For instance, the educational curriculum shifted from canons of knowledge to curricula developed for relevance and usefulness for economic purposes. In addition, the relationship that universities now have towards the external communities exhibits a more engaged community approach. More students need to be educated, with less support from the government, while more pressure is placed on the body of educators – a process that often leads to erosion of education quality (Salmi *et al.*, 2002:75).

Because of changes in funding of universities, funds generated by university research outputs have been increasingly valued. Universities are not subsidised by contributing to policy of the country, but rather for producing research outputs in the form of publications. This could have an

impact on the type of research they decide to pursue. International (or sometime local) funding can also drive the nutrition research agenda and not be aligned to what is actually needed. In the light of partaking in the fourth industrial revolution, the state mandates of the universities to produce research. Yet support for these institutions varies, and universities who are not research-focussed but who excel in a niche area should receive more support (Kupe, 2019). How each university mandates research internally is, however, not clear. Policy and funding of higher education are thought to be generally aligned with research productivity (Council on Higher Education, 2016:193) and postgraduate students are often recruited in an effort to increase research activity. Although an increase in annual doctoral graduations has been evident from 2001 (823) to 2012 (1878) (Council on Higher Education, 2016:194), the research undertaken by doctoral candidates may not always be of economic value.

Massification has caused a change in the value of certain classes of research. In general, Chalmers *et al.* (2014) suggest that a certain category of research is wasteful. Figure **2-4** illustrates the suggested categories. Pure basic research is often done without consideration of the relevance it has to practical issues, and is often solely for the purpose of advancing knowledge, while pure applied research aims to address important practical questions in practice and policy decisions. At the intersection between the two is use-inspired basic research, which aims to address important practical questions, to both advance knowledge and increase applicability. If the research does not advance knowledge, and it does not have immediate application, it can be thought of as wasteful (Chalmers *et al.*, 2014:156). As a result of massification, pure applied research has now increased in value, reflecting its increased utility within the changing economy (Council on Higher Education, 2016:10).

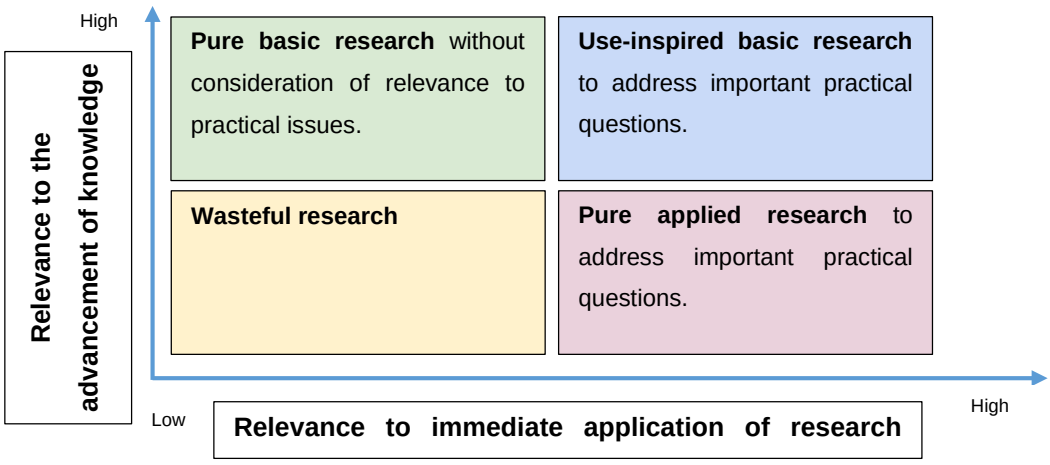


Figure 2-4: Different categories of research (adapted from (Chalmers *et al.*, 2014:157))

Education and research generally, including that done in nutrition, have also been influenced by massification in different ways (Council on Higher Education, 2016:10). The shifts in curricula

resulted in a focus on, and accommodation of, increased student numbers and issues pertaining to Africa and South Africa. However, the more traditional knowledge transmission or transfer approaches in pedagogy are being exchanged for competency or outcomes-based approaches and generic skills transfer (Council on Higher Education, 2016:10). Students are increasingly equipped for addressing health issues and to value the acquisition of skills for taking part in the health research discourse. It is therefore expected to see these changes affecting students' work, especially postgraduate student research projects, which should impact on contemporary health issues.

2.2.3.2 Nutrition research at the African Unit for Transdisciplinary Health Research (AUTHeR); Centre of Excellence for Nutrition (CEN) / Training and Research in Nutrition and Dietetic Solutions (TReNDS)

Primary health care became part of the national agenda shortly after the establishment of democracy in the 1990s. Epidemiological research by academic institutions soon followed. At the NWU, nutrition research was conducted at the Africa Unit for Transdisciplinary Health Research, Faculty of Health Sciences (AUTHeR). Little information is available at this point on the research statistics of AUTHeR. AUTHeR started in 1998 as a focus area entitled Preventive and Therapeutic Interventions, with an initial holistic, integrated and multidisciplinary approach to health research (AUTHeR, 2006:12). In 2005, as a result of the development of a transdisciplinary identity, the focus area was incorporated within a unit. As a vision, AUTHeR set out to "contribute to a better quality of life for all by promoting, preserving and restoring physical and mental health and well-being of individuals, families, communities and populations through appropriate and relevant research and services" (AUTHeR, 2006:12). The core business of AUTHeR was a multi- and trans-disciplinary approach to research and post-graduate training within the health and natural sciences (AUTHeR, 2006:4).

The existence of a highly qualified and highly productive group of experienced nutrition researchers led to a decision, in 2006 to apply to become a CEN (CEN, 2008b:3). By late 2008 it was approved and since then researchers at CEN have been focussing on addressing nutrition issues (CEN, 2008b:5). Under certain circumstances, the group used the brand name TReNDS (Training and Research in Nutrition and Dietetic Solutions), to "give more meaning to their activities" (CEN, 2008a:2). The CEN consists of scientists with experience, expertise, knowledge and resources specifically aimed at addressing the nutritional problems of Africa. They do this through research, training of master's and doctoral students, and building capacity through leadership training (CEN, 2008b:9).

In 2008, the aim of research at CEN was to "generate in-depth information about all aspects of malnutrition and its alleviation in order to provide evidence for solutions to the scientific community and governmental bodies responsible for policies, strategies and intervention programmes" (CEN, 2008a:5). Master's and doctoral students have since been trained in research programmes, resulting in nutrition research that could be applied to policies, programmes and dietary recommendations to improve the quality of life of all South Africans. The focus of CEN is determined by "the prevailing nutritional problems in South Africa, the rest of Africa and also globally" with a vision of being the "leaders in developing scholars in Nutrition in Africa" (CEN, 2010:4). Some of the studies, projects and programmes at CEN focus on in-depth examinations of biological mechanisms, yet the aim is always to better understand existing nutrition problems in an effort to add knowledge to address these problems (CEN, 2008b:9).

By the end of 2008, CEN focussed on changes in dietary patterns during the nutrition transition, as well as on micronutrient malnutrition, the role of fatty acids in human development, child nutrition, nutrigenetics, and sports nutrition (CEN, 2008a:6; CEN, 2008b:13). By 2015, CEN focussed on nutrition transition, body composition and health, NCD, and infant and young child feeding. These focus areas provided the opportunity to examine a particular nutritional problem "from molecular to societal level, integrating epidemiological, clinical and molecular (genetic) studies" (CEN, 2015:9). In addition to these areas were the then-emerging areas of leadership, therapeutic nutrition and food security. CEN provides master's and doctoral students with the opportunity not only to do research on relevant nutrition problems but also to study under nationally and internationally recognised nutrition leaders and researchers.

Governmental, national and international projects highlight these acclaimed researchers for their development of nutritional evidence and support. Since its inception, many CEN publications have aimed to inform nutritional policies in SA (CEN, 2015:9), and the results have been applied in policies, programmes and recommendations (CEN, 2008a:5). Already by 2008, citations within international literature indicated significant impact on nutrition research and practice globally (CEN, 2008a:5). By 2015, several researchers at CEN had either nationally or internationally recognised standing (CEN, 2015:6). A few organisations that recognised them include the WHO's Nutrition Guidance Expert Advisory Group, the International Society of Thrombosis and Haemostasis, Health Professions Council of South Africa, Sackler Institute for Nutrition Science, World Public Health Nutrition Association, African Nutrition Society, and the International Society for the Study of Fatty Acids and Lipids.

Meanwhile, since 1998, the NWU has graduated nearly 120 master's and 50 doctorate nutrition students who either stayed within academia or continued into nutrition research or practice. Subsequently, the CEN has published internationally acknowledged work and collaborated with

several different research entities on nutrition research (CEN, 2015:9). The evidence produced by the CEN, both from students and from experts, contributes to addressing public health, and one of the important areas where such evidence is used is within the field of Health Policy and Systems Research.

2.3 Utilisation of Nutrition Research Evidence

As seen in the previous section, scientific evidence is often utilised to address problems. The current section unpacks the notion of evidence and its utilisation by the public health community and the scientific community. The public health community is discussed under the umbrella of Health Policy and Systems Research, as it encompasses multiple fields to address public health issues. However, the notion of evidence within this field is first explored.

2.3.1 Health Policy and Systems Research

Evidence, in Health Policy and Systems Research, has an ambiguous nature due to the complex and diverse theoretical frameworks underpinning the field. The Alliance for Health Policy and Systems Research (WHO, 2011l) describes Health Policy and Systems Research as a multi- and inter-disciplinary blend of sciences with the purpose of understanding how health systems respond and adapt to health policies, and how health policies are and can be shaped by the health systems and broader determinants of health (WHO, 2011l). It is a field "that seeks to understand and improve how societies organise themselves in achieving collective health goals, and how different actors interact in the policy and implementation processes to contribute to policy outcomes". The alliance adds that "by nature, it (Health Policy and Systems Research) is interdisciplinary, a blend of economics, sociology, anthropology, political science, public health and epidemiology that together draw a comprehensive picture of how health systems respond and adapt to health policies, and how health policies can shape − and be shaped by − health systems and the broader determinants of health" (WHO, 2011l). Active contributors to the field therefore include medical research, nutrition, public health and policy sciences, and epidemiology.

2.3.2 Epistemology in Health Policy and Systems Research

The blend of disciplines forming Health Policy and Systems Research results in evidence being shaped by multiple epistemological and ontological paradigms. Epistemology is the "theory of knowledge, especially with regard to its methods, validity, and scope, and the distinction between justified belief and opinion" (Lexico, 2019a). According to this theory, disciplines define what they view as evidence differently. Similarly, ontology is the abstract theory with no basis in reality dealing with the nature of being (Lexico, 2019c), or in other words, dealing with what is viewed as reality. The social and political reality of Health Policy and Systems Research is that evidence is

produced in accordance with the researcher's understanding of what reality and knowledge is (Loewenson, 2010). Research in Health Policy and Systems Research draws on social science perspectives, from the epistemology of the positivists (including the neo- and post-positivists), through the critical realists, to the relativists (Loewenson, 2010). Evidence is, therefore, multifaceted and often ambiguous.

In addition to the epistemological diversity of the Health Policy and Systems Research multidisciplinary team, evidence is further classified into different forms. Lomas *et al.* (2005:3), for the Health Evidence Network of the WHO, define evidence as "findings from research and other knowledge that may serve as a useful basis for decision-making in public and health care". The WHO includes three conceptualised forms of evidence for health systems guidance: colloquial, scientific evidence on context, and scientific evidence on effectiveness (Lomas *et al.*, 2005:3).

- Colloquial evidence consists of "evidence about resources, expert and professional opinion, political judgement, values, habits and traditions, lobbyists and pressure groups, and the particular pragmatics and contingencies of the situations" (Lomas *et al.*, 2005:1).
- Scientific evidence on context is context-sensitive, social science-oriented evidence focussing on "how or whether it works" in a particular circumstance (Lomas *et al.*, 2005:3).
- Scientific evidence on effectiveness consists of context-free, medically oriented, universal truths on "what works" and its effectiveness (Lomas *et al.*, 2005:3).

The above-mentioned epistemological paradigms and evidence forms contribute to different policy process theories (Sabatier, 2007:8) of which the engaging role-players need to be mindful. In his book on policy process theories, Sabatier presents influential theories from the past few decades (Sabatier, 2007:8). One, the Multiple Streams theory of John Kingdon, was adapted by Loewenson in 2010 when commissioned by the WHO to present some background for the 2010 Global Symposium on Health Systems Research. The adaptation was made to indicate how the knowledge from Health Systems Research was translated into policy and practice in the then termed 'low- and middle-income countries'. In the paper, Loewenson pointed to the "interfacing dynamic systems" of research, policy and practice (Loewenson, 2010:9). Loewenson showed that the knowledge inherent in research, policy or practice could influence change on the basis of connecting the different streams. Of particular importance was Loewenson's acknowledgement of the "Knowledge to Policy and Practice Catalysts" and his call for them to be "able to bridge political, policy and technical discourse, with the credibility and positioning to tap opportunities for policy change" (Loewenson, 2010:9). In understanding the epistemological nature and form of evidence, the Knowledge to Policy and Practice Catalysts would be able to introduce evidence more effectively when connecting the different streams.

The purpose of synthesis and utilisation of scientific evidence is generally accepted as growing the body of knowledge, affecting policy and improving practice. Scientific evidence synthesis should be evidence based, while public health processes are similarly expected to be evidence based (Brownson *et al.*, 2009:1567). In the past, evidence synthesis underpinned the now-accepted praxis of evidence-based/informed practice, including that of medicine and policy-making. Researchers and policy-makers in the decision-making process of policy-making are two separate but interdependent communities expected to privilege scientific evidence over colloquial evidence (Lomas *et al.*, 2005).

2.3.3 Utilisation of Evidence by the Public Health Decision-makers

2.3.3.1 Evidence-based decision-making process and policy-making

To understand the decision-making process in which policy-makers are involved, Dobrow *et al.* (2004:215) developed a conceptual framework for decision-making by researchers that states that "[t]hinking needs to shift from evidence-based decision-making to *context-based* evidence-based decision-making" (italics original document). It has since been established that evidence should become the informant to decision-making, based on the well-founded observation by Dobrow *et al.* (2004:209) that decisions are made within certain contexts, with internal and external contextual factors influencing decisions. Therefore, policy-makers are encouraged to make evidence-informed decisions, while researchers are encouraged to understand that the use of evidence can be utilised as a basis for decisions, or simply to inform the decision-making process.

Both the way in which decision-makers view evidence and the context in which decisions are made influence the decision outcome. Dobrow *et al.* (2004:208) suggest that what constitutes evidence is determined by the fundamentally different relationship between evidence and context during the decision-making process. The aspects of evidence, according to Dobrow *et al.* (2004:208) have two distinct orientations. The first is philosophical-normative, where "evidence is largely a function of the quality of the evidence, with the supposition being that higher quality evidence would lead, in turn, to higher quality decision". The second and contrasting orientation is practical-operational, whereby a specific decision-making context is the definer of evidence (Dobrow *et al.*, 2004:209). This orientation may explain the South African policy-making situation, where a multitude of factors influence the decision outcome, where evidence and context are mutually inclusive. Yet, what is regarded as context should also be evaluated.

It is acknowledged that all the factors contextualising decisions can hardly ever be known. Dobrow *et al.* (2004:209) therefore make a distinction between internal and external contexts for decision-making. Within this framework, the internal category describes the "why, who and how" or

"purpose, participant and process" of the context in which decisions are made (Dobrow *et al.*, 2004:209). In addition, external contextualising factors influence the decision-making context as they relate to the environment where the decision will be applied. These include object-specific, political and extra-jurisdictional factors (Dobrow *et al.*, 2004:210). The axes of evidence-based decision-making (EBDM) are shown in **Figure 2-5**, indicating that the ideal relationship is balanced between evidence and context.

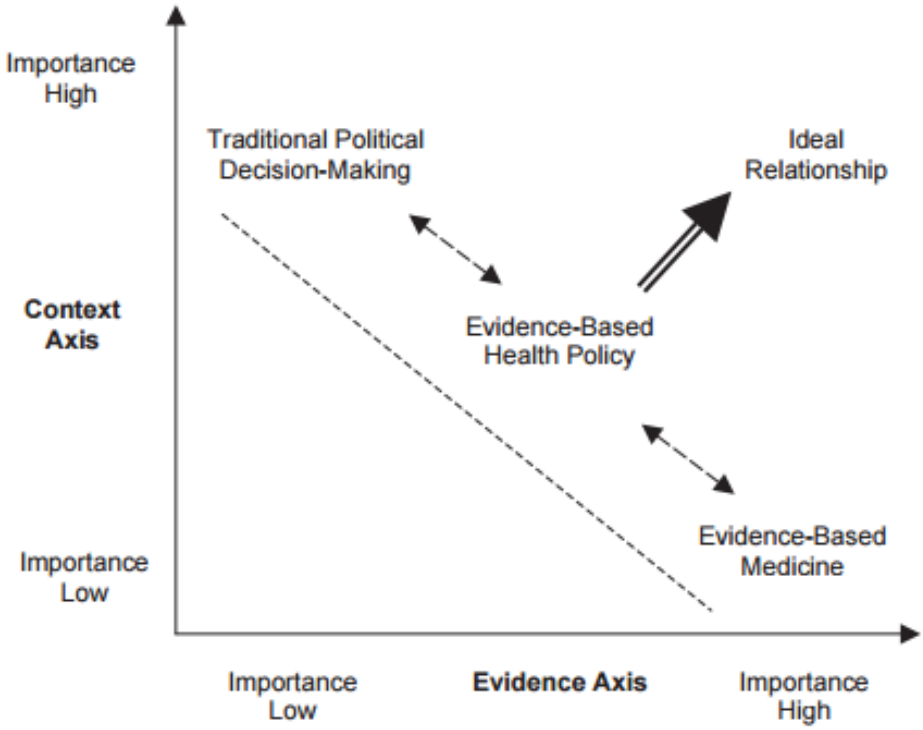


Figure 2-5: Axes of evidence-based decision-making (adapted from Dobrow *et al.* (2004:211)).

Both the UNICEF Triple A (UNICEF, 1991) and the Public Health Nutrition (Gibney *et al.*, 2004) cycles guide policy-makers in making evidence-based decisions, and all steps should follow an evidence-based approach. Scientific evidence is preferable to colloquial evidence; however, in the absence of scientific evidence, colloquial evidence plays a role in the decision-making process. Based on the process model that Dobrow *et al.* (2004:213) describe, utilisation of evidence takes place in three stages (Bowen & Zwi, 2005:0603). These stages are (1) introduction, (2) interpretation and (3) application.

The introduction of evidence relates to its availability and accessibility, including the dissemination, transfer, diffusion and transmission of activities. This is based on both its perceived conceptions and operationalisation, subject to internal and external contextual factors. The stage

that follows is interpretation, where evidence that has been introduced in the first stage is synthesised, evaluated and assessed on its quality and generalisability. Here "recognition, appreciation and determination of the relevance, appropriateness, applicability and utility of individual sources of evidence for supporting and justifying a decision" occurs. Only after this process can the evidence be applied, to support or justify a decision. This framework highlights the use of evidence as informing the whole decision-making process. For the purpose of this study, *evidence-based practices therefore include evidence-informed practices, which can be thought of as the "process of distilling and disseminating the best evidence from research, context, and experience (political, organisational) and using that evidence to inform and improve public health practice and policy" (Brownson et al., 2017).* Therefore, identifying factors influencing EBDM will be subject to the way evidence is viewed, by whom, for what purpose and how it could be utilised, as well as its justification within the external context.

It has been shown that the divide between research and policy in many developing countries is substantial, as a result of factors relating to supply and demand. The supply of quality research may be constrained because of limited institutional capacity (Koon *et al.*, 2012:1). As mentioned before, SA has an abundant supply of institutions producing research to aid policy-making. On the demand side, developing countries might have limited opportunities for researchers and research institutions to influence the policy process, or actors within the policy-making culture might regard evidence-based research as being of little importance (Koon *et al.*, 2012). The influence of evidence produced by research institutions on public policy may be negated by several factors. The RAPID framework (RAPID, 2004) suggests that the following factors can be assumed to influence evidence uptake in policy, with several studies providing confirmation:

- the political context (Liverani *et al.*, 2013; Orton *et al.*, 2011)
- communication and credibility (Campbell & Griffiths, 2009; Oliver *et al.*, 2014; Orton *et al.*, 2011),
- networks of influence and legitimacy (Campbell & Griffiths, 2009; Naude *et al.*, 2015; Oliver *et al.*, 2014; Orton *et al.*, 2011), especially when policy-makers are engaged as early as defining research questions (Juma & Kaseje, 2017:105),
- external influences (Orton *et al.*, 2011).

The influence of scientific evidence on the policy-making process cannot, however, be ignored and barriers and facilitators influencing uptake of scientific evidence in the policy process are noteworthy (Brownson *et al.*, 2006). According to Loewenson (2010:22), features of research that contribute to evidence uptake in policies and practice include:

- the priorities and questions under investigation by the research community should be identified in collaboration with the decision-makers;
- the research evidence should be timely and relevant to the needs of the policy process;
- research evidence should be drawn from a variety of relevant disciples and linked to possible applications;
- evidence that is produced should be able to be utilised to assist in clarifying what works, how it works and under what circumstances;
- end stakeholders of the research should be engaged and receive the opportunity to test the transferability of possible recommendations; and
- deliberations and discussions on the findings should be welcomed, encouraged, and facilitated by individuals who catalyse the intersection of knowledge, policy and politics (Loewenson, 2010:9).

These features all contribute to research uptake. As expected, problem-solving research is more likely to be utilised than problem-raising research (Loewenson, 2010:22). In addition, systematic summarising of evidence from different sites or findings is viewed as more useful than single-setting research (Loewenson, 2010:23).

In contrast, barriers to uptake are reported by Abou-Zeid *et al.* (2012), Bowen and Zwi (2005) and Loewenson (2010). Abou-Zeid indicated that lack of communication between the researchers and the policy makers, as well as low demand by the policy makers for scientific research, were barriers to evidence uptake (Abou-Zeid *et al.*, 2012:47). In addition, the absence of research was a major limiting factor to research uptake (Loewenson, 2010:23). However, when barriers are overcome, facilitators engaged, and windows of opportunity exploited, scientific evidence has the opportunity to change the public health processes.

As seen above, decision-making in the process of policy-making is underscored by evidence-based principles, including the informative role that evidence may have. The idea that high quality evidence equates to high quality decisions is not a generally accepted standard, as the role of the context within which the decision is made determines both the production and utilisation of evidence. Only when these are in balance can evidence inform or offer a basis for decisions. It should be acknowledged that some factors might continue to hinder evidence uptake during the policy-making process. The ambiguous nature of evidence uptake in policy-making is similar to the evidence utilisation that takes place within the scientific community.

2.3.4 Utilisation of Evidence by the Scientific Community

Scientific study is the use of experimental and observational inquiry to test hypotheses in systematic ways. A theory or hypothesis can be either supported or countered by the use of scientific evidence. Scientific evidence refers to facts systematically obtained by means of the

scientific method. It is "a method or procedure that has characterised natural science since the 17th century, consisting of systematic observation, measurement, and experiment, and the formulation, testing, and modification of hypotheses" (Oxford living dictionaries, 2019). It should be replicable, observable, credible and verifiable, or basically supportable (Lomas *et al.*, 2005:8). But, as mentioned earlier, the epistemological and ontological reality of the researcher determines the production of evidence (Loewenson, 2010). Despite the diversity of views on what constitutes evidence (Gilson, 2012:35), utilisation of evidence within the scientific community occurs according to the generally accepted scientific process.

Evidence used within the scientific process does, however, need to be credible and trustworthy. It hinges on the principle that "science is cumulative and scientists need to cumulate scientifically (Chalmers, 2007:53) and it "often goes through a synthesised process to reduce the influence of flaws or errors from single studies" (Yu & Magaya, 2017). Within the field of medicine, the evidence-based medicine movement began in the early 1990s with the purpose of educating clinicians in assessing the credibility of research evidence, understanding clinical studies, and finding best applications for the results (Djulbegovic & Guyatt, 2017:415). Yet, "central to the epistemology of evidence-based medicine is that what is justifiable or reasonable to believe depends on the trustworthiness of the evidence, and the extent to which we believe that evidence is determined by credible processes" (Djulbegovic & Guyatt, 2017:416). The use of evidence in medicine hinges on epistemological principles including that the best available evidence be used and that the totality of evidence be weighed instead of selecting particular pieces to support a claim. Evidence is therefore viewed not only as individual pieces of proof, but as part of the body of knowledge.

The intrinsic inquisitive nature of humanity will cause the body of knowledge to continue to grow, but we live in interesting times where reductionism can no longer be the only way to view reality. It is evident, as demonstrated earlier, that nutrition research had an initial reductionist perspective. Fardet and Rock (2014) make the case that, with the growing epidemic of diet-related diseases, a holistic approach to nutrition is needed to improve nutritional recommendations. It is already evident in the field of Health Policy and Systems Research, as the multitude of disciplines associated produce evidence that impact each other. Another example of this holistic approach is how evidence-based medicine developed to combine scientific evidence with the values and preferences of the individual patients treated in the decision-making process of treatment (Djulbegovic & Guyatt, 2017:415). Shelton *et al.* (2018) mentions another example, regarding the many opportunities that social sciences have to improve public health. They mention specifically the linking role that social science plays when providing the relevant questions that could better link the empirical sciences to the policy-making community (Shelton *et al.*, 2018:3). The study of

the use of research evidence offers a further example. The social phenomenon of the use of research evidence in policy-making includes several different qualitative methods and methodologies (Gitomer & Crouse, 2019).

Whether reductionist or holistic, the trustworthiness and credibility of the best available evidence often influences its use. Conversely, the totality of evidence led to the rise of the use of systematic reviews, whereby all available evidence at a specific point in time, is included (Djulbegovic & Guyatt, 2017:417). These two principles indicate a twofold use of scientific evidence in scientific research: the acknowledgement of evidence because it is most relevant, or the use of evidence purely because it is evidence.

When evidence is used to support or counter a theory, claim or hypothesis, it impacts on subsequent research and this impact can be investigated, studied and analysed empirically. *Several* scientific indicators have been implemented to evaluate the impact achieved by scientific evidence (Waltman, 2016:366). These scientific indicators acknowledge evidence uptake and utilisation within the scientific research community and can be used to determine the impact of scientific evidence. The way in which evidence impacts research assists the researcher utilising the evidence in drawing an evidence-based conclusion from the research at hand and then being able to communicate something about the value of the evidence used. This communication in published scientific research evidence is studied within the field of bibliometrics, in the subfield of scientometrics. It investigates "the quantitative aspects of the process of science as a communication system" (Mingers & Leydesdorff, 2015:1).

2.4 The Study of Publications in Communication: Scientometrics

In 1934, Otlet first proposed the term "bibliometrics" for what was later reported by Pritchard in 1969 as the "application of mathematical and statistical methods to books and other media of communication" (Mingers & Leydesdorff, 2015:1). Currently, infometrics is the broadest subfield as it covers all types of information regardless of origin or form (Mingers & Leydesdorff, 2015:2). The subfield of bibliometrics, focussing on scientific publications within scientific journals is called scientometrics. It can be viewed as "the study of the quantitative aspects of science and technology seen as a process of communication" (Mingers & Leydesdorff, 2015:1) primarily determined by publication citations. This study focuses only on citations and not on social networking tools like views, downloads etc. as investigated in altmentrics, or scientometrics 2.0.

As seen in the previous section, scientific research evidence impacts the scientific community. And although "impact" is probably the most frequent term in the scientometrics literature, along with "citation", the target of impact is seldom specified and its definition rarely stated (Abramo,

2018:9). Research impact, for the purpose of this investigation, is defined as "the contribution of research outputs to further scientific and technical advancement" (Abramo, 2018:10).

Organisations engaged in scientific and technical advancement, such as universities, may measure research impact for several reasons, including assessing the efficient allocation of financial or human resources, or measuring aspects pertaining to research performance (Moed, 2009:13). Independent of the reason, Bertocchi *et al.* (2015:463) indicated that, when compared to the peer-review process, the quality of assessments made by bibliometric analysis is fairly similar. Such bibliometric assessment often requires the application of scientific indicators (Abramo, 2018:2; Waltman, 2016:366).

Citations, as a scientific indicator, are often used to measure the impact of publications (Hicks *et al.*, 2015:431), by means of exploration and evaluation (Bornmann, 2016:776). In practice, scientometrics centres on the core notion of citations (Mingers & Leydesdorff, 2015:2). As early as the 1950s the importance of the citation led Eugene Garfield to coin the idea of the *Science Citation Index* with the purpose of assisting researchers in searching for literature. After the addition of the *Social Science Citation Index* and the *Arts & Humanities Citation Index,* Thomson Corporation later converted it into what is now known as the *Web of Science (Mingers & Leydesdorff, 2015:3).* During the 1990s and 2000s, citation databases have greatly increased. As rivals to Web of Science, which goes back as early as 1900, are the 2004 Elsevier *Scopus*, going back to 1996, and the more recent 2004 *Google Scholar*[6]*.* The coverage of Google Scholar is generally higher than that of Web of Science and Scopus, but the reliability and quality of the data can be poor. Citations reported on different databases produce different bibliometric results, leaving discrepancies among results and imperfect proxies for paper quality (Bertocchi *et al.*, 2015:463; Bornmann & Daniel, 2008; Fagerberg *et al.*, 2012; Rafols *et al.*, 2012).

Nonetheless, citation analysis is a key methodology in evaluative bibliometrics which evaluates research performance. For instance, the impact of individual publications can be evaluated *via* citation impact indicators (Waltman, 2016:366). However, the different citation impact indicators each carry their own merits for application (Waltman, 2016:366). Citation impact indicators include paper citation count, the journal impact factor, Eigen factor score and article influence score, to name but a few (Bertocchi *et al.*, 2015:463). These indicators can be used independently or in combination to conduct citation analysis.

Citation analysis is a key methodology for evaluating research performance. It involves the counting of citations, assuming that important work gets cited more often (Meho, 2007:32),

[6] https://harzing.com/resources/publish-or-perish

resulting in an impact classification based partly on citation counts. It has, however, been the object of criticism. For instance, critics point to discrepancies among results and imperfect proxies of paper quality (Bertocchi *et al.*, 2015:463; Bornmann & Daniel, 2008; Fagerberg *et al.*, 2012; Rafols *et al.*, 2012), or the problem of self-citation: "citations for which the citing and the cited publication have at least one author in common" (Waltman, 2016:373). In addition, there is the question as to how to determine the optimal citation window. There is no generally applicable rule for choosing either a longer or a shorter citation window (Waltman, 2016:374), however, there is a trade-off between accuracy of impact and timeliness of research when making such a selection.

A key consideration within citation analysis is normalisation across sub-disciplines, journals and year of publication. In order to address citation impact normalisation within citation analysis, several methods have been suggested, again each with its own merit (Waltman, 2016:374). One such method is the ratio of averages approach, which rests on the expected number of citations of a publication, seen as "the average number of citations of all publications in the same field (and from the same year and of the same document type)" (Waltman, 2016:375). The ratio between the actual citation count and the expected citation count therefore indicates the relative impact of the publication when compared with other publications.

As previously noted, scientometrics is effective in the analysis of citations of research evidence. This is, however, not the case with policy documents. It is worth noting that the start of the scientometrics research programmes in the 1970s was closely accompanied by the first research evaluation and use of citation analysis in policy-making (Mingers & Leydesdorff, 2015:3). Yet, until now, no formal standardised method - such as scientometrics - has emerged as a tool to measure the impact of scientific evidence on policy-making in a reliable and valid way (Bornmann, 2016:776; Khazragui & Hudson, 2014:59). Two methods of measuring scientific evidence impact on society based on a citation equivalent have emerged: citations in patents (Bornmann, 2016:776; Schneider, 2007) and in clinical guidelines (Bornmann, 2016:776; Lewison & Sullivan, 2008; Thelwall & Maflahi, 2016). These methods provide some advantages: (1) the measurement is calculated in a way similar to that of scientific measurements. (2) The measurements are citation-based and therefore relatively objective and non-reactive, and extensive data are available for the measurement. And (3) patents and guidelines, like policies, are relatively freely accessible and can be evaluated with a reasonable amount of effort. However, a study conducted to investigate citations to Australian obesity public policy documents between 2000 and 2015 (Newson *et al.*, 2018:11) found that cited research documents did not always influence the policy process despite being accessed. Research documents were, however, believed to be relevant to the policies being created, and to inform the content of the policy documents.

To conduct a full impact analysis of research evidence would require exploration of elements such as knowledge translation, looking at grey literature, or at non-academic sources (Mitton *et al.*, 2007; Sarli *et al.*, 2010:17). However, the scope of this study will be limited to research utilisation by means of uptake into scientific publications and public health documents, indicated by citations, as stipulated in the methodology chapter.

2.5 Evidence Mapping

As mentioned earlier, despite publications of scientific research evidence available in peer-reviewed journals, many South African policy makers report scientific evidence as being unavailable, inaccessible, not applicable or time consuming and the policy-making process is reported as "difficult and vexed" (Naude *et al.*, 2015:7). Yet, it has been established that the policy-making process needs to be based on evidence, specifically scientific evidence.

Traditional scientific evidence summaries often used in practice and policy-making take the form of systematic reviews and meta-analysis. As mentioned earlier, one of the principles that guide evidence utilisation in clinical studies is that the totality of evidence be weighed instead of selecting evidence to simply support a claim (Djulbegovic & Guyatt, 2017:416). This idea led to use of research synthesis as found in systematic reviews and meta-analysis (Chalmers, 2007:38; Djulbegovic & Guyatt, 2017:217). Iain Chalmers (2007), the person most responsible for the advances that the Cochrane Collaboration has made in systematic review methodology, documented accounts and results of the failure of science to cumulate evidence systematically. Systematic reviews and meta-analyses are essential for developing clinical practice guidelines, for avoiding duplication of research efforts, and for helping inform design of new research studies" (Djulbegovic & Guyatt, 2017:418). Now, although these two forms of evidence summary provide an answer to *what* is currently known, they do not answer the question as to where *gaps in current knowledge* exist. This is where a new form of evidence synthesis methodology comes in, that of Evidence Mapping or Evidence Gap Mapping.

In an effort to ensure that "existing evidence is accessible to decision-makers, that new studies avoid duplication, and that evidence gaps are addressed", governments, researchers and non-governmental organisations are investing in evidence mapping exercises (Phillips *et al.*, 2017). In their systematic review on the topic, Miake-Lye *et al.* (2016:2) described evidence gap mapping as a "systematic search of a broad field to identify gaps in knowledge and/or future research need that presents results in a user-friendly format". The African Centre for Evidence (2018) defines evidence mapping as "an evidence synthesis methodology to systematically source and organise a body of knowledge to provide a high-level overview of the size and nature of the available evidence in order to inform and facilitate the use of this evidence-base". These maps often take

the form of an interactive platform, presenting all the literature gathered through systematic searching (Yu & Magaya, 2017).

The topic, form and reason for maps differ greatly. The founders of evidence gap maps, International Initiative for Impact Evaluation (3ie), lead an international initiative for impact assessment and have produced several maps about effects of international development policies and programmes (International Initiative for Impact Evaluation, 2019). See an example of an evidence gap map of 3ie in **Figure 2-6** below. The International Rescue Committee produces evidence maps to assist in standardising and streamlining its programmes and to monitor its processes (International Rescue Committee, 2016). Sightsavers is developing multiple evidence gap maps on topics relevant to visual impairment (Sightsavers, 2019). Phillips *et al.* (2017), of 3ie have even reported on interventions in sustainable development in developing countries by means of a cumulative map of evidence maps. Within South Africa, the Department of Planning, Monitoring and Evaluation has already started using these maps in order to better support its policy makers (National Department of Performance Monitoring and Evaluation, 2016; Yu & Magaya, 2017).

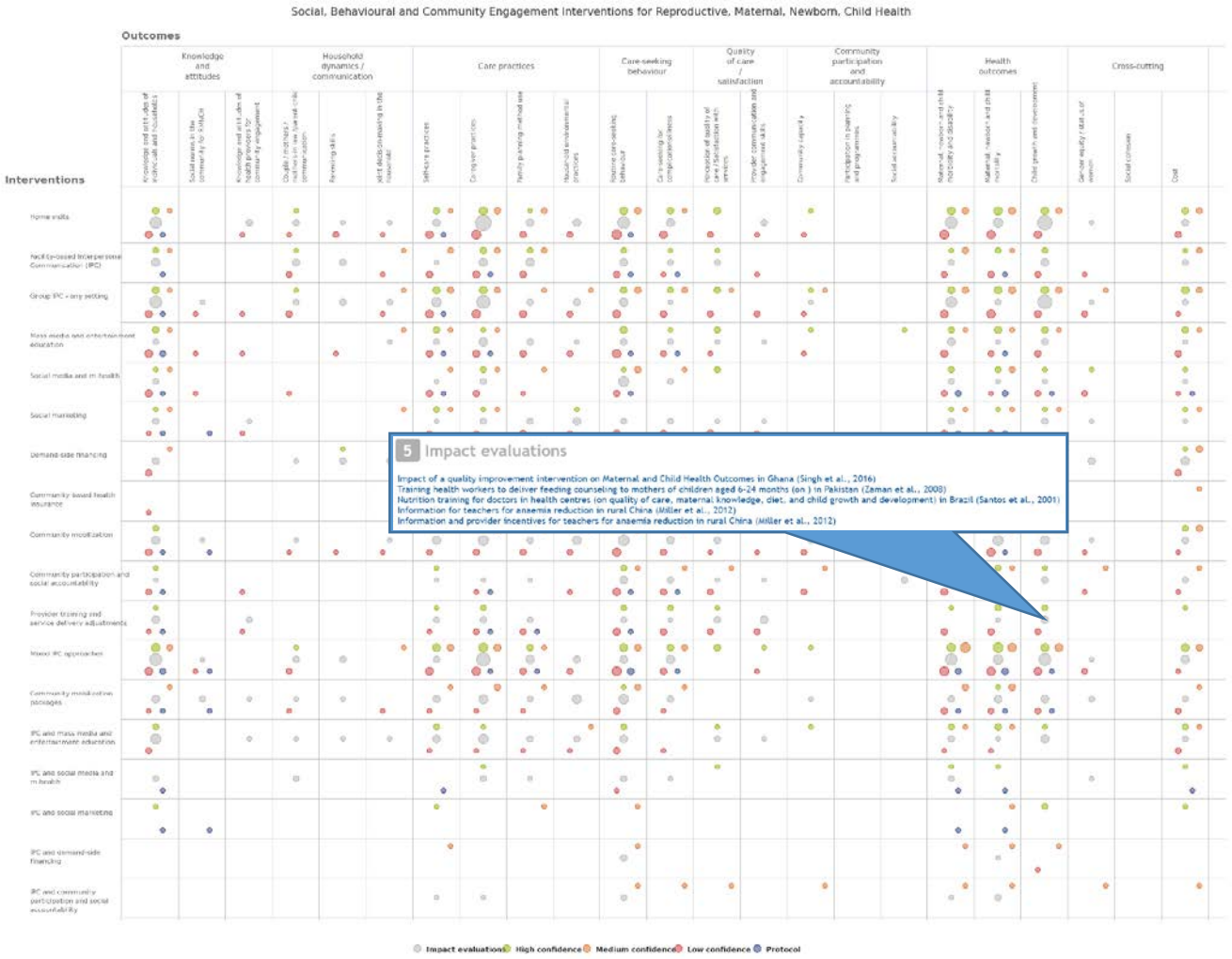


Figure 2-6: Example of an evidence map (adapted from 3ie (2017))

Although further scrutiny is needed to assess this method of research (Miake-Lye *et al.*, 2016:2), it has been used in several fields, especially to inform policy-makers (Atal, 2017). In an example of the use of evidence mapping in scientific research, a recent evidence map publication on knowledge translation in African health systems by Edwards *et al.* (2019:11) presented SA and Uganda as the highest-ranking knowledge translation-generating countries in Africa. This process of transfer and exchange of knowledge between the producers and users of evidence in health policy decision-making has been investigated in the past (Mitton *et al.*, 2007). In 2007, Mitton *et al.* (2007) found that on a global scale there was insufficient evidence of evidence-based knowledge translation activity. The subsequent evidence maps by Edwards *et al.* (2019:11) showed this to be still true for Africa.

While systematic reviews and meta-analyses have their uses in summarising evidence, evidence gap mapping and evidence mapping have a completely different role to play in scientific endeavours. This is true in exposing gaps in current knowledge when planning for future research. It is also true for South African policy-making and health systems research (Yu & Magaya, 2017).

2.6 Conclusion

Nutrition as a science has contributed to addressing the national and global public health nutrition agenda. In both the MDG and SDG, nutrition has been playing a significant role. This is evident in the simultaneous SUN movement currently taking effect in some countries around the world. Prior to democracy, South African nutrition history was tainted with inequality and injustices, but the democratic government has taken steps to address public health nutrition issues. However, some major issues are still being faced. Several bodies, like research units and universities, provide evidence for the improvement of public health issues, but interactions between evidence and practice are complex and continuous. The South African higher education system requires universities to produce evidence, and in the developing of the new knowledge economy, postgraduate students are increasingly equipped to address health issues relating to public health.

At the NWU, nutrition research and training have been taking place for a number of years and the sophisticated body of researchers is acknowledged and acclaimed for its world-class work. Over 120 masters and 50 doctorate nutrition students have completed their studies within this research unit since 1998. The experts and students at the research unit have published evidence that has been informing public health issues. Evidence produced by the scientific community, however, needs to be utilised within the policy-making process, and as seen within the Health Policy and Systems Research, evidence has an ambiguous nature, the policy-making process is complex,

and a delicate balance exists between the context in which decisions are made and the quality of evidence produced.

Within the scientific community, research evidence is viewed in a very similar way, as the scientific process depends on the accumulation of knowledge. However, the epistemology upon which the production and validity of evidence rests is two-fold: the best available evidence ought to be used, and the totality of evidence needs to be taken into account. If evidence is used, the study of that utilisation of evidence within scientific publications is called scientometrics, and is based on the analysis of citations. Similar studies have been conducted to assess scientific research uptake into policy documents to determine the impact they have had.

If the postgraduate students studying at the NWU since 1998 have been guided to conduct research in such a way as to address, either directly or indirectly, the prevailing public health issues, the scope of their research ought to mirror research themes as seen in the international arena. In addition, if the research is to be considered valid, it ought to have reached either the national or the international scientific community. Furthermore, if the evidence is to be rated as high quality, the number of citations, compared with the expected numbers, should indicate the impact of the research. These results can then be presented in a manner that not only can assist future research at the unit, but can also inform the policy-making community of available evidence on specific problem areas. What is, however, less clear is whether the research should be expected to have been utilised by the public health community.

CHAPTER 3: METHODOLOGY

3.1 Introduction

The aim of this chapter is to present the methodology used in this study. Owing to the diversity of currently available evidence maps, there is no single acceptable methodology. Consequently, a systematic approach was implemented. The study procedure followed the consecutive completion of the different objectives, which in turn served to complete later objectives. Each objective was subdivided into steps. See **Figure 3-1** for a recap of the objectives. Thereafter, **Figure 3-2** visually presents a stepwise presentation on reaching the set objectives. Note the hyperlinks for quick access.

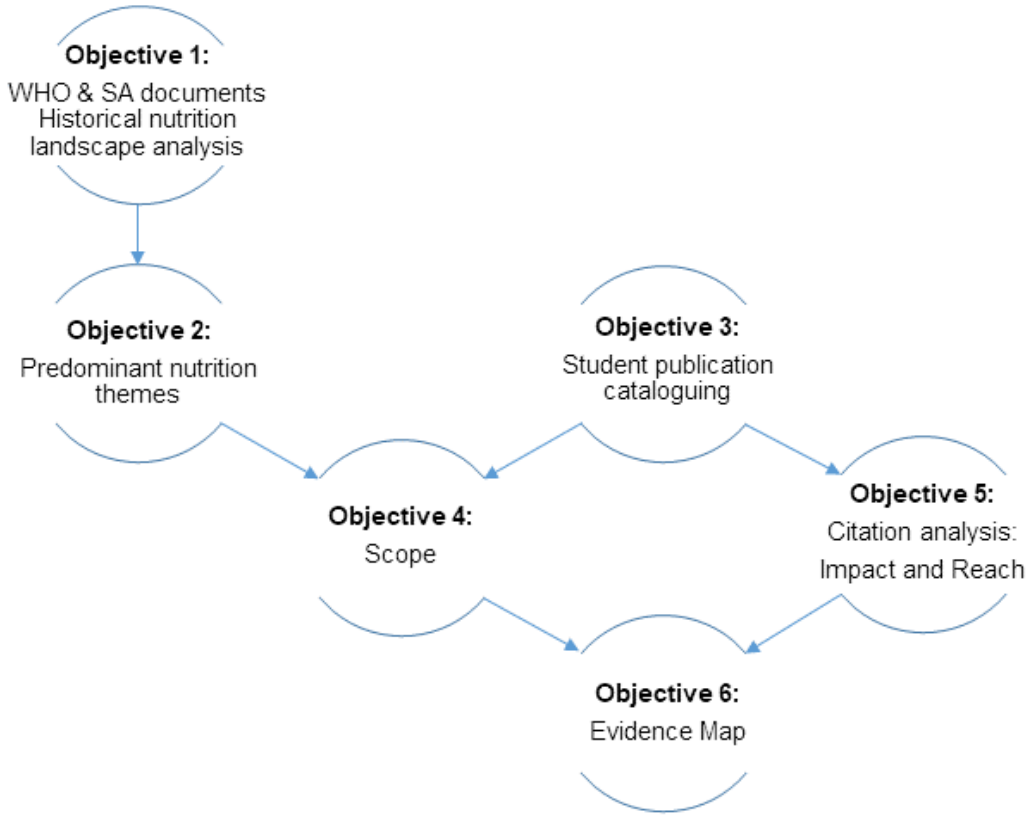
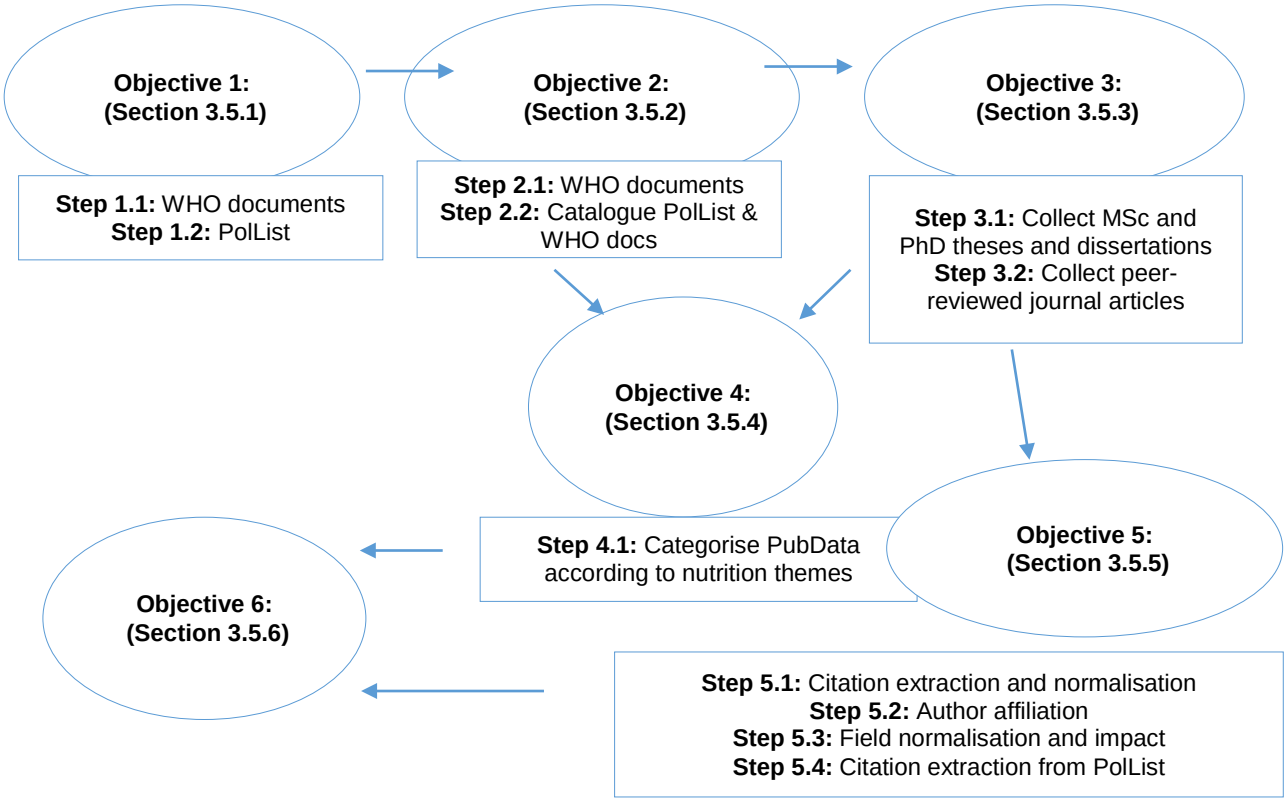


Figure 3-1: Diagram of study objectives



*WHO – World Health Organisation, PolList – List of South African public health policies, programmes and guidelines, PubData - NWU post-graduate student publication database. Note: **all Sections, Tables and Figures** in this figure are hyperlinked to the corresponding sections, tables and figures in the text for ease of access.*

Figure 3-2: Stepwise approach to reaching set objectives

3.2 Study design

Evidence mapping uses a systematic approach to collect and "describe the nature, characteristics and volume of research in a particular area" (Snilstveit *et al.*, 2013). In order to achieve this, this study employed both a cross-sectional and a longitudinal design. A quantitative evaluation of citations to student publications in academic publications and policy guidelines was made. Abramo *et al.* (2011:666) indicated that a two to three-year citation window is sufficient to determine robust impact indicators. For timeliness of papers, a unique citation count within three years from paper publication (year of publication with an additional two years) is necessary. By means of a cross-sectional investigation of the three-years post-publication the timeliness of the publications was shown, while all-time citations present the accuracy and relevance of publication results. For impact evaluation by means of normalised citation counts, a cross-sectional design was used to indicate impact of articles at the time of the study.

3.3 Study data and research setting

In order to limit the scope of the study for manageability as well as focussing on the effectiveness of the education system over the two-decade period, the data used for this study only included

publications of NWU students registered for Master's and Doctoral studies in Nutrition or Dietetics. The purpose was to determine the impact, scope and reach of these students' publications on the scientific and public health communities. In order to achieve this, citations made to these publications were analysed. International and local policy documents were collected as part of the analysis.

3.4 Inclusion and exclusion of documents and publications

For the purpose of this study, only active documents and publications were included. Any archived documents (from the WHO or DoH) or publications (theses, dissertations or articles) unaccusable or retracted were excluded. In addition, any documents focussing on subjects or geographical areas not pertaining to Africa were excluded. Furthermore, any article publication not directly connected to student thesis or dissertation, of which the author became an academic or lecturer at the university, were excluded.

3.5 Indicators used in the execution of this study

Table 3-1: Terms and bibliometric and other indicators used in this study

Indicator	Explanation	
Documents and Publications	"Documents" refer to all WHO and DoH manuscripts, while "publications" refer to any student-related work and scientific work – which includes theses, dissertations and peer-reviewed journal articles.	
Self-citation	Refers to the citing publication authors. If any one of the citing authors correspond to any one of the cited publication authors, the publication is deemed "self-cited".	
Time since publication	Refers to the time since the publication came out. If accepted in 2010 but published in 2011, publication time would be set at 2011. For instance, if a student submitted a thesis or dissertation in November 2018, but only graduated in 2019, the publication date is set at 2019. In the study, a differentiation is made between three years' post-publication and all-time since publication. Three years would be the year of publication with an additional two years. All-time refers to publication date until August 2019 when data extraction took place.	
Measure of reach	Citing author affiliation	Refers to citing publication authors'–affiliation, distinguishing between organisations within SA and internationally.
	National reach	Refers to student publications cited by publications where none of the citing authors were internationally affiliated.
	International reach	Refers to student publications which have been cited by, at least one, internationally affiliated author, irrespective of being cited nationally.

Table 3-1: Terms and bibliometric and other indicators used in this study *(continue)*

Measure of scope	Nutrition theme	The WHO website presents all nutrition-related documents according to categories. These were used within this study to indicate nutrition themes. From the documents contained in each theme, the researcher defined the theme. 1. **Accelerating Nutrition Improvements in Sub-Saharan Africa (ANI)** 2. **Adolescents** 3. **Country Assessment** 4. **Emergency and humanitarian crisis** 5. **Foetal Development** 6. **Food Labelling** 7. **Growth and development** 8. **HIV/AIDS** 9. **Infant and young child feeding** 10. **Nutrient requirements and dietary guidelines** 11. **Overweight and obesity** 12. **Food and nutrition policies** 13. **Nutrition and Pregnancy** 14. **Nutrition-friendly Schools** 15. **Food and Nutrition Security** 16. **Tuberculosis related topics** 17. **Undernutrition** 18. **Vitamins and Minerals** 19. **Nutrition and WASH** Government documents and student publications were categorised according to these themes to indicate the scope.
Measures of impact	Research impact	Perceived according to the definition provided by Abramo (2018:595): "the contribution of research outputs to further scientific and technical advancement". If a publication was utilised and cited in another publication, it had an impact. Through the process of comparing publication citation count with the expected citation counts of all publications in the same sub-discipline over the same period of time (normalisation), the relative impact of a publication is determined.
	Citation count	Direct measure for articles and theses and dissertations citations as referred to in either academic peer-reviewed journal articles, or in government publications.
	Average citation count	Indicator of the average number of citations a set of publications obtained. Within this study, a *set* can be defined by scope (nutrition theme), time since publication, self-citation, and reach (not cited, nationally cited, governmentally cited, and internationally cited).

Table 3-1: Terms and bibliometric and other indicators used in this study ***(continue)***

	Normalisation of publication citation	Refers to the process of normalisation of citations to take into account other publications from the same sub-discipline over the same period of time. Refers to the expected citation count.
	Expected citation count	Refers to the normalisation of publications in relation to all other publications within the same sub-discipline over the same time period. $From\ a\ subdicipline\ and\ year\ of\ publication\colon total\ citations$ $\div From\ the\ subdiscipline\ and\ year\ of\ publiation\colon total\ number\ of\ publication$ $= Expected\ ciation\ count.$ The expected citation count is therefore the world average for articles. For this study, normalisation was done according to metrics provided by the Web of Science feature of InCites for all-time citations according to the year of publication.
	Relative impact and world average	Citation-based normalised impact indicator that measures the impact of evidence by dividing the publication citation count by the expected citation count of articles of the same sub-discipline over the same time period – in this case, all-time until August 2019. $For\ a\ sub-discipline\ and\ year\ of\ publication, citation\ count\ of\ publiation$ $\div Expected\ citation\ count\ (see\ description\ above)$ $= Relative\ impact$ When a publication has the same number of citations as the expected citation count, it has a relative impact of 1, which is therefore equal to the world average. Exceeding the expected citation count results in a relative impact higher than the world average, indicating that the publication had an above-average impact.
	Average of relative impact	Direct measure of the average scientific impact of a set of articles. As with average citation counts, a *set* can be defined by scope, time since publication, self-citation, and reach. $Sum\ of\ relative\ impacts\ for\ a\ set\ of\ publications$ $\div Amount\ of\ documents\ in\ the\ set$ $= Average\ relative\ impact\ of\ set\ of\ publications$

3.6 Study procedure

3.6.1 Objective 1: Compilation of the historical nutrition landscape

3.6.1.1 Step 1.1: WHO nutrition-specific documents

From the WHO website, all nutrition-specific documents were extracted. The interface allows the user to choose documents according to nutrition categories, however no category definition is given. From the content of the documents contained in each WHO category the following were deduced as the scope of each category:

1. **Accelerating Nutrition Improvements in Sub-Saharan Africa (ANI)**: strengthening nutrition surveillance systems, determining baseline key indicators, and scaling-up of evidence-informed nutrition actions.
2. **Adolescents**: focus on adolescent health.
3. **Country Assessment**: assessing country focus on accelerated action on nutrition.
4. **Emergency and humanitarian crisis:** emergencies and humanitarian crises requiring nutritional assistance.
5. **Foetal Development**: any documents focussing on foetal development.
6. **Food Labelling**: relating to labelling, marketing, public procurement of foods, health claims etc.
7. **Growth and development**: relating to the growth of infants and children.
8. **HIV/AIDS**: nutrition and HIV/AIDS.
9. **Infant and young child feeding**: relating to nutritional needs of infants and children.
10. **Nutrient requirements and dietary guidelines**: nutrient distribution and requirements within set conditions.
11. **Overweight and obesity**: relating to overweight and obesity.
12. **Food and nutrition policies**: actions on nutrition in the form of policies and relating to policies.
13. **Nutrition and Pregnancy**: nutrition during pregnancy.
14. **Nutrition-friendly Schools**: nutrition interventions at school for school-aged children and adolescents.
15. **Food and Nutrition Security**: household and country food and nutrition security.
16. **Tuberculosis related topics**: nutrition and tuberculosis.
17. **Undernutrition**: focus on undernutrition.
18. **Vitamins and Minerals**: relating to conditions of deficiency, fortification, and daily requirements of vitamins and minerals.
19. **Nutrition and WASH**: nutrition in relation to water, sanitation, and hygienic conditions.
20. **Other**: In order to make provision for any publication not addressing any of the above mentioned public health categories, this category was added.

3.6.1.2 Step 1.2: List of South African public health policies, programmes and guidelines

From the South African DoH website, all historical policy, programme and guideline documents since 1994 were extracted. Individuals from a CEN expert group, as well as some DoH stake-holders, were consulted to confirm or expand the comprehensiveness of this list of South African public health policies, programmes and guidelines (PolList). Some of these individuals indicated

that a number of nutrition-related documents could be found from other departments or platforms. These documents mentioned were added to the PolList.

3.6.2 Objective 2: Determination of predominant nutrition themes

After the historical nutrition landscape was determined, broad themes were extracted from the WHO website to categorise subsequent documents and publications.

3.6.2.1 Step 2.1: Extracted the WHO nutrition themes as present on the website

As found on the WHO website, all the nutrition documents were pre-categorised by the WHO into 19 categories. The nutrition categories on the WHO website were used as nutrition themes, with the addition of an “Other” category to account for publications outside of the public health scope. As mentioned, the categories were not expanded on what the content entails, resulting in the researcher scanning the documents contained in each category to determine the scope. A reading of the abstracts, summaries, executive summaries or nutrition sections served as analysis of the theme content.

3.6.2.2 Step 2.2: Catalogued the PolList according to WHO themes

The PolList documents were assessed and catalogued according to the nutritional theme. Theme cataloguing was determined by means of a thematic analysis of document titles, key words, abstracts or executive summaries, stated objectives or nutrition sections.

3.6.3 Objective 3: Capturing and cataloguing NWU post-graduate student outputs (PubData)

In order to evaluate the impact, scope and reach of all the MSc and PhD Nutrition and Dietetic publications at the NWU over the past two decades, a comprehensive publication list was compiled (PubData). The PubData included all theses and dissertations obtained between 1998 and 2018, as well as any academic journal publications associated with those theses and dissertations. Conference papers and editorials were excluded. Articles were included independent of year of publication, from 1997 till 2019.

3.6.3.1 Step 3.1: Collected all MSc and PhD Nutrition and Dietetics theses and dissertations from 1998-2018

All the theses and dissertation publications of NWU MSc and PhD Nutrition and Dietetic degrees obtained between 1998 and 2018 were included. A list of degrees was compiled from the graduation yearbooks (1998-2018) held at the NWU Ferdinand Postma Library. This list was

matched to the ones held by AUTHeR and CEN, where the students received supervision. CEN provided a list of publications since 2003, however no list of publications was provided from AUTHeR for publications before 2003.

Once the list was completed, document searches were conducted in Boloka (the Institutional Repository) and NRF Nexus (current and completed projects repository). In Boloka searches were conducted according to study title, surname of student and date of thesis or dissertation issue. The institutional repository search was matched with a similar search on the NRF Nexus. Publications were extracted and collected on Endnote. Any publications not in electronic format were viewed at the university library. Some documents were written in article format, with suggested articles and titles ready for publishing, while others were written in chapter format only. From the publications the following information was extracted: title, author, supervisor(s), year of publication, key words, abstracts, table of contents and titles of embedded articles.

3.6.3.2 Step 3.2: Collection of subsequent journal articles associated with the theses and dissertations

All journal article publications resulting from the post-graduate publications were added to the PubData. The publications were collected in three steps. Thereafter they were consolidated into a single list and the presence of an online publications were then confirmed.

A. From the theses and dissertations, embedded article titles were extracted and verified by means of online database searches for these titles in Boloka and EbscoHost.
B. From publication lists held at CEN since 2003, student publications were collected.
C. Electronic searches for academic journal articles were conducted on Boloka and EbscoHost with student surname (or maiden name) alone and in combination with supervisor(s). Titles were excluded if no publication (pdf) document was present or when publications were retracted.

Back to:
Figure 3-2: Stepwise approach to reaching set objectives

All publications collected in phases A – -C were combined and duplicates removed. In order to exclude any publications not related to student research, the research team assessed each article. Upon completion if this were articles searched for, downloaded and collected in Endnote.

3.6.4 Objective 4: Determination of the scope of student outputs

3.6.4.1 Step 4.1: Categorised student outputs according to predominant nutrition

From the PubData, the publications were matched to the nutrition themes determined in objective 2. Publications were matched based on the thematic analysis of titles, key words, abstracts or summaries, or stated objectives. Single publications addressing multiple themes were included in all relevant themes. Publications not addressing any of the themes were categorised under the theme “other”.

3.6.5 Objective 5: Citation analysis of student publications: impact and reach

Use of citations, as a quantitative aspect of science communication, is a subject of investigation in scientometrics, especially in the form of citation analysis which “involves counting how many times a paper or researcher is cited” (Meho, 2007:1). Citation analysis requires normalisation. Self-citation, period of citation, and expected citations are partly controlled for in this study.

3.6.5.1 Step 5.1: Citation normalisation and extraction

Citation normalisation included controlling for self-citation and time of citation. Self-citation can be described as “citations for which the citing and the cited publication have at least one author in common” (Waltman, 2016:373). To account for self-citation, separate citation counts were required, but both citation counts both with self-citations and without self-citations were extracted. Citing article author information was taken into account to control for self-citation.

As mentioned earlier, time since publication requires a three-year citation window to be present a robust impact. However, to determine the longevity of paper impact, a longer citation window was required, which could be normalised against all other publications. All-time citations counts were thus extracted separately to determine impact.

For the analysis of citations of the NWU student publications made by the scientific community, the following databases were used to conduct the citation count extraction: Elsevier Scopus, Web of Science, and Google Scholar. Details of each publication were sought for on the target databases and a citation count extracted as explained. Citations were matched across databases to remove any duplicate citations and all non-academic journals e.g. conference paper citations. The removal of these discrepancies resulted in the final unique citation count consolidated across databases. The unique consolidated citation count consists of the total number of unique citations found in academic journals or higher education theses or dissertations. The data collection took

place between January and August 2019, with citation counts extracted between June and August 2019. Subsequent citation counts are therefore excluded.

3.6.5.2 Step 5.2: Assessing citing author affiliation

For the purpose of this study, reach within the scientific community was defined as either limited to the South African community or also reaching the international community. Reach within the South African public health community was determined by whether publications reached the South African nutrition-related documents or not. In order to assess the reach of the publications within the scientific community, the citing publications were accessed and assessed to determine the country of origin of all organisations associated with the publication authors. If the citing publication authors were affiliated with South African organisations, publication reach was classified as national. If the citing authors were associated with an organisation outside of South Africa, irrespective of having a national classification, the reach was classified as international. If the student publication was cited by a South African nutrition-related document (from the PolList), the reach would also receive a national public health classification.

3.6.5.3 Step 5.3: Impact normalisation according to expected citation count

For the normalisation of publication impact, an expected citation count for similar publications is required. The expected number of citations depend on publication type, sub-discipline, year of publication, and citation window. Owing to the limitations on theses and dissertation database metrics, impact normalisation was not possible for these. However, normalisation could be conducted for article publications up until the time of this study.

Impact normalisation of student articles was undertaken through utilising the Web of Science database feature InCites. InCites provides users access to the Web of Science database of articles and subsequent bibliometric data. Through investigating the data available for the different sub-disciplines (InCites Research Areas), the time period was set to year of publication, with the subsequent extraction of number of publications per year as well as the citation count for the set of publications. Note that Web of Science provides this citation count as it occurs on the day of extraction. Extraction occurred during August 2019.

For each category, an expected citation count – the relativisation – was calculated. The expected citation count was calculated by dividing the total number of citations by the total number of publication within the subfield. Impact of publications was subsequently calculated by dividing the all-time citation counts of student publications by the expected citation count. If a document received an impact of 1, it would be on par with the average of publications worldwide.

Sub-discipline categories were determined by the InCites research areas. These did not correspond to the WHO themes and required additional categorisation. As with the WHO nutrition themes, some student publications were categorised into several research areas. For ease of use, if a publication were categorised into the research area *Nutrition and Dietetics*, irrespective of any other, *Nutrition and Dietetics* was the research area we assigned to it. Publications not categorised by InCites into *Nutrition and Dietetics* were assessed and assigned to a research area best aligning with the WHO nutrition theme assigned to it in objective 4. Publications not present in the Web of Science database, were categorised into the *Nutrition and Dietetics* research area.

3.6.5.4 Step 5.4: Extract citation counts of PubData from PolList

In addition to citations from the scientific community, South African nutrition-related policies and programme documents were also analysed for citations. For the citation count of publication uptake into these public health documents, the PolList compiled and verified in objective 1 was used. Each document was assessed for the presence of citations. Documents were grouped in one of four groups: (1) any law or legislative document for which citations are not applicable, (2) documents where no references were presented, (3) documents where some references were presented, and (4) documents where complete reference lists were presented.

3.6.6 Objective 6: Compiling and presenting the evidence map

With different types of evidence maps available, several mapping methodologies are implemented for presenting evidence. Evidence maps provide very broad overviews of the evidence base available (Hempel *et al.*, 2014). To present the available publications (as evidence), the maps of the current study will be located on an online platform (open view on Google Drive and Youtube) for interactive use. A Google spreadsheet have been created and is visible to those who have the link.

The data from this study is displayed in several forms. Because of the limitations of Google spreadsheets, three separate maps have been compiled: one presents a summary of research impact, another presents impact and citation counts with normalisation elements, and a third presents also individual publication information. On the online document, additional supporting sheets are added for ease of use.

Summary averages impact map of all-time citations of articles, without self-citation: The summary bubble chart presents the impact of all the article publications, and uses four dimensions to display information: y-axis, x- axis, size, and colour.

1. Reach (x-axis): the four different divisions of reach are presented on the x axis.
2. Scope (colour): for each reach category, all nutrition themes are included and each theme received its own colour (presented in the legend).
3. Publication count (y-axis): the number of articles included within the specific theme is presented on the y-axis.
4. Impact (size): finally, the bubble size represents the average relative impact of the publications.

Averages map: In order to present the different impact and citation count averages for the normalisation according to time since publication (for citation counts only) and inclusion of self-citation, a bubble plot table map is used. The table of bubble plot charts used several dimensions to display information: Table rows, column groups and columns, and chart x-axis, y-axis, and size.

Publications type and indicator (column groups): the first presents article impact, while the second and third are similar in displaying article and theses and dissertation citation counts.

1. Scope (row): the rows present the different nutrition themes.
2. Article impact dimensions presented in the first column. Bubble charts per nutrition theme present the different normalisation elements for article impact:
   2.1. Publications count (bubble charts y-axis): the y axis presents the number of publications for the set parameters.
   2.2. Reach and self-citation element (bubble charts x-axis): on the x-axis the reach elements of national and international are shown, with the addition or exclusion of self-citation.
   2.3. Average impact (size): the size of the bubbles represents the average impact of the set of publications.
3. Citation count dimensions in the second and third column groups:
   3.1. Reach (columns): for each column group, the different columns represent the reach: nationally cited, internationally cited or not cited. Within each column, corresponding to the rows, a bubble chart delivers the data for the set parameters.
   3.2. Publications count (bubble charts y-axis): the y-axis presents the number of publications for the set parameters.
   3.3. Normalisation according to time since publication and the self-citation element (bubble charts x-axis): each x-axis element presents either the three years' post-publication or all-time post-publication, the inclusion of self-citation or not, and inclusion within government documents or not.
   3.4. Citation count (size): eventually the size of the bubbles represents the average citation of publications, and in the impact column group, the average all-time impact of articles.

Expanded averages data table: On an expanded table, averages of impacts and citation counts for the nutrition themes were developed, with the addition of individual publication information. The averages data table evidence map presents data on seven different levels: per row, column group 1, column group 2, column 1, 2, and 3, and cell notes.

1. Scope (rows): the rows present the different nutrition themes.
2. Reach (greater column groups): the four different reach groups are presented in the greater column groups.
3. Normalisation according to time and self-citation (lesser column groups): each greater column group is subdivided into lesser column groups, indicating the time frame of citation extraction and inclusion of self-citation.
4. Publications (column 1): each lesser column group is again divided into three columns. The first presents the number of publications included within the subdivision.
5. Average citation counts (column 2): the second division of the lesser columns present the average citations count for the set parameter.
6. Average impact (column 3): the third division of the lesser columns present the average impact of the articles cited nationally or internationally.
7. List of publications included with their citation count or relative impact (cell notes): each cell presenting the citation count or impact of publications included within the subdivision presents also a cell note, where the list of included publications is shown, each with its own citation or relative impact.

3.7 Conclusion

In this chapter the methodology, study procedures and citation analysis were described. The methods used to achieve each objective were described, while the results of these will be presented in the following chapter.

CHAPTER 4: RESULTS

4.1 Introduction

The aim of this chapter is to present systematically the results of the different objectives obtained from each objective step set out in the previous chapter. Since the purpose of an evidence map is to present data in a user-friendly format, the results are presented in electronic format, along videos to guide the interpretation of the maps. The videos and maps can be found online at the following URL: http://bit.ly/2nUDs9m_CEN1EM. However, in order to present the data in printed format, the data presentation differs from the online versions. As mentioned earlier, because of the large amount of publications and documents inluded in the analysis, one single bibliography will present all references within the study at the end of the dissertation. As a reminder of the steps that were taken for each objective, see **Figure 4-1**. For ease of reference, the relevant tables and/or figures addressing each specific objective have also been included in Figure 4-1 and hyperlinked.

Go to:
Figure 4-1: Diagram of study objectives, steps… p.56

Objective 2 – Predominant nutrition themes p.57

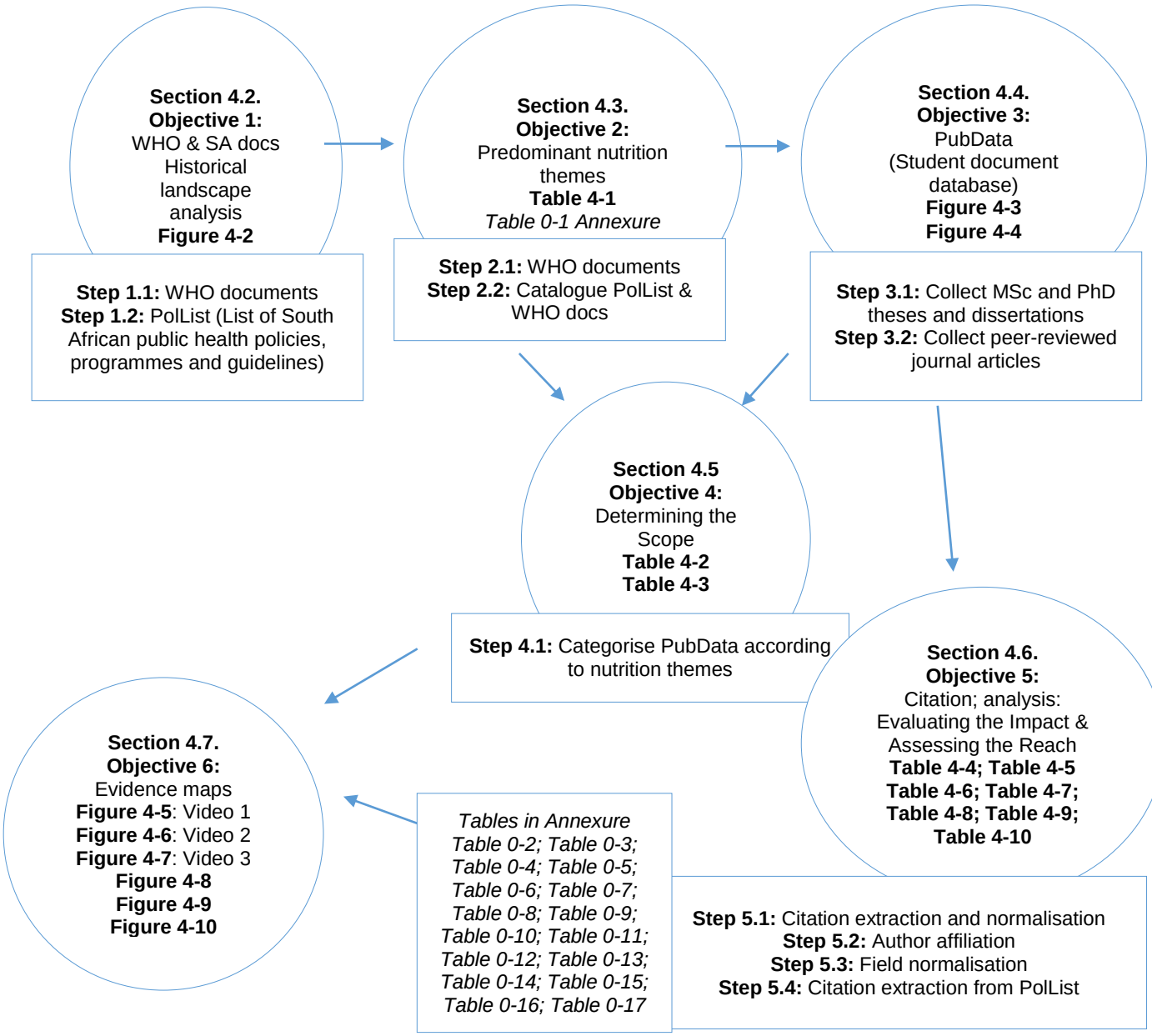
4.2 Objective 1 – Historical nutrition landscape

Results obtained from step 1.1: From the WHO website, a total of 363 unique documents were identified. Of these, 114 were excluded, either being unavailable or addressing irrelevant subjects or geographical locations. Finally, 249 documents were included in the document list. See **Figure 4-2** for a visual presentation of the process of document collection. According to the WHO categorisation of the documents, while many of them addressed at least one theme, several addressed more than one. A list of these documents and the themes they address can be found in the Annexure in **Table 0-1**.

Results obtained from step 1.2: For the compilation of the list of South African public health policies, programmes and guidelines (PolList), 21 documents were available from the DoH website. An additional 49 documents were added after consulting with the CEN expert group and DoH stakeholders. A total of 70 documents were included in the PolList (see **Figure 4-2**). Suggested documents added to the list included documents which were:

- produced or co-produced and publications by the DoH,
- co-produced by the Department of Social Development and UNICEF,
- co-produced by the Department of Basic Education and the DoH,
- produced by the Department of Agriculture, Forestry and Fisheries,

- governmental publications like the constitution, acts or legislations produced by SA as democratic country, or associated governmental departments, e.g. sugar tax policy produced by the Department of the Treasury, or the Zero Hunger Programme by the Parliamentary Monitoring Group or
- co-produced by the South African National AIDS council and the DoH.



WHO – World Health Organisation, PolList – List of South African public health policies, programmes and guidelines, PubData - NWU post-graduate student publication database. Note: all ***Sections, Tables and Figures*** *in this figure are hyperlinked to the corresponding sections, tables and figures in the text for ease of access.*

Figure 4-1: Diagram of study objectives, steps, and results tables, figures and video numbers

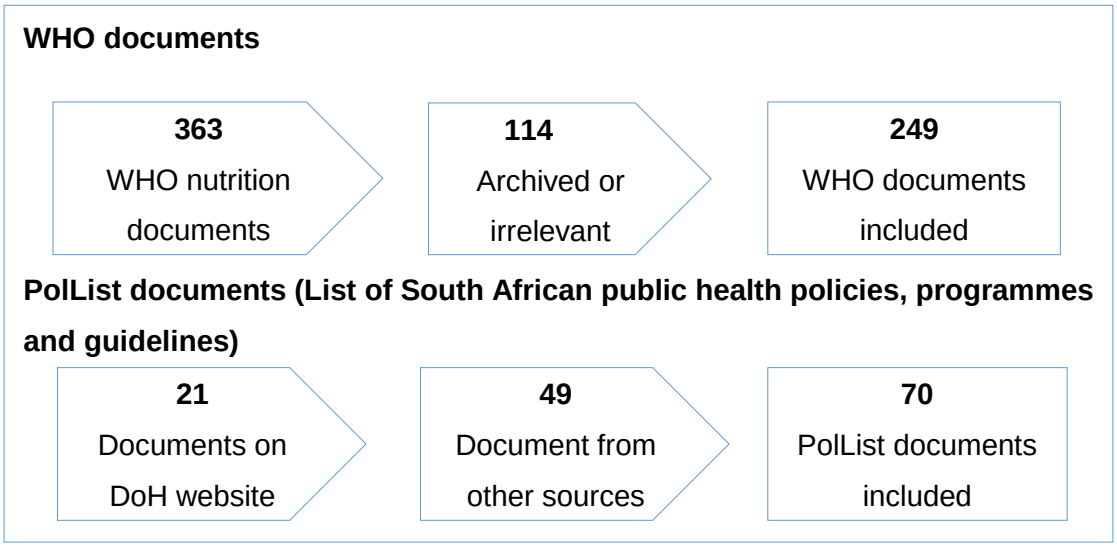


Figure 4-2: Documents included in the historical nutrition landscape

4.3 Objective 2 – Predominant nutrition themes

All WHO documents were pre-categorised by the WHO in nutrition-related categories. These were used as nutrition themes in this study. **Results obtained from step 2.1:** Nineteen WHO nutrition themes were extracted from the website, but not defined. From a content analysis the researcher constructed basic descriptions of the themes. For the purpose of this study the themes were ordered alphabetically and numbered chronologically. As mentioned in section 4.2, the WHO documents were pre-categorised by the WHO and many of the documents addressed more than one theme (see the list of documents and themes they addressed in Table 0-1 in the annexure). The themes that were most often addressed by the WHO were: *(18) Vitamins and minerals* (n=89) and *(9) Infant and young child feeding* (n=79).

Results obtained from step 2.2: The 19 WHO themes were used along with a twentieth, *(20) Other*, for cataloguing the South African policy, programme and guidelines list (PolList) documents. As with the WHO documents, several of the PolList documents covered more than one theme and were therefore categorised into more than one theme. **Table 4-1** presents the PolList document per nutrition theme. The theme of *(10) Nutrient requirements and dietary guidelines* (n=27) was addressed most often by the government documents, followed by that of *(9) Infant and young child feeding (n=23)*. However, none of the documents addressed the following themes; *(1) Accelerating Nutrition Improvements in Sub-Saharan Africa, (2) Adolescents,* and *(3) Country Assessment.* The number of documents and publications addressing each theme is shown in **Table 4-2**.

Table 4-1: South African public health policies, programmes and guidelines contributing to the historical nutrition landscape: per nutrition theme

Year	PolList document title	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary guidelines	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
1996	Constitution of the Republic of South Africa No. 108 of 1996	(South Africa, 1996)																				
1997	White paper for the transformation of the health system in South Africa	(Department of Health, 1997)																				
1998	Basic Conditions of Employment Act 75 of 1997: Code of good practice of the protection of employees during pregnancy and after the birth of a child R. 1441 of 1998	(South Africa, 1998)																				
2001	Health research policy in South Africa	(Department of Health, 2001a)																				
2001	South African food-based dietary guidelines.	(Gibney & Vorster, 2001)																				
2001	South African national guidelines on nutrition for people living with HIV, AIDS, TB and other chronic debilitating conditions	(Department of Health, 2001b)																				
2002	Basic Conditions of Employment Act 75 of 1997: Amendment Act 11 of 2002	(South Africa, 2002)																				
2002	Regulations governing general hygiene requirements for food premises and the transport of food, R. 723 of 2002	(Department of Health, 2002)																				
2003	Foodstuffs, cosmetics and disinfectants Act 54 of 1972: Regulations relating to the fortification of certain foodstuffs R. 1206 of 2003	(South Africa, 2003a)																				
2003	Unemployment Insurance Act 63 of 2001: Amendment Act 32 of 2003	(South Africa, 2003b)																				
2006	Broad frame-work for HIV and AIDS and STI strategic plan for South Africa 2007-2011	(Department of Health, 2006)																				
2006	Guidelines for early childhood development programmes	(Department of Social Development, 2006)																				
2007	Guidelines for maternity care in South Africa	(Department of Health, 2007a)																				
2007	HIV and AIDS and STI strategic plan for South Africa 2007-2011	(Department of Health, 2007b)																				
2007	Infant and young child feeding policy	(Department of Health, 2007c)																				
2007	South African national guidelines on nutrition for people living with HIV, AIDS, TB and other chronic debilitating conditions	(Department of Health, 2007d)																				
2007	Tuberculosis strategic plan for South Africa 2007-2011	(Department of Health, 2007e)																				
2008	Foodstuffs, cosmetics and disinfectants Act 54 of 1972: Amendment of regulations relating to the fortification of certain foodstuffs R. 1206 of 2008	(South Africa, 2008)																				
2008	Policy and guidelines for the implementation of the PMTCT programme	(Department of Health, 2008)																				
2010	Clinical guidelines: PMTCT (prevention of mother-to-child transmission)	(Department of Health & South African national AIDS council, 2010)																				
2010	Foodstuffs, cosmetics and disinfectants Act 54 of 1972: Regulations relating to the labelling and advertising of foodstuff R. 146 of 2010	(South Africa, 2010)																				
2010	National department of health strategic plan 2010/11-2012/13	(Department of Health, 2010a)																				
2010	National Policy For Food Service Management In Public Health Establishments	(Department of Health, 2010b)																				

Table 4-1: South African public health policies, programmes and guidelines contributing to the historical nutrition landscape: per nutrition theme *(Continued)*

Year	PolList document title	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary guidelines	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
2011	Annual performance plan 2011/12-2013/14	(Department of Health, 2011a)																				
2011	Foodstuffs, cosmetics and disinfectants Act 54 of 1972: Regulations relating to trans-fat in foodstuffs R. 127 of 2011	(South Africa, 2011)																				
2011	South African Declaration on the prevention and control of non-communicable diseases. South African summit of the prevention and control of non-communicable diseases. Gauteng 12-13 September 2011	(Department of Health, 2011b)																				
2011	Tshwane Declaration of Support for Breastfeeding in South Africa	(Department of Health, 2011c)																				
2012	Annual performance plan 2012/13-2014/15	(Department of Health, 2012a)																				
2012	Foodstuffs, cosmetics and disinfectants Act 54 of 1972: Regulations relating to foodstuffs for infants and young children R. 991 of 2012	(South Africa, 2012)																				
2012	Integrated school health policy	(Department of Health & Department of Basic Education, 2012)																				
2012	National strategic plan on HIV, STI and TB 2012-2016	(Department of Health, 2012b)																				
2012	National Vitamin A supplementation guidelines for South Africa	(Department of Health, 2012c)																				
2012	South Africa's national strategic plan for a campaign on accelerated reduction of maternal and child mortality in Africa (CARMMA)	(Department of Health, 2012d)																				
2012	Strategic Plan for Maternal, Newborn, Child and Women's Health (MNCWH) and Nutrition in South Africa 2012-2016	(Department of Health, 2012e)																				
2012	Zero Hunger Programme Provincial Implementation: Department of Agriculture, Forestry & Fisheries Briefing, 15 May 2012	(Parliamentary Monitoring Group, 2012)																				
2013	Food-based dietary guidelines for South Africa	(Department of Health *et al.*, 2013)																				
2013	Foodstuffs, cosmetics and disinfectants Act 54 of 1972: Regulations relating to foodstuffs for infants and young children R. 434 of 2013	(South Africa, 2013)																				
2013	Foodstuffs, cosmetics and disinfectants Act 54 of 1972: Regulations relating to the reduction of sodium in certain foodstuffs and related matters R. 214 of 2013	(Department of Health, 2013a)																				
2013	Infant and young child feeding policy 2013	(Department of Health, 2013b)																				
2013	Roadmap for nutrition in South Africa 2013-2017	(Department of Health, 2013c)																				
2013	Strategic Plan for the Prevention and Control of Non-Communicable Diseases 2013-17	(Department of Health, 2013d)																				
2013	The Government of South Africa United Nations strategic cooperation framework 2013-2017	(South Africa & United Nations, 2013)																				
2014	Draft Guidelines relating to the labelling and advertising of foods (R. 428 of 2014) for compliance purposes	(Department of Health, 2014a)																				
2014	Foodstuffs, cosmetics and disinfectants Act 54 of 1972: Regulations relating to the labelling and advertising of foods: amendment R. 429 of 2014	(South Africa, 2014)																				
2014	Guidelines to industry and health care personnel: the regulations relating to foodstuffs for infants and young children R. 991 of 2012: Questions and Answer document	(Department of Health, 2014b)																				
2014	The national policy on food and nutrition security South Africa No. 637 of 2014	(Department of Agriculture Forestry and Fisheries, 2014)																				

Table 4-1: South African public health policies, programmes and guidelines contributing to the historical nutrition landscape: per nutrition theme *(Continued)*

Year	PolList document title	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary guidelines	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
2015	Guidelines for maternity care in South Africa (4th Edition): A manual for clinics, community health centres and district hospitals	(Department of Health, 2015a)																				
2015	Integrated management of children with acute malnutrition in South Africa: operational guidelines	(Department of Health, 2015b)																				
2015	National Consolidated Guidelines for PMTCT and the management of HIV in children, adolescents and adults in South Africa.	(Department of Health, 2015c)																				
2015	National guidelines on nutrition care, support and treatment (NCST) for malnourished individuals.	(Department of Health, 2015d)																				
2015	National integrated early childhood development (ECD) policy.	(Republic of South Africa, 2015)																				
2015	Strategic plan 2015/16-2019/20	(Department of Health, 2015f)																				
2015	The framework for the Zero Hunger programme	(Department of Agriculture Forestry and Fisheries, 2015)																				
2015	The national health promotion policy and strategy 2015-2019	(Department of Health, 2015e)																				
2016	Excise external policy on health promotion levy on sugary beverages from April 2018	(Department of the Treasury, 2016)																				
2016	Foodstuffs, cosmetics and disinfectants Act 54 of 1972: Regulations relating to the fortification of certain foodstuffs R. 217 of 2016	(South Africa, 2016a)																				
2016	Foodstuffs, cosmetics and disinfectants Act 54 of 1972: Regulations relating to the reduction of sodium in certain foodstuffs R. 989 of 2016	(South Africa, 2016b)																				
2016	National enteral nutrition practice guidelines for adults	(Department of Health, 2016a)																				
2016	National guide for the healthy meal provision in the workplace	(Department of Health, 2016b)																				
2016	National parenteral nutrition practice guidelines for adults	(Department of Health, 2016c)																				
2016	National parenteral nutrition practice guidelines for paediatrics	(Department of Health, 2016d)																				
2016	Nutrition guidelines for early childhood development centres	(Department of Health, 2016e)																				
2016	Strategy for the prevention and control of obesity in South Africa 2015-2020	(Department of Health, 2016f)																				
2017	Foodstuffs, cosmetics and disinfectants Act 54 of 1972: Regulations relating to the reduction of sodium in certain foodstuffs and related matters R. 214 of 2013 Amendment No. 1071 of 2017	(Department of Health, 2017a)																				
2017	Guidelines for the Management of Type 2 diabetes mellitus	(SEMDSA Type 2 Diabetes Guidelines Expert Committee, 2017)																				
2017	National health act: national health insurance policy No. 627 of 2017.	(Department of Health, 2017b)																				
2017	Rates and monetary amounts and amendment of revenue laws Act 14 of 2017	(South Africa, 2017)																				
2017	Standard treatment guidelines and essential medicines list for South Africa hospital level paediatrics	(Department of Health, 2017d)																				
2018	Essential drugs programme. Primary healthcare standard treatment guideline and essential medicine list	(Department of Health, 2018a)																				

Table 4-1: South African public health policies, programmes and guidelines contributing to the historical nutrition landscape: per nutrition theme *(Continued)*

Year	PolList document title	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary guidelines	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
2018	Policy framework and strategy for ward based primary healthcare outreach teams 2018/19 - 2023/24	(Department of Health, 2018b)																				

4.4 Objective 3 – NWU publication data: PubData

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Figure 4-1: Diagram of study objectives, steps p.56

Objective 2 – Predominant nutrition themes p.57

Go to:
Objective 4 – Scope of PubData according to nutritional themes p.64

Results obtained from step 3.1: From the graduation yearbooks (1998-2018) held at the NWU Ferdinand Postma Library, a total of 180 theses and dissertations were listed. These agreed with the lists held by the CEN and AUTHeR offices. These publications were also found on the indexes of the Boloka and NRF Nexus repositories. Of these, 40 theses and dissertations were available only in print. Some of the theses and dissertations were written in article format while others were written in chapter format. Those written in article format (n=102) had embedded articles, while those written in chapter format (n=76) often did not. Those in article format presented their subsequent potential articles more straightforwardly than those in chapter format. The embedded articles present an expected number of articles (n=185) (see **Figure 4-3**).

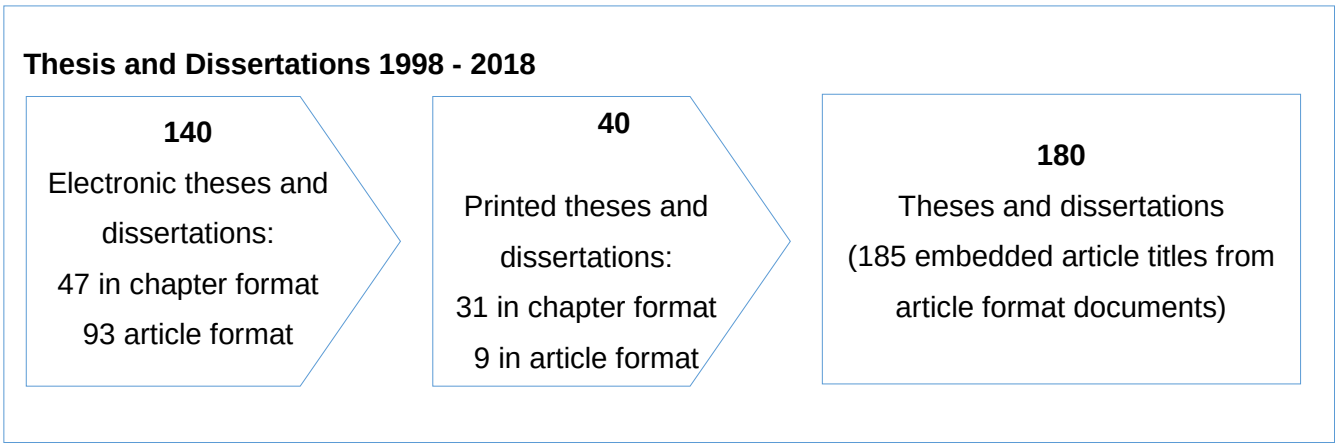

Figure 4-3: Theses and dissertations included in the analysis

Results obtained from step 3.2: The collection of the articles took place in four phases.

Firstly, the embedded article titles were searched on Boloka and EbscoHost for academic journal articles to confirm student dissemination of research in peer-reviewed journals. To account for articles published outside of the range of theses and dissertation publications, the time range included 1997-2019. From the article format theses and dissertations, 185 embedded titles were mentioned. Of these, 120 were excluded as they did not appear on Boloka or EbscoHost as academic articles.

In phase B, the purpose was to match the articles captured in phase A to article titles held by the University offices of AUTHoR (1997-2002) and CEN (2003-2019). Unfortunately, no list of publications was available from AUTHoR to which publications before 2003 could be matched.

The CEN list of publications since 2003 was used to find relevant articles. The 408 titles on the CEN list of publications were matched to the student names, resulting in 152 article titles retained after matching.

Phase C consisted of searches conducted on Boloka and EbscoHost to account for specifically years 1997-2002 and to check publications between 2003-2019. Searches were conducted for authors alone and in combination with supervisor(s). Retracted articles (n=1) and articles which cannot be accessed because journals ceased to exist or publications are unattainable were excluded (n=1).

Finally, during phase D, all the articles retained from the first three phases were combined and duplicates removed. In consultation with the study supervisors, articles were assessed to exclude those that not directly connected to post-graduate studies. These included study titles not matching those mentioned in article format theses or dissertations or articles attributed to students who became lecturers or researchers at the university. Eventually, 155 articles were included in this study. In **Figure 4-4** the process of student article collection is shown.

The theses, dissertations and articles collected in steps 3.1-3.2 were combined to form the PubData list, a total of 335 publications. From this process it was determined that, of the 180 research studies (theses and dissertation studies), 60.56% (n=109) disseminated their findings in at least one article publication.

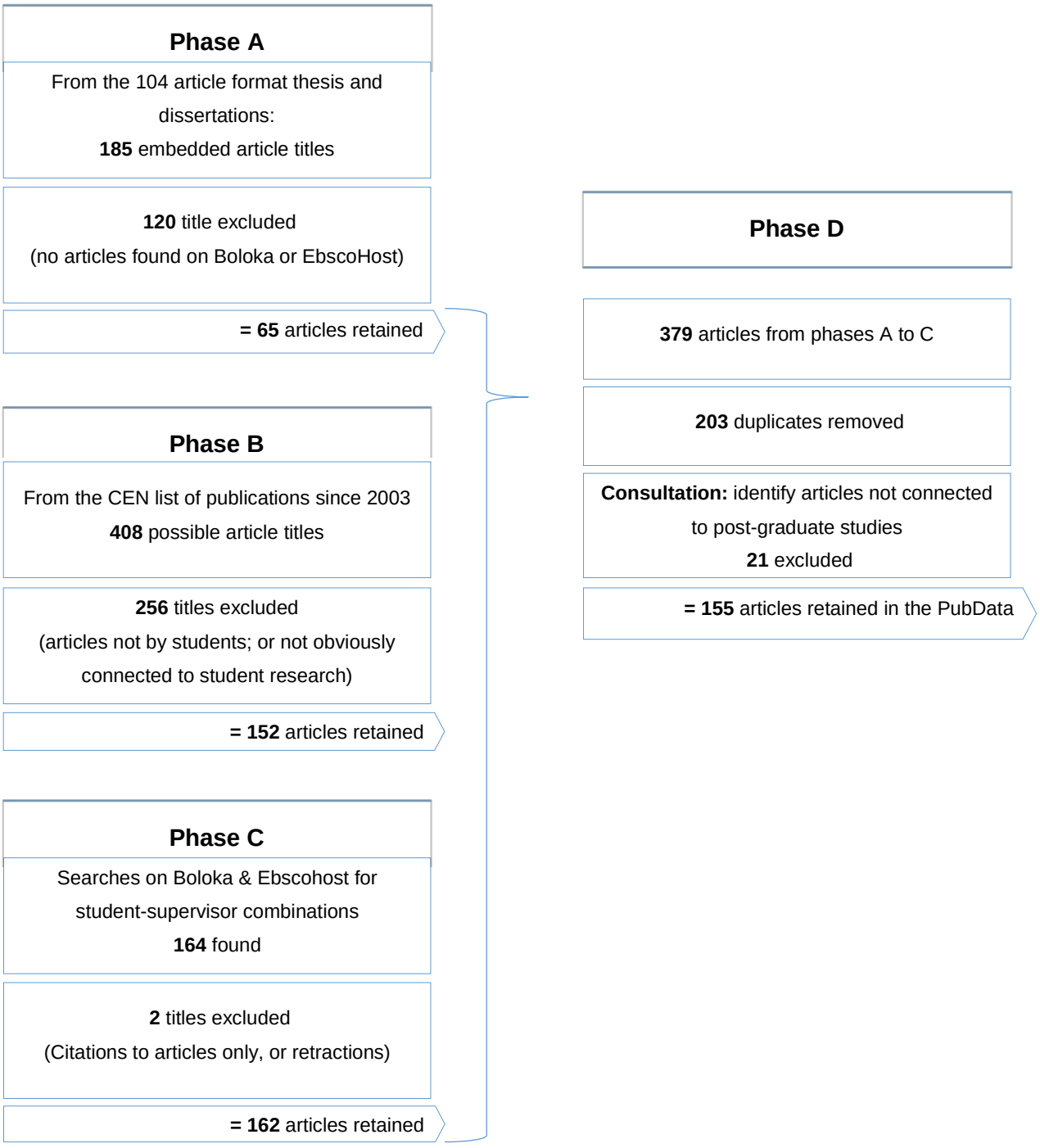

Figure 4-4: Systematic process for the collection of student articles included in the analysis

4.5 Objective 4 – Scope of PubData according to nutritional themes

Results obtained from step 4.1: The 335 PubData publications (including theses, dissertations and articles), were categorised according to the nutrition themes as determined in

Objective 2 – Predominant nutrition themes. The themes most often addressed were those of *(10) Nutrient requirements and dietary guidelines* (Articles n=71; M&D n=69), *(1) Accelerating Nutrition Improvements in Sub-Saharan Africa (ANI)* (Articles n=35; M&D n=40) and *(18) Vitamins and Minerals* (Articles n=32; M&D n=40).

Several of the themes were not addressed by any of the student publications: (*1) Country assessment, (2) Emergency and Humanitarian Crisis, (3) Tuberculosis related topics,* and *(4) Nutrition and WASH,* and no student articles addressed (*5) Foetal development*, while others were only sporadically addressed: (*8) HIV/AIDS, (12) Food and nutrition policies, (13) Nutrition and pregnancy,* and *(14) Nutrition-friendly schools*. In **Table 4-2,** the nutrition themes and the number of documents and publications addressing each theme are presented. These have previously been addressed in section **4.3**. **Table 4-3** presents in detail the PubData publications, arranged first chronologically then alphabetically according to the first author. The table presents publications per nutrition theme and shows how several publications addressed more than one of the themes.

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Figure 4-1: Diagram of study objectives, steps p.56

Objective 3 – NWU publication data: PubData p.62

Go to:
Objective 5 – Impact and reach: citation analysis p.84

Table 4-2: Document and publication count per nutrition theme

Nutrition Theme	WHO documents	SA documents	M&D publications	Article publications
1. Accelerating Nutrition Improvements in Sub-Saharan Africa (ANI)	5	0	**40**	**35**
2. Adolescents	2	0	11	12
3. Country Assessment	1	0	0	0
4. Emergency and humanitarian crisis	20	2	0	0
5. Foetal Development	1	6	1	0
6. Food Labelling	2	6	5	2
7. Growth and development	32	18	25	18
8. HIV/AIDS	17	19	10	3
9. Infant and young child feeding	**79**	**23**	32	24
10. Nutrient requirements and dietary guidelines	23	**27**	**69**	**71**
11. Overweight and obesity	28	7	25	25
12. Food and Nutrition Policies	11	8	1	2
13. Nutrition and Pregnancy	16	11	6	1
14. Nutrition-friendly Schools	2	3	3	1
15. Food and Nutrition Security	5	11	1	3
16. Tuberculosis related topics	2	10	0	0
17. Undernutrition	36	14	2	5
18. Vitamins and Minerals	**89**	5	**40**	**32**
19. Nutrition and WASH	1	2	0	0
20. Other	0	2	14	17

Table 4-3: PubData publications included in the study per nutrition theme

Year	Publication type	Title of the publication	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
1997	Article	The effect of Simvastatin on the plasma antioxidant concentrations in patients with hypercholesterolaemia	(Human *et al.*, 1997)																				
1997	Article	Effect of simvastatin, a 3-hydroxy-3-methylglutaryl coenzyme A reductase inhibitor, on the haemostatic balance of familial hypercholesterolaemic subjects.	(Jerling *et al.*, 1997)																				
1997	Article	Dietary pectin influences fibrin network structure in hypercholesterolaemic subjects	(Veldman *et al.*, 1997)																				
1997	Article	Soluble-fibre concentrate lowers plasminogen activator inhibitor-1 in baboons (Papio ursinus)	(Venter *et al.*, 1997)																				
1997	Article	Dietitian's attitude towards fat substitutes and the acceptability of high-fibre muffins containing Simplesse®	(Bosman *et al.*, 1997)																				
1998	Article	Plasma fibrinogen of black South Africans: the BRISK study	(Vorster *et al.*, 1998)																				
1998	Article	Lecithin has no effect on serum lipoprotein, plasma fibrinogen and macro molecular protein complex levels in hyperlipidaemic men in a double-blind controlled study	(Oosthuizen *et al.*, 1998)																				
1998	Doctorate	Dietary intakes of Africans in transition in the North West province	(MacIntyre, 1998)																				
1998	Doctorate	The glycemic index of indigenous South African foods	(Mbhenyane, 1998)																				
1998	Doctorate	Die effek van simvastatien, 'n HMG-KoA-reduktase-inhibeerder op die hemostatiese balans in hipercholesterolemiese pasiënte	(Jerling, 1998)																				
1998	Maters	Changes in dietary risk factors of colon cancer in Africans during urbanisation	(Nell, 1998)																				
1998	Maters	Purchasing efficiency in the mining foodservice industry	(Oldewage-Theron, 1998)																				
1998	Maters	Die effekte van geëkstrueerde droëbone op lipoproteïen- en hemostatiese veranderlikes	(Scholtz, 1998)																				
1998	Maters	Changes in risk factors of breast cancer in African women during urbanisation	(Burger, 1998)																				
1999	Article	Apolipoprotein E and methylenetetrahydrofolate reductase genetic polymorphisms in relation to other risk factors for cardiovascular disease in UK Caucasians and Black South Africans	(Loktionov *et al.*, 1999)																				
1999	Article	Purchasing efficiency in a mining food service organisation	(Oldewage-Theron *et al.*, 1999)																				
1999	Article	Possible mechanisms through which dietary pectin influences fibrin network architecture in hypercholesterolaemic subjects	(Veldman *et al.*, 1999)																				
1999	Doctorate	The development and evaluation of a low-fat high-fibre muffin using Simplesse as a fat substitute	(Bosman, 1999)																				
1999	Doctorate	The puzzle of obesity in African women: contributing factors and associated risk factors.	(Kruger, 1999)																				
1999	Doctorate	The effect of nutrition on risk factors for coronary heart disease	(Oosthuizen, 1999)																				
1999	Maters	The effect of the glycaemic index of a pre-exercise meal on serum triglycerides during acute exercise in male athletes	(Badenhorst, 1999)																				
1999	Maters	The development and standardisation of a scale to measure food security	(Hanekom, 1999)																				

Table 4-3: PubData publications included in the study per nutrition theme *(Continued)*

Year	Publication type	Title of the publication	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
1999	Maters	The effect of the glycaemic index of a pre-exercise meal on the glycaemic and insulin responses during acute exercise	(Pieters, 1999)																				
1999	Maters	Changes in Factor (VIIc) and fibrinogen during acute exercise in young male athletes and controls: Influence of the glycaemic index of the pre-exercise meal.	(Snyman, 1999)																				
1999	Maters	Breastfeeding practices in Potchefstroom Hospital according to the babyfriendly hospital initiative.	(Waanders, 1999)																				
2000	Article	Nutritional status influences plasma fibrinogen concentration: evidence from the THUSA survey.	(James *et al.*, 2000)																				
2000	Article	The effect of batter refrigeration on the characteristics of high-fibre muffins with oil replaced by a protein-based fat substitute	(Bosman *et al.*, 2000)																				
2000	Article	Extruded dry beans and serum lipoprotein and plasma haemostatic factors in hyperlipidaemic men	(Oosthuizen *et al.*, 2000)																				
2000	Article	The development and testing of a food portion photograph book for use in an African population.	(Venter *et al.*, 2000)																				
2000	Doctorate	Changes in levels of plasma fibrinogen and macromolecular protein complex among Africans in transition in the North-West Province of South Africa	(James, 2000)																				
2000	Maters	Intra-and inter-individual variations in the glucose response to different standards and test foods	(Botes, 2000)																				
2000	Maters	The effect of urbanisation on bone turnover in black postmenopausal women.	(Vorster, 2000)																				
2001	Article	Obesity in African women in the North West Province, South Africa is associated with an increased risk of non-communicable diseases: the THUSA study. Transition and Health during Urbanisation of South Africans	(Kruger *et al.*, 2001)																				
2001	Article	A culture-sensitive quantitative food frequency questionnaire used in an African population: 1. Development and reproducibility	(MacIntyre *et al.*, 2001a)																				
2001	Article	A culture-sensitive quantitative food frequency questionnaire used in an African population: 2. Relative validation by 7-day weighed records and biomarkers	(MacIntyre *et al.*, 2001b)																				
2001	Article	A combination of statistical methods for the analysis of the relative validation data of the quantitative food frequency questionnaire used in the THUSA study	(MacIntyre *et al.*, 2001c)																				
2001	Article	The glycemic index of indigenous South African foods	(Mbhenyane *et al.*, 2001)																				
2001	Article	Co-existence of over-and undernutrition related diseases in low income, high-burden countries: a contribution towards the 17th IUNS congress of nutrition, Vienna 2001	(Rutengwe *et al.*, 2001)																				
2001	Doctorate	The metabolic syndrome, does it exist in Africans in transition in the North West Province?	(Kruger, 2001)																				
2001	Doctorate	The variation and application of the glycaemic index of foods	(Nell, 2001)																				
2001	Doctorate	Evaluation of the fortification of sugar with vitamin A	(Oldewage-Theron, 2001)																				
2001	Maters	Die effek van mikronutriëntsupplementasie op merkers van verworwe immuniteitsgebreksindroom	(Dercksen, 2001)																				

Table 4-3: PubData publications included in the study per nutrition theme *(Continued)*

Year	Publication type	Title of the publication	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
2001	Maters	Evaluation of the effects of an instant soy and maize meal supplement on the vitamin A status of patients infected with the human immune deficient virus.	(Hanson, 2001)																				
2001	Maters	Die effek van 'n dieetsupplement op die lipiedprofiele van MIV-positiewe pasiënte in die Noordwes Provinsie	(Labuschagne, 2001)																				
2001	Maters	Acceptability of an instant soy maize porridge by HIV-positive and -negative consumers	(Mooko, 2001)																				
2001	Maters	The impact of vitamin A fortified sugar on the nutritional status and intakes of 13 - 25 years females in the Vaal Triangle	(Selepe, 2001)																				
2001	Maters	Vitamien C se effek op serumlipiede in hiperlipidemiese pasiënte	(Spies, 2001)																				
2001	Maters	Die ysterstatus van pasiënte met menslike immuniteitsgebreksvirus voor en na mikronitriëntsupplemenering	(Steyn, 2001)																				
2002	Article	Physical inactivity is the major determinant of obesity in black women in the North West Province, South Africa: the THUSA study. Transition and Health During Urbanisation of South Africa.	(Kruger *et al.*, 2002)																				
2002	Article	Impact of urbanisation on serum lipid profiles--the THUSA survey	(Oosthuizen *et al.*, 2002)																				
2002	Article	Differences in N-acetylation genotypes between Caucasians and Black South Africans: implications for cancer prevention.	(Loktionov *et al.*, 2002)																				
2002	Article	Dietary intakes of an African population in different stages of transition in the North West Province, South Africa: the THUSA study	(MacIntyre *et al.*, 2002)																				
2002	Article	Effect of freeze-drying, freezing and frozen storage of blood plasma on fibrin network characteristics	(Pieters *et al.*, 2002)																				
2002	Doctorate	Fibrin network characteristics and red palm oil in hyperfibrinogenaemic, hypercholesterolaemic subjects.	(Pieters, 2002)																				
2002	Doctorate	The sensory, lipid and haemostatic profile evaluation of a potential functional food using red palm olein	(Scholtz, 2002)																				
2002	Maters	The effect of a sports drink on muscle glycogen and blood glucose, insulin and lactate responses after multiple exercise sessions	(de Jager, 2002)																				
2002	Maters	Markers of skeletal muscle damage as predictors of delayed onset muscle soreness	(Opperman, 2002)																				
2003	Article	Physical inactivity as a risk factor for cardiovascular disease in communities undergoing rural to urban transition: the THUSA study.	(Kruger *et al.*, 2003)																				
2003	Article	Intra- and inter-individual variation in glucose response to white bread and oral glucose in healthy women.	(Nell *et al.*, 2003)																				
2003	Doctorate	The effect of vitamin A status on the iron status of African females in the North West Province: the THUSA study	(Hanekom, 2003)																				
2003	Doctorate	The determinants of overweight among 10-15 year old schoolchildren in the North West Province	(Kruger, 2003)																				
2003	Doctorate	The effectiveness of micronutrient fortification of maize meal in improving the nutritional status of children	(Nesamvuni, 2003)																				
2003	Doctorate	Development of a model for the monitoring and evaluation of nutrition and nutrition-related programmes in South Africa	(Wentzel-Viljoen, 2003)																				
2003	Doctorate	Developing and evaluating a food supplement to optimise post-exercise recovery	(Wright, 2003)																				

Table 4-3: PubData publications included in the study per nutrition theme *(Continued)*

Year	Publication type	Title of the publication	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
2003	Maters	A comparison between the effects of black tea and rooibos on the iron status of primary school children	(Breet, 2003)																				
2003	Maters	Demographics and beliefs of consumers indicating preference for healthy food or dietary supplements	(Du Toit, 2003)																				
2003	Maters	The glycaemic index of muffins baked with extruded dried bean flour compared to muffins baked with whole wheat flour	(Gouws, 2003)																				
2003	Maters	The relationship between calcium, vitamin D status, anthropometry, physical activity and bone density in Black men : a case control study	(Groenewald, 2003)																				
2003	Maters	The effects of vitamin C on the haemostatic system	(Loots, 2003)																				
2003	Maters	The association between stunting and overweight among 10-15 year old children in the North West Province	(Mukuddem-Petersen, 2003)																				
2003	Maters	Avocados: consumer beliefs and effect on weight loss and markers of cardiovascular health	(Pieterse, 2003)																				
2003	Maters	Consumers' attitudes regarding the link between frozen and fresh vegetables and health	(Van der Walt, 2003)																				
2003	Maters	Evaluation of the methodology for determining the glycaemic index of foods with special reference to blood sampling	(Van Heerden, 2003)																				
2004	Article	Foodstate vitamin C complex may beneficially affect haemostasis and fibrin network structure in hyperlipidaemic patients	(Loots *et al.*, 2004)																				
2004	Article	Association between stunting and overweight among 10–15-y-old children in the North West Province of South Africa: the THUSA BANA Study	(Mukuddem-Petersen & Kruger, 2004)																				
2004	Article	Meta-analysis of the health effects of using the glycaemic index in meal-planning	(Opperman *et al.*, 2004)																				
2004	Article	The effect of red palm olein and refined palm olein on lipids and haemostatic factors in hyperfibrinogenaemic subjects	(Scholtz *et al.*, 2004)																				
2004	Article	Dietary macronutrient recommendations for optimal recovery post-exercise: Part II	(Wright *et al.*, 2004a)																				
2004	Article	Dietary macronutrient recommendations for optimal recovery post-exercise: Part I	(Wright *et al.*, 2004b)																				
2004	Doctorate	Insulin resistance and the metabolic syndrome in obese black South African women : a focus on risk factors	(Jonker, 2004)																				
2004	Doctorate	Meta-analysis and systematic review of the benefits expected when the glycaemic index is used in planning diets	(Opperman, 2004)																				
2004	Maters	Beliefs and practices related to label reading and its implications for functional foods in South Africa	(Badham, 2004)																				
2004	Maters	Risk factors for osteoporotic fractures in Black South African men : a case control study	(Leach, 2004)																				
2004	Maters	The development of nutrition knowledge and good dietary practices among farm dwellers	(Phometsi, 2004)																				
2004	Maters	Dietary calcium intake and obesity in adult women : the POWIRS study	(Rautenbach, 2004)																				
2004	Maters	South African consumers' beliefs about the link between food and health	(Reid, 2004)																				

Table 4-3: PubData publications included in the study per nutrition theme *(Continued)*

Year	Publication type	Title of the publication	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
2004	Maters	Pregnancy weight gain and outcomes	(Rheeder, 2004)																				
2005	Article	Actions of black tea and Rooibos on iron status of primary school children.	(Breet *et al.*, 2005)																				
2005	Article	Nutrient intake and consumption of indigenous foods by college students in the Northern Province.	(Mbhenyane *et al.*, 2005)																				
2005	Article	A systematic review of the effects of nuts on blood lipid profiles in humans.	(Mukuddem-Petersen *et al.*, 2005)																				
2005	Article	Fortification of maize meal improved nutritional status of 1-3 year old African children.	(Nesamvuni *et al.*, 2005)																				
2005	Article	The effect of extrusion processing on the glycaemic index of dry bean products.	(Oosthuizen *et al.*, 2005)																				
2005	Article	Some health benefits of low glycaemic diets: a systematic review.	(Opperman *et al.*, 2005a)																				
2005	Article	Dietary Challenges For Optimal Control Of Type 2 Diabetes.	(Opperman *et al.*, 2005b)																				
2005	Article	Nutrition knowledge and barriers to good dietary practices among primary school children in a farming community.	(Phometsi *et al.*, 2006)																				
2005	Article	Measuring the glycaemic index: Consensus and issues of debate.	(Pieters & Jerling, 2005)																				
2005	Article	Substitution of high monounsaturated fatty acid avocado for mixed dietary fats during an energy restricted diet: Effects on weight loss, serum lipids, fibrinogen and vascular function.	(Pieterse *et al.*, 2005)																				
2005	Article	Clustering of haemostatic variables and the effect of high cashew and walnut diets on these variables in metabolic syndrome patients.	(Pieters *et al.*, 2005)																				
2005	Article	Consumer acceptance of high-fibre muffins and rusks baked with red palm olein	(Scholtz & Bosman, 2005)																				
2005	Article	More evidence for capillary sampling in the determination of the glycaemic index.	(Venter *et al.*, 2005)																				
2005	Doctorate	The process towards development of an integrated National Nutrition Policy framework for Lesotho	(Hanson, 2005)																				
2005	Doctorate	The effects of nuts on markers of the metabolic syndrome	(Mukuddem-Petersen, 2005)																				
2005	Maters	The effects of a high walnut and unsalted cashew nut diet on the antioxidant status of subjects with diagnosed metabolic syndrome	(Davis, 2005)																				
2005	Maters	The development of a strategy to promote fruit and vegetable consumption in South Africa	(De Witt, 2005)																				
2005	Maters	Beliefs of South Africans regarding food and cardiovascular health	(Dolman, 2005)																				
2005	Maters	Development of a functional beverage from the Kei apple fruit Dovyalis caffra	(Gore, 2005)																				
2005	Maters	Comparison of the association of PAI-1 act with the metabolic syndrome markers in caucasian and black South African women	(Greyling, 2005)																				
2005	Maters	Energy expenditure, dietary intake and nutritional knowledge of elite, school-aged gymnasts	(Joubert, 2005)																				

Table 4-3: PubData publications included in the study per nutrition theme *(Continued)*

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2005	Maters	The association between black tea consumption and iron status of African women in the North West Province : THUSA study	(Muller, 2005)																				
2005	Maters	Eating habits and nutrient intakes of 10-15 year old children in the North West Province	(Rossouw, 2005)																				
2005	Maters	Dietary intake and pregnancy outcome of pregnant women in an outpatient clinic	(Van der Walt, 2005)																				
2005	Maters	The impact of training on productivity in mass food production	(Van Zyl, 2005)																				
2006	Article	Effects of a policosanol supplement on serum lipid concentrations in hypercholesterolaemic and heterozygous familial hypercholesterolaemic subjects.	(Greyling *et al.*, 2006)																				
2006	Article	Poverty and household food security of black South African farm workers: legacy of social inequalities.	(Kruger *et al.*, 2006a)																				
2006	Article	The determinants of overweight and obesity among 10- to 15- year-old schoolchildren in the North West Province, South Africa – the THUSA BANA (Transition and Health during Urbanisation of South Africans; BANA, children) study.	(Kruger *et al.*, 2006b)																				
2006	Article	Phytosterols/Stanols Lower Cholesterol Concentrations in Familial Hypercholesterolemic Subjects: A Systematic Review with Meta-Analysis.	(Moruisi *et al.*, 2006)																				
2006	Article	Polyunsaturated fatty acid intake is adversely related to liver function in HIV-infected subjects: the THUSA study.	(Oosthuizen *et al.*, 2006)																				
2006	Article	The effect of glycaemic control on fibrin network structure of type 2 diabetic subjects.	(Pieters *et al.*, 2006)																				
2006	Doctorate	Effect of dietary fibre on selected haemostatic variables and C-reactive protein	(North, 2006)																				
2006	Maters	Professional nurses' perceptions of their ability to render effective nutritional care and support to people living with HIV/AIDS	(Chasauka, 2006)																				
2006	Maters	Fibrinogen glycation and glycaemic control in type 2 diabetic subjects	(Göttsche, 2006)																				
2006	Maters	Body composition, physical activity and C-reactive protein in children : the PLAY study	(Harmse, 2006)																				
2006	Maters	Haemostatic variables in African adolescents : the PLAY study	(Nienaber, 2006)																				
2006	Maters	Body composition and systematic low-grade inflammation in children : the PLAY study	(Pretorius, 2006)																				
2006	Maters	The characteristics of underreporting women in the POWIRS II study	(Raubenheimer, 2006)																				
2006	Maters	The processes of planning and nutrient analysis of diets for controlled feeding trials in free-living subjects	(Van der Watt, 2006)																				
2006	Maters	Implementation of hazard analysis and critical control point (HACCP) system in a food service unit serving immuno-suppressed patient diets	(Vermeulen, 2006)																				
2007	Article	The effects of high walnut and cashew nut diets on the antioxidant status of subjects with metabolic syndrome	(Davis *et al.*, 2007)																				
2007	Article	An inverse association between calcium intake and adiposity in women with high fat and calcium intakes.	(Kruger *et al.*, 2007)																				

Table 4-3: PubData publications included in the study per nutrition theme *(Continued)*

Year	Publication type	Title of the publication	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
2007	Article	Aloe ferox Leaf Gel Phytochemical Content, Antioxidant Capacity and Possible Health Benefits	(Loots *et al.*, 2007)																				
2007	Article	Effects of a high walnut and high cashew nut diet on selected markers of the metabolic syndrome: A controlled feeding trial.	(Mukuddem-Petersen *et al.*, 2007)																				
2007	Article	Glycation of fibrinogen in uncontrolled diabetic patients and the effects of glycaemic control on fibrinogen glycation.	(Pieters *et al.*, 2007)																				
2007	Doctorate	What is the optimum diet for asymptomatic HIV-infected people (AHIV)? : a public health approach	(Van Graan, 2007)																				
2007	Doctorate	Bioavailability of iron from fortified maize using stable isotope techniques	(White, 2007)																				
2007	Maters	Polyphenols, ascorbate and antioxidant capacity of the Kei-apple (Dovyalis caffra)	(De Beer, 2007)																				
2008	Article	Beliefs of South Africans regarding food and cardiovascular health	(Jerling *et al.*, 2008)																				
2008	Article	Overfatness, stunting and physical inactivity are determinants of plasminogen activator inhibitor-1activity, fibrinogen and thrombin – antithrombin complex in African adolescents.	(Nienaber *et al.*, 2008)																				
2008	Article	Glycaemic control improves fibrin network characteristics in type 2 diabetes – A purified fibrinogen model.	(Pieters *et al.*, 2008)																				
2008	Article	Opinion of South African pre-and post-menopausal women on the potential menopause-related health benefits of soy and soy products	(Van Aardt *et al.*, 2008)																				
2008	Article	The process of nutrient analysis for controlled feeding trials: A comparative study of two South African nutrient databases with chemical analysis	(Van der Watt *et al.*, 2008)																				
2008	Doctorate	The association between specific genetic, demographic and lifestyle factors related to homocysteine concentrations in black South Africans undergoing an epidemiological transition	(Nienaber, 2010)																				
2008	Doctorate	Associations between biological alcohol consumption markers, reported alcohol intakes, and biological health outcomes in an African population in transition.	(Pisa, 2008)																				
2008	Doctorate	The validity and reproducibility of the 24–hour recall dietary assessment method amongst adolescents in North–West Province, South Africa	(Rankin, 2008)																				
2008	Maters	The effect of blood glucose control on fibrin network characteristics of African subjects with uncontrolled type 2 diabetes	(Covic, 2008)																				
2008	Maters	The effect of a fatty acid-based carrier on the bioavailability of epigallocatechin gallate	(Moruisi, 2008)																				
2008	Maters	Factors affecting mothers' choice of infant feeding method	(Schoonwinkel, 2008)																				
2008	Maters	Micronutrient dilution associated with alcohol and added sugar intake in the THUSA population	(Serfontein, 2008)																				
2008	Maters	Effects of policosanol supplements on serum lipid concentrations : a systematic review	(Walsh, 2008)																				
2009	Article	South African consumers' opinions and consumption of soy and soy products.	(Bosman *et al.*, 2009)																				
2009	Article	The effects of dietary fibre on C-reactive protein, an inflammation marker predicting cardiovascular disease.	(North *et al.*, 2009)																				

Table 4-3: PubData publications included in the study per nutrition theme *(Continued)*

Year	Publication type	Title of the publication	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
2009	Doctorate	The phytochemical content and anti-diabetic properties of Aloe ferox and Aloe greatheadii var. davyana.	(Botes, 2009)																				
2009	Doctorate	Towards a responsible food-based dietary guideline for alcohol consumption for South Africa	(Gopane, 2009)																				
2009	Doctorate	The validity of a short questionnaire on Iron intake and Iron status in humans	(Kunneke, 2009)																				
2009	Doctorate	The prevalence of selected risk markers for noncommunicable diseases and associations with lifestyle behaviours in an Indian community in KwaZulu-Natal	(Naicker, 2009)																				
2009	Maters	The effects of highly active antiretroviral therapy on body composition in children 3 to 16 years old	(Jooste, 2009)																				
2009	Maters	The effect of ethanol and products of its metabolism on haemostatic modifications following moderate alcohol consumption	(Kotze, 2009)																				
2009	Maters	Factors associated with nutritional status of children aged 0-60 months residing in Eastern Cape and KwaZulu-Natal provinces	(Lesiapeto, 2009)																				
2009	Maters	Assessment of hazard analysis and critical control points principles in primary school feeding schemes in the Western Region of Gauteng	(Müller, 2009)																				
2009	Maters	The feasibility of implementing a point-of-use micronutrient fortification among African pre-school children : a pilot study.	(Ogunlade, 2009)																				
2009	Maters	Testing the preliminary paediatric food-based dietary guidelines amongst Xhosa- and Zulu-speaking mothers/caregivers of children aged 1-7 years	(van Zyl, 2009)																				
2010	Article	Factors affecting mothers' choice of breastfeeding vs. formula feeding in the lower Umfolozi district war memorial hospital, KwaZulu-Natal.	(Swarts *et al.*, 2010)																				
2010	Article	Relationships of alcohol intake with biological health outcomes in an African population in transition: the Transition and Health during Urbanisation in South Africa (THUSA) study	(Gopane *et al.*, 2010)																				
2010	Article	Significant differences between serum CRP levels in children in different categories of physical activity: the PLAY study	(Harmse & Kruger, 2010)																				
2010	Article	Stunting, adiposity and low-grade inflammation in African adolescents from a township high school.	(Kruger *et al.*, 2010)																				
2010	Article	Risk factors of poor anthropometric status in children under five years of age living in rural districts of the Eastern Cape and KwaZulu-Natal provinces, South Africa	(Lesiapeto *et al.*, 2010)																				
2010	Article	Triglyceride concentration and waist circumference influence alcohol-related plasminogen activator inhibitor-1 activity increase in black South Africans.	(Pieters *et al.*, 2010a)																				
2010	Article	The effect of ethanol and its metabolism on fibrinolysis	(Pieters *et al.*, 2010b)																				
2010	Article	Alcohol consumption and cardiovascular disease risk in an African population: The PURE study.	(Pisa *et al.*, 2010a)																				
2010	Article	Alcohol metabolism and health hazards associated with alcohol abuse in a South African context: a review	(Pisa *et al.*, 2010b)																				
2010	Article	Dietary assessment methodology for adolescents: a review of reproducibility and validation studies.	(Rankin *et al.*, 2010)																				

Table 4-3: PubData publications included in the study per nutrition theme *(Continued)*

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2010	Article	Alcohol intake and micronutrient density in a population in transition: the transition and health during urbanisation in South Africa (THUSA) study	(Serfontein *et al.*, 2010)																				
2010	Doctorate	Comparison of waist circumference distribution of South African black children from different study populations	(Motswagole, 2010)																				
2010	Maters	The association between alcohol consumption, PAI-1 activity and fibrinogen concentration in black South Africans	(De Lange, 2010)																				
2010	Maters	The use of a musical play in the transfer of knowledge on nutrition, a healthy lifestyle and the prevention of obesity	(Kruger, 2010)																				
2010	Maters	Dietary fat intake and blood lipid profiles of South African communities in transition in the North–West Province : the PURE study	(Richter, 2010)																				
2011	Article	The relationship between indices of iron status and selected anthropometric cardiovascular disease risk markers in an African population: the THUSA study	(Aderibigbe *et al.*, 2011a)																				
2011	Article	Iron status and cardiovascular disease risk in black South African women: the PURE study	(Aderibigbe *et al.*, 2011b)																				
2011	Article	South African consumers' opinions and beliefs regarding the health benefits of soy and soy products.	(Bosman *et al.*, 2011)																				
2011	Article	Disordered eating and menstrual patterns in female university netball players.	(Havemann *et al.*, 2011)																				
2011	Article	Risk factor profile of coronary artery disease in black South Africans.	(Jerling *et al.*, 2011)																				
2011	Article	Antidiabetic effects of Aloe ferox and Aloe greatheadii var. davyana leaf gel extracts in a low-dose streptozotocin diabetes rat model	(Loots *et al.*, 2011)																				
2011	Article	The sensitivity of waist-to-height ratio in identifying children with high blood pressure	(Motswagole *et al.*, 2011)																				
2011	Article	Point-of-use micronutrient fortification: lessons learned in implementing a preschool-based pilot trial in South Africa	(Ogunlade *et al.*, 2011)																				
2011	Article	Dietary intakes assessed by 24-hrecalls in peri-urban African adolescents: validity of energy intake compared with estimated energy expenditure.	(Rankin *et al.*, 2011)																				
2011	Doctorate	Associations between indices of iron status, anthropometric and biological markers of cardiovascular disease risk	(Aderibigbe, 2011)																				
2011	Maters	The social drift phenomenon : associations between the socio–economic status and cardiovascular disease risk in an African population undergoing a health transition	(Behanan, 2011)																				
2011	Maters	Effects of iron and omega–3 fatty acid supplementation on physical activity of iron deficient primary school children residing in KwaZulu–Natal	(Greeff, 2011)																				
2011	Maters	The relevance of glycosylated haemoglobin in screening for non–insulin dependent diabetes mellitus in a black South African population	(Pieterse, 2011)																				
2011	Maters	Iron status, anthropometric status and cognitive performance of black African school children aged 6-11 years in the Klerksdorp area	(Taljaard, 2011)																				
2012	Article	Plasma clot lysis time and its association with cardiovascular risk factors in black South Africans	(De Lange *et al.*, 2012)																				

Table 4-3: PubData publications included in the study per nutrition theme *(Continued)*

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2012	Article	Measuring micronutrient intakes at different levels of sugar consumption in a population in transition: the Transition and Health during Urbanisation in South Africa (THUSA) study.	(MacIntyre *et al.*, 2012)																				
2012	Article	Body composition in stunted, compared to non-stunted, black South African children, from two rural communities.	(Motswagole *et al.*, 2012)																				
2012	Article	Social drift of cardiovascular disease risk factors in Africans from the North West Province of South Africa: the PURE study	(Pisa *et al.*, 2012)																				
2012	Article	Reproducibility of two, three, four and five 24-hour recalls in peri-urban African adolescents in the North West province.	(Rankin *et al.*, 2012)																				
2012	Doctorate	Effect of a micronutrient–fortified beverage on cognition and nutritional status of primary school children	(Taljaard, 2012)																				
2012	Maters	The role of attitude and barriers on the implementation of a nutrition intervention in primary school children	(Harris, 2012)																				
2012	Maters	Potential contribution of African leafy vegetables to the nutritional status of children	(Osei, 2012)																				
2012	Maters	A critical analysis of the labels of processed complementary foods for infants and young children in South Africa against international marketing guidelines	(Sweet, 2012)																				
2012	Maters	The validation of a suitable nutrient profiling model for South Africa	(Wicks, 2012)																				
2013	Article	In black South Africans from rural and urban communities, the 4G/5G PAI-1 polymorphism influences PAI-1 activity, but not plasma clot lysis time	(De Lange *et al.*, 2013)																				
2013	Article	Gene–environment and gene–gene interactions of specific MTHFR, MTR and CBS gene variants in relation to homocysteine in black South Africans.	(Nienaber-Rousseau *et al.*, 2013a)																				
2013	Article	Nutritional genetics: the case of alcohol and the MTHFR C677T polymorphism in relation to homocysteine in a black South African population.	(Nienaber-Rousseau *et al.*, 2013b)																				
2013	Article	Field-testing of guidance on the appropriate labelling of processed complementary foods for infants and young children in South Africa	(Sweet *et al.*, 2013)																				
2013	Article	Studies since 2005 on South African primary schoolchildren suggest lower anaemia prevalence in some regions	(Taljaard *et al.*, 2013a)																				
2013	Article	Effects of a multi-micronutrient-fortified beverage, with and without sugar, on growth and cognition in South African schoolchildren: a randomised, double-blind, controlled intervention	(Taljaard *et al.*, 2013b)																				
2013	Article	Indigenous and traditional plants: South African caregivers' knowledge, perceptions and uses and their children's sensory acceptance .	(Van der Hoeven *et al.*, 2013)																				
2013	Doctorate	Global fibrinolytic potential of black South Africans in the North West Province	(De Lange, 2013)																				
2013	Doctorate	The role of diet in cardiovascular disease in black South Africans : both sides of the story	(Dolman, 2013)																				
2013	Doctorate	The association of LDLR and PCSK9 variants with LDL-c levels in a black South African population in epidemiological transition	(Van Zyl, 2013)																				
2013	Maters	Lifestyle risk factors and bone mineral density of urban postmenopausal women in the North West Province	(Ellis, 2013)																				

Table 4-3: PubData publications included in the study per nutrition theme *(Continued)*

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2013	Maters	Fatty acid status and dietary intake of children and their caregivers from three distinct communities	(Ford, 2013)																				
2013	Maters	Using existing dietary data for evaluating the construct validity of a nutrient profiling model	(Lee, 2013)																				
2013	Maters	Effectiveness of probiotic Bifidobacterium animalis DN-173010 in the management of constipation-predominant irritable bowel syndrome in black South African women	(Rammbwa, 2013)																				
2013	Maters	Pathogenic weight control measures and disordered eating behaviour of female student dancers	(Robbeson, 2013)																				
2013	Maters	The relevance of specific c-reactive protein genetic variants towards cardiovascular disease risk in a black South African population undergoing an epidemiological transition	(Swanepoel, 2013)																				
2014	Article	The relationship between iron status and adiposity in women from developing countries: a review	(Aderibigbe *et al.*, 2014)																				
2014	Article	South African adult metropolitan consumer's opinions and use of health information on Food Labels.	(Bosman *et al.*, 2014)																				
2014	Article	The use of predefined diet quality scores in the context of CVD risk during urbanization in the South African Prospective Urban and Rural Epidemiological (PURE) study	(Dolman *et al.*, 2014)																				
2014	Article	A strategy for scaling up vitamin A supplementation for young children in a remote rural setting in Zimbabwe.	(Dube *et al.*, 2014)																				
2014	Article	CVD risk factors are related to plasma fibrin clot properties independent of total and or γ' fibrinogen concentration	(Kotzé *et al.*, 2014)																				
2014	Article	Low immune cell ARA and high plasma 12-HETE and 17-HDHA in iron-deficient South African school children with allergy.	(Malan *et al.*, 2014a)																				
2014	Article	n–3 Long-chain PUFAs reduce respiratory morbidity caused by iron supplementation in iron-deficient South African schoolchildren: a randomized, double-blind, placebo-controlled intervention	(Malan *et al.*, 2014b)																				
2014	Article	Interactions between C-Reactive Protein Genotypes with Markers of Nutritional Status in Relation to Inflammation.	(Nienaber-Rousseau *et al.*, 2014)																				
2014	Article	Evidence that fibrinogen γ′ regulates plasma clot structure and lysis and relationship to cardiovascular risk factors in black Africans	(Pieters *et al.*, 2014)																				
2014	Article	Different dietary fatty acids are associated with blood lipids in healthy South African men and women: The PURE study	(Richter *et al.*, 2014)																				
2014	Article	**Common and rare single nucleotide polymorphisms in the LDLR gene are present in a black South African population and associate with low-density lipoprotein cholesterol levels**	**(Van Zyl *et al.*, 2014)**																				
2014	Article	A desire for weight loss in season increases disordered eating behaviour risk and energy deficiency in athletes	(Wright *et al.*, 2014)																				
2014	Doctorate	Fibrinogen functionality in black South Africans: the PURE study	(Kotzé, 2014)																				
2014	Doctorate	Effects of iron and omega-3 supplementation on the immune system of iron deficient children in South Africa: a randomised controlled trial	(Malan, 2014)																				
2014	Doctorate	Associations between plasma fatty acids, dietary fatty acids and cardiovascular risk factors: The PURE study	(Richter, 2014)																				
2014	Doctorate	Body composition, bone health and vitamin D status of African adults in the North West Province	(Sotunde, 2014)																				

Table 4-3: PubData publications included in the study per nutrition theme *(Continued)*

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2014	Doctorate	The effect of African leafy vegetables on the alleviation of micronutrient deficiencies in school children residing in the North West Province of South Africa	(Van der Hoeven, 2014)																				
2014	Maters	Evaluation of common genetic variants associated with type 2 diabetes susceptibility in a black South African population	(Chikowore, 2014)																				
2014	Maters	UNICEF infant and young child feeding training in Zimbabwe : analysis and recommendations	(Dube, 2014)																				
2014	Maters	The association between fibrinolysis markers and body composition in black adults in the North West Province of South Africa	(Eksteen, 2014)																				
2014	Maters	A critical analysis of iron status indicators in three independent studies of South African primary school children	(Harris, 2014)																				
2014	Maters	The influence of genetic polymorphisms of fibrinogen genes on changes in total fibrinogen and fibrinogen gamma prime concentrations over time in black South Africans	(Jobse, 2014)																				
2014	Maters	Associations between specific ApoE genetic variants and their interactions with environmental factors in relation to the lipid profile of black South Africans	(Meades, 2014)																				
2014	Maters	Iron and zinc bioaccessibility from African leafy vegetables: implications for nutrition	(Mongwaketse, 2014)																				
2014	Maters	Violations of the International Code of Marketing of Breast Milk Substitutes in South African health facilities	(Muravha, 2014)																				
2014	Maters	Iron status, inflammation and anthropometric nutritional status of four–to–thirteen month old black infants from a rural South African population	(Nel, 2014)																				
2014	Maters	Stakeholder attitudes and acceptability on donating and receiving donated human breast milk	(Oosthuizen, 2014)																				
2014	Maters	Assessing the extent of violations of the International Code of Marketing of Breast Milk Substitutes in South African advertising media.	(Radebe, 2014)																				
2014	Maters	Feeding practices of mothers and/or caregivers of infants below the age of 6 months in South Africa	(Siziba, 2014)																				
2014	Maters	The intake and quality of breakfast consumption among adolescents attending public secondary schools in Potchefstroom	(Tee, 2014)																				
2015	Article	**Common variants associated with type 2 diabetes in a Black South African population of Setswana descent: African populations diverge**	**(Chikowore *et al.*, 2015)**																				
2015	Article	UNICEF Training Package for Scaling Up Skilled Community Infant and Young Child Feeding Counselors: Zimbabwe Experience	(Dube *et al.*, 2015)																				
2015	Article	The association of clot lysis time with total obesity is partly independent from the association of PAI-1 with central obesity in African adults.	(Eksteen *et al.*, 2015)																				
2015	Article	The contribution of genetic and environmental factors to changes in total and γ' fibrinogen over 5 years.	(Jobse *et al.*, 2015)																				
2015	Article	Genetic polymorphisms influencing total and γ' fibrinogen levels and fibrin clot properties in Africans	(Kotzé *et al.*, 2015)																				

Table 4-3: PubData publications included in the study per nutrition theme *(Continued)*

Year	Publication type	Title of the publication	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
2015	Article	Potential contribution of African green leafy vegetables and maize porridge composite meals to iron and zinc nutrition	(Kruger *et al.*, 2015)																				
2015	Article	Differential ferritin interpretation methods that adjust for inflammation yield discrepant iron-deficiency prevalence	(Nel *et al.*, 2015)																				
2015	Article	Prevalence of glutamine deficiency in ICU patients: a cross-sectional analytical study.	(Nienaber *et al.*, 2015)																				
2015	Article	Association of Alcohol Consumption with Specific Biomarkers: A Cross-sectional Study in South Africa.	(Pisa *et al.*, 2015)																				
2015	Article	Disordered eating behavior, body image, and energy status of female student dancers	(Robbeson *et al.*, 2015)																				
2015	Article	Acceptability of Novel Small-Quantity Lipid-Based Nutrient Supplements for Complementary Feeding in a Peri-Urban South African Community	(Rothman *et al.*, 2015)																				
2015	Article	Long-chain n-3 PUFA supplementation decreases physical activity during class time in iron-deficient South African school children.	(Smuts *et al.*, 2015)																				
2015	Article	Lean mass appears to be more strongly associated with bone health than fat mass in urban black South African women	(Sotunde *et al.*, 2015)																				
2015	Article	The intake and quality of breakfast consumption in adolescents attending public secondary schools in the North West province, South Africa	(Tee *et al.*, 2015)																				
2015	Article	Effect of African leafy vegetables on the micronutrient status of mildly deficient farm-school children in South Africa: a randomized controlled study.	(Van der Hoeven *et al.*, 2016)																				
2015	Doctorate	Nutritional status, feeding practices and motor development of 6-month-old infants	(Rothman, 2015)																				
2015	Maters	Branding and cartoon character usage in food marketing to children : the South African picture	(Delport, 2015)																				
2015	Maters	Associations between specific measures of adiposity and high blood pressure in black South African women	(Doubell, 2015)																				
2015	Maters	Monitoring the reduction of sodium content of selected food items using label information in South Africa	(Hattingh, 2015)																				
2015	Maters	Dietary intake, energy availability and weight control practices of male apprentice jockeys residing at the SA Jockey Academy	(Krog, 2015)																				
2015	Maters	Plasma glutamine levels in critically ill intensive care patients	(Nienaber, 2015)																				
2015	Maters	Development of an implementation tool for a breast milk bank in the North West Province	(Pretorius, 2015)																				
2015	Maters	Relationship of salt usage behaviours and urinary sodium excretion in normotensive South African adults	(Visser, 2015)																				
2016	Article	The contribution of different adipose tissue depots to plasma plasminogen activator inhibitor-1 (PAI-1) levels	(Barnard *et al.*, 2016a)																				
2016	Article	Degree of obesity influences the relationship of PAI-1 with body fat distribution and metabolic variables in African women	(Barnard *et al.*, 2016b)																				
2016	Article	Predictive utility of a genetic risk score of common variants associated with type 2 diabetes in a black South African population	(Chikowore *et al.*, 2016)																				

Table 4-3: PubData publications included in the study per nutrition theme *(Continued)*

Year	Publication type	Title of the publication	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
2016	Article	Dietary fat intake and red blood cell fatty acid composition of children and women from three different geographical areas in South Africa.	(Ford *et al.*, 2016)																				
2016	Article	Iron and a mixture of DHA and EPA supplementation, alone and in combination, affect bioactive lipid signalling and morbidity of iron deficient South African school children in a two-by-two randomised controlled trial.	(Malan *et al.*, 2016)																				
2016	Article	Breast-milk iodine concentrations, iodine status, and thyroid function of breastfed infants aged 2-4 months and their mothers residing in a South African township	(Osei *et al.*, 2016)																				
2016	Article	Association of 25-hydroxyvitamin D and parathyroid hormone with the metabolic syndrome in black South African women	(Sotunde *et al.*, 2016)																				
2016	Article	Sodium and potassium intake in South Africa: an evaluation of 24-hour urine collections in a white, black, and Indian population	(Swanepoel *et al.*, 2016)																				
2016	Article	Restricting the marketing of foods and non-alcoholic beverages to children in South Africa: Are all nutrient profiling models the same?	(Wicks *et al.*, 2016)																				
2016	Doctorate	Plasminogen activator inhibitor-1 in black South Africans, methodological and clinical considerations	(Barnard, 2016)																				
2016	Doctorate	Genetic and dietary determinants of type 2 diabetes in a black South African population	(Chikowore, 2016)																				
2016	Doctorate	Iodine nutrition in mothers and their infants during breastfeeding and complementary feeding	(Osei, 2016)																				
2016	Maters	Effects of zinc fortification on the plasma fatty acid composition of Beninese school children : a randomised, double-blind controlled trial	(Chimhasha, 2016)																				
2016	Maters	Genotypic exploration of the fibrinogen phenotype in a black South African population	(Cronjé, 2016)																				
2016	Maters	The comparison of antenatal education, breastfeeding knowledge and neonatal positioning and attachment of HIV reactive and HIV non-reactive primgravidae	(Greyvenstein, 2016)																				
2016	Maters	Nutrition-related concerns of the primary caregiver regarding children with spastic cerebral palsy	(Lourens, 2016)																				
2016	Maters	Development and validation of portion size food photographs to determine maize intake of young children in rural Eastern Cape Province	(Rasekhala, 2016)																				
2016	Maters	Knowledge and perceptions of North-West University rugby players on timing of protein ingestion	(Swanepoel, 2016)																				
2016	Maters	Dietary adherence amongst adults with type 2 diabetes mellitus : a South African urban population perspective	(Winskill, 2016)																				
2017	Article	Nutrient patterns associated with fasting glucose and glycated haemoglobin levels in a black South African population	(Chikowore *et al.*, 2017)																				
2017	Article	Fibrinogen and clot-related phenotypes determined by fibrinogen polymorphisms: Independent and IL-6-interactive associations	(Cronje *et al.*, 2017)																				
2017	Article	Candidate gene analysis of the fibrinogen phenotype reveals the importance of polygenic co-regulation	(Cronjé *et al.*, 2017)																				

Table 4-3: PubData publications included in the study per nutrition theme *(Continued)*

Year	Publication type	Title of the publication	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
2017	Article	Agreement between specific measures of adiposity and associations with high blood pressure in black South African women	(Kruger *et al.*, 2017)																				
2017	Article	The prevalence and factors associated with stunting among infants aged 6 months in a peri-urban South African community	(Matsungo *et al.*, 2017a)																				
2017	Article	Lipid-based nutrient supplements and linear growth in children under 2 years: A review	(Matsungo *et al.*, 2017b)																				
2017	Article	Iodine status and associations with feeding practices and psychomotor milestone development in six-month-old South African infants	(Osei *et al.*, 2017)																				
2017	Article	Adherence challenges encountered in an intervention programme to combat chronic noncommunicable diseases in an urban black community, Cape Town	(Solomons *et al.*, 2017)																				
2017	Article	**Sodium content of foodstuffs included in the sodium reduction regulation of South Africa**	**(Swanepoel *et al.*, 2017)**																				
2017	Doctorate	Efficacy of lipid nutrient supplements on growth and micronutrient status in infants	(Matsungo, 2017)																				
2017	Doctorate	Sodium intake in South Africa: an analysis of food supply, 24-hour excretion and blood pressure in a tri-ethnic population	(Swanepoel, 2017)																				
2017	Doctorate	The development of food based dietary guidelines (FBDGs) for 6 to 23 month old Rwandan children	(Umungwangeza, 2017)																				
2017	Doctorate	A framework to regulate the marketing of foods and beverages to children in South Africa	(Wicks, 2017)																				
2017	Maters	Effects of lipid-based nutrient supplements on the immunity of 6-month old infants: a randomised controlled trial	(Joosten, 2017)																				
2017	Maters	The relationship between female adiposity and physical attractiveness amongst adults in Ranaka village, Botswana	(Seru, 2017)																				
2017	Maters	A 4-day test weighing study to assess volume and variations in fat and energy content of breast milk	(Siro, 2017)																				
2018	Article	Sensitivity of fatty acid desaturation and elongation to plasma zinc concentration: A randomised controlled trial in Beninese children	(Chimhashu *et al.*, 2018)																				
2018	Article	Household access to traditional and indigenous foods positively associated with food security and dietary diversity in Botswana	(Kasimba *et al.*, 2018)																				
2018	Article	The relationship between female adiposity and physical attractiveness amongst adults in rural Ranaka village, Botswana	(Kruger *et al.*, 2018)																				
2018	Article	CRP genotypes predict increased risk to co-present with low vitamin D and elevated CRP in a group of healthy black South African women	(Myburgh *et al.*, 2018)																				
2018	Article	Infant Development at the Age of 6 Months in Relation to Feeding Practices, Iron Status, and Growth in a Peri-Urban Community of South Africa	(Rothman *et al.*, 2018)																				
2018	Article	Associations of plasma total phospholipid fatty acid patterns with feeding practices, growth, and psychomotor development in 6-month-old South African infants	(Siziba *et al.*, 2018)																				

Table 4-3: PubData publications included in the study per nutrition theme *(Continued)*

Year	Publication type	Title of the publication	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
2018	Article	Association between dietary adherence anthropometric measurements and blood pressure in an urban black population South Africa	(Solomons *et al.*, 2018)																				
2018	Article	Monitoring the South African population's salt intake: spot urine v. 24 h urine	(Swanepoel *et al.*, 2018)																				
2018	Doctorate	Utilisation of traditional and indigenous foods and potential contribution to consumers' nutrition and vendors' income in Botswana	(Kasimba, 2018)																				
2018	Doctorate	Interactions of CRP-SNPs with selected contributing factors in determining CRP concentrations in black South Africans	(Myburgh, 2018)																				
2018	Doctorate	Long-chain polyunsaturated fatty acid nutrition in breastfed and complementary fed South African infants	(Siziba, 2018)																				
2018	Doctorate	Challenges with implementation of nutrition interventions aimed at non-communicable diseases among black urban South Africans	(Solomons, 2018)																				
2018	Maters	Assessment and evaluation of in-patient diagnosis and discharge protocols of Ghanaian infant and children (0-59months) diagnosed with severe acute malnutrition - the SAMAC study	(Carboo, 2018)																				
2018	Maters	Dietary intake practices of adults with intellectual disability in a controlled care centre environment	(Dreyer, 2018)																				
2018	Maters	Iron status in relation to morbidity when considering iron supplementation among urban pregnant women in South Africa	(Goodchild, 2018)																				
2018	Maters	Effect of omega-3 fatty acids on the clinical outcomes of mechanically ventilated critically ill patients : a systematic review	(Greyling, 2018)																				
2018	Maters	Dietary intake of the African-PREDICT study population	(Jordaan, 2018)																				
2018	Maters	The relationship between blood lipids, fatty acids and plasma clot properties in black South Africans	(Kahler, 2018)																				
2018	Maters	Sodium content of processed foods frequently consumed by children in early childhood development centres in the North-West Province	(Korff, 2018)																				
2018	Maters	The association between anthropometric measures and physical performance in black adults of the North West Province, South Africa	(Mamphwe, 2018)																				
2018	Maters	Comparison of weight gain to age-and sex-specific norms in children 2 to 10 years old on highly active anti-retroviral treatment	(Scholtz, 2018)																				
2018	Maters	Effects of pre-and postnatal iron and n-3 fatty acid depletion, alone and in combination, on bone development in rats	(Strydom, 2018)																				
2018	Maters	Dietary intake of infants followed from age 6 to 18 months from a low socio-economic peri-urban community	(Swanepoel, 2018)																				
2018	Maters	Gene-diet interactions in relation to circulating homocysteine concentrations	(Van Schalkwyk, 2018)																				
2018	Maters	Consumers' attitudes regarding the use of the salt information on food labels	(Van Staden, 2018)																				

Table 4-3: PubData publications included in the study per nutrition theme *(Continued)*

Year	Publication type	Title of the publication	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
2018	Maters	Fatty acid and micronutrient intake and status in association with allergy among pregnant urban women in South Africa	(Van Zyl, 2018)																				
2019	Article	Plasma phospholipid fatty acids are associated with altered fibrin clot properties in a population-based setting	(De Lange *et al.*, 2019)																				
2019	Article	Consumption of traditional and indigenous foods and their contribution to nutrient intake among children and women in Botswana	(Kasimba *et al.*, 2019)																				
2019	Article	Stakeholder Attitudes towards Donating and Utilizing Donated Human Breastmilk	(Lubbe *et al.*, 2019)																				
2019	Article	Waist circumference percentiles of black South African children aged 10-14 years from different study sites	(Motswagole *et al.*, 2019)																				
2019	Article	Effect of small-quantity lipid-based nutrient supplements on growth, psychomotor development, iron status, and morbidity among 6-to 12-mo-old infants in South Africa: a randomized controlled trial.	(Smuts *et al.*, 2019)																				
2019	Article	Contribution of commercial infant products and fortified staple foods to nutrient intake at ages 6, 12, and 18 months in a cohort of children from a low socio-economic community in South Africa	(Swanepoel *et al.*, 2019)																				

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4.6 Objective 5 – Impact and reach: citation analysis

Results obtained from step 5.1: Citation extraction required normalisation for self-citation and time since publication. Self-citation took into account any overlap of citing authors to cited authors. Normalisation for time since publication resulted in extraction of citation counts for the three years from paper publication and all-time citation. Four different citation counts were therefore extracted for each publication. Citation counts increase in the following order: Three years post-publication without self-citation, three years post-publication with self-citation included, all-time without self-citation, with all-time with self-citation having the maximal citation count. Citation counts were extracted from three databases, and consolidated into a single citation count per publication.

Results obtained from step 5.2: During the process of extraction, from the citing articles, author affiliation was determined to assess publication reach. From the citing articles, any author who was affiliated with an international organisation resulted in the cited student publication being classified as reaching an international audience. If, however, all citing authors were affiliated with South African organisations only, the cited publication reached only a national audience. A summary of publications cited is shown in **Table 4-4**. Note the decrease in the number of publications not cited, and the increase of number of publications cited internationally, when comparing three years without self-citation with all-time without self-citation. Currently, 87.7% of student articles have been cited internationally (all-time with self-citation), while 10.6 % of theses and dissertations have been cited internationally.

Table 4-4: Summary of number of publications cited across different time ranges, accounting for self-citation

Publication citation status	3 years without self-citation n (%)	3 years with self-citation n (%)	All-time without self-citation n (%)	All-time with self-citation n (%)
Articles internationally cited	105 (67.7)	109 (70.3)	134 (86.5)	136 (87.7)
Articles only nationally cited	20 (12.90)	22 (14.2)	6 (4.0)	6 (4.0)
Articles not cited	30 (19.35)	24 (15.5)	15 (9.6)	13 (8.4)
M/D internationally cited	2 (1.1)	4 (2.2)	15 (8.3)	19 (10.6)
M/D only nationally cited	8 (4.4)	11 (6.1)	22 (12.2)	25 (13.9)
M/D not cited	170 (94.4)	165 (91.7)	143 (79.4)	136 (75.6)

As a summary of the scope and reach of student publication citations, **Table 4-5** presents the number and percentages of publication citations within the different reach categories. From the table it is evident that articles within the themes (*18) Vitamins and minerals* (90.6%), (*10) Nutrient requirements and dietary guidelines* (90.1%) and *20-Other* (94.1%) had the highest percentage of publications cited within the international community. Of the theses and dissertation publications, only 8 publications in the theme *10-Nutrient requirements and dietary guidelines* were cited internationally.

Table 4-5: Summary of percentages of all-time citations, self-citations included, of publication reach and scope

	Article reach percentages n (%)			Theses and dissertation percentages n (%)		
	Not cited	**Nationally cited**	**Internationally cited**	**Not cited**	**Nationally cited**	**Internationally cited**
All publication*	13 (8.4)	6 (4.0)	136 (87.7)	136 (75.6)	25 (13.9)	19 (10.6)
Accelerating Nutrition Improvements in Sub-Saharan Africa (ANI)	5 (14.3)	1 (2.9)	29 (82.9)	33 (82.5)	4 (10.0)	3 (7.5)
Adolescents	3 (25)	0	9 (75)	5 (45.5)	4 (36.4)	2 (18.2)
Country Assessment	0	0	0	0	0	0
Emergency and humanitarian crisis	0	0	0	0	0	0
Foetal Development	0	0	0	1 (100)	0	0
Food Labelling	0	0	2	2 (40)	1 (20.0)	2 (40.0)
Growth and development	3 (16.7)	0	15 (83.3)	19 (76.0)	1 (4.0)	5 (20.0)
HIV/AIDS	0	0	3 (100)	9 (90.0)	1 (10.0)	0
Infant and young child feeding	6 (25)	0	18 (75)	27 (84.4)	2 (6.3)	3 (9.4)
Nutrient requirements and dietary guidelines	3 (4.2)	4 (5.6)	64 (90.1)	50 (72.5)	11 (15.9)	8 (11.6)
Overweight and obesity	2 (8)	1 (4)	22 (88)	19 (76.0)	4 (16.0)	2 (8.0)
Food and nutrition policies	0	0	2 (100)	0	0	1 (100)
Nutrition and Pregnancy	1 (100)	0	0	5 (83.3)	0	1 (16.7)
Nutrition-friendly Schools	0	0	1 (100)	2 (66.7)	1 (33.3)	0
Food and Nutrition Security	0	0	3 (100)	1 (100)	0	0
Tuberculosis related topics	0	0	0	0	0	0
Undernutrition	0	0	5 (100)	2 (100)	0	0
Vitamins and Minerals	2 (6.3)	1 (3.1)	29 (90.6)	34 (85.0)	3 (7.5)	3 (7.5)
Nutrition and WASH	0	0	0	0	0	0
Other	1 (5.9)	0	16 (94.1)	53 (77.9)	10 (14.7)	5 (7.4)

***** *Publications per theme do not cumulate to form this total as publications may address more than one theme.*

Results obtained from step 5.3: For impact assessment, each publication citation count needed to be assessed against an expected citation count. The expected citation count was determined by dividing all citations made to a set of publications, from a sub-field from a specific year and time period, by the number of the set of publications. The impact normalisation was undertaken for article publications from date of publication until the time the study was conducted. From the Web of Science feature, InCites, publication metrics were obtained for all research areas matching student publications. Student publications fell into 17 InCites research areas.

As an example of the calculation of expected citation count per year and sub-discipline, the research area *Nutrition and dietetics*, is shown in **Table 4-6**. Per year of publication, the total number of publications is shown, followed by number of citations each set of publications received until August 2019. The last column presents the calculated expected citation count, where the number of citations is divided by the number of publications. From this table it can be seen that we would expect a publication published in the year 2000, to have had been cited at least 33.81 times by 2019 – based on data for all comparable publications.

Table 4-6: InCites category Nutrition and Dietetics as an example of expected citation count data

Year of publication	**All-time publication until August 2019**		
	Number of publications	Citations made to the set of publications until August 2019	Expected citation count (citations / publications)
1997	6,594	163,000	24.72
1998	6,240	178,300	28.57
1999	6,407	198,916	31.05
2000	7,540	254,930	33.81
2001	6,953	228,389	32.85
2002	7,464	253,835	34.01
2003	7,224	270,690	37.47
2004	9,449	306,252	32.41
2005	8,685	272,829	31.41
2006	8,075	284,681	35.25
2007	11,964	330,538	27.63
2008	11,467	321,072	28.00
2009	14,278	309,440	21.67
2010	13,159	294,715	22.40
2011	14,622	280,641	19.19
2012	12,914	267,771	20.73
2013	18,112	242,746	13.40
2014	13,724	215,260	15.68
2015	16,686	183,817	11.02
2016	15,553	140,293	9.02
2017	18,359	92,138	5.02
2018	16,516	43,242	2.62
2019	14,620	8,479	0.58
Extracted from (Clarivate Analytics, 2019)			

Several factors could contribute to expected citation counts, such as global events or ground-breaking research in the field. This study, however, did not set out to investigate this, yet what should be noted is the continued increase in nutrition and dietetic research. From **Table 4-6**, the increase in research over the past 20 year is evident in the increasing number of publications per annum. Publications between 1999 and 2006 achieve expected citation counts exceeding 30, while those published between 2007 and 2012 generate expected counts of around 20. Because of the decreasing amount of time available for citations of more recent publications, later publications have comparably lower expected citation counts.

Several publications were categorised within more than one research area, but those under *Nutrition and Dietetics* were by default labelled as such. The majority of publications (72.54%) fell into the research area *Nutrition and Dietetics*. **Table 4-7** shows the ranges of expected citation counts of all research areas. Ranges cover different time periods related to the year of article publications.

Table 4-7: Expected citation count ranges

Incites research areas of 155 articles (number of student articles per research area)	**Expected citation count range (year)**
1. Biochemistry and molecular biology (6)	52.09 (1997) – 0.41 (2019)
2. Biology (1)	3.03 (2017)
3. Business (2)	11.88 (2009) – 9.20 (2011)
4. Cardiac and cardiovascular systems (4)	23.61 (1999) – 11.14 (2012)
5. Endocrinology and metabolism (2)	6.68 (2016)
6. Environmental sciences (2)	2.90 (2018) – 0.62 (2019)
7. Food science and technology (2)	11.82 (2014) – 43.88 (2017)
8. Genetics and heredity (3)	21.84 (2013) – 12.59 (2015)
9. Health care sciences and services (2)	17.48 (2007) – 2.29 (2017)
10. Haematology (3)	20.94 (2005) – 4.31 (2016)
11. Medicine, research and experimental (1)	20.39 (2008)
12. Multidisciplinary sciences (3)	13.57 (2012) – 3.31 (2017)
13. Nutrition and dietetics (112)	24.72 (1997) – 0.58 (2019)
14. Oncology (1)	36.46 (2002)
15. Paediatrics (1)	0.25 (2019)
16. Peripheral vascular disease (7)	19.71 (1997) – 4.30 (2016)
17. Public environmental and occupational health (3)	12.85 (2011) – 7.19 (2015)
Extracted from (Clarivate Analytics, 2019)	

To calculate the impact of student articles, the citation count of each article was divided by the expected citation count resulting in a relative impact for that publication. The number and percentages of articles impacting the scientific community and exceeding the expected average citation count (≥1), are shown in **Table 4-8**. With self-citation excluded, 90.35% of publications impacted the scientific community, with 32.9% reaching the expected world average. Of these, seven exceeded the expected citation count by more than 4 times. These are shown in **Table 4-9.**

Table 4-8: Average relative impact of all articles and those exceeding expected world average per nutrition theme

	Average relative impact (n; % of articles in set)		Average impact of articles exceeding expected world average (n; % of articles in set)	
Set	w/sc	Wsc	w/sc	wsc
All publication* (n=155)	1.211 (140; 90.3)	1.341 (142; 91.6)	2.532 (51; 32.9)	2.547 (59; 38.1)
(1) Accelerating Nutrition Improvements in Sub-Saharan Africa (ANI) (n=35)	1.124 (30; 85.7)	1.350 (30; 85.7)	2.407 (10; 28.6)	2.311 (14; 40.0)
(2) Adolescents (n=12)	1.481 (9; 75.0)	1.581 (9; 75.0)	2.676 (4; 33.3)	2.861 (4; 33.3)
(3) Country Assessment (n=0)	0	0	0	0
(4) Emergency and humanitarian crisis (n=0)	0	0	0	0
(5) Foetal Development (n=0)	0	0	0	0
(6) Food Labelling (n=2)	1.351 (2; 100)	1.548 (2; 100)	2.031 (1; 50)	2.200 (1; 50)
(7) Growth and development (n=18)	1.132 (15; 83.3)	1.405 (15; 83.3)	1.837 (7; 38.9)	2.116 (8; 44.4)
(8) HIV/AIDS (n=3)	0.610 (3; 100)	0.688 (3;100)	0	0
(9) Infant and young child feeding (n=24)	1.073 (17; 70.8)	1.255 (18; 75.0)	1.661(7; 29.2)	1.938 (8; 33.3)
(10)Nutrient requirements and dietary guidelines (n=71)	1.283 (67; 94.4)	1.399 (68; 95.8)	2.610 (25; 35.2)	2.529 (30; 42.3)
(11)Overweight and obesity (n=25)	1.439 (22; 88.0)	1.506 (23; 92.0)	2.653 (10; 40.0)	2.671 (11; 44.0)
(12)Food and nutrition policies (n=2)	0.697 (2; 100)	0.697 (2; 100)	0	0
(13)Nutrition and Pregnancy (n=1)	0	0	0	0
(14)Nutrition-friendly Schools (n=1)	0.605 (1; 100)	0.637 (1; 100)	0	0
(15)Food and Nutrition Security (n=3)	0.804 (3; 100)	1.062 (3; 100)	1.220 (1; 33.3)	1.210 (2; 66.7)
(16)Tuberculosis related topics (n=0)	0	0	0	0
(17)Undernutrition (n=5)	1.110 (5; 100)	1.192 (5; 100)	1.808 (2; 40.0)	1.953 (2; 40.0)
(18)Vitamins and Minerals (n=32)	0.866 (93.8)	1.094 (93.8)	1.747 (28.1)	1.893 (40.6)
(19)Nutrition and WASH (n=0)	0	0	0	0
(20)Other (n=17)	0.810 (16; 94.1)	0.935 (16; 94.1)	4.977 (2; 11.8)	5.008 (2; 11.8)

***** *Publications per theme do not cumulate to form this total as publications may address more than one theme.*
Relative impact = citation count / expected citation count as determined by the division of all citations made to a set of publications from the same sub-discipline and the same year of publication by the amount of publication in the set.

Table 4-9: List of articles exceeding a relative impact of greater than four

Reference	Title	Study purpose	Relative impact, self-citation excluded
(Mukuddem-Petersen *et al*., 2005)	A systematic review of the effects of nuts on blood lipid profiles in humans.	"… systematic review … to evaluate the scientific evidence that is related to the effects of nut consumption on lipid profiles"	8.436
(Opperman *et al*., 2004)	Meta-analysis of the health effects of using the glycaemic index in meal-planning.	"…a meta-analysis to evaluate and integrate a number of studies conducted on the GI and its effects on health."	7.775
(Loots *et al*., 2007)	Aloe ferox Leaf Gel Phytochemical Content, Antioxidant Capacity and Possible Health Benefits.	"… identified, quantified, and compared the phytochemical contents and antioxidant capacities of Aloe ferox lyophilized leaf gel (LGE) and 95% ethanol leaf gel extracts (ELGE) using GC-MS and spectrophotometric methods.	6.351
(Kruger *et al*., 2002)	Physical inactivity is the major determinant of obesity in black women in the North West Province, South Africa: the THUSA study. Transition and Health During Urbanisation of South Africa.	"...investigated the association between measures and determinants of obesity in African woman. "	5.175
(Kruger *et al*., 2006b)	The determinants of overweight and obesity among 10- to 15- year-old schoolchildren in the North West Province, South Africa – the THUSA BANA (Transition and Health during Urbanisation of South Africans; BANA, children) study.	"To investigate the determinants of overweight and obesity among 10- to 15-yearold schoolchildren in a population in the transitional phase in the North West Province of South Africa."	4.709
(North *et al.,* 2009)	The effects of dietary fibre on C-reactive protein, an inflammation marker predicting cardiovascular disease.	"… to assess the influence of dietary fibre (DF) on CRP in clinical trials."	4.568
(Davis *et al.,* 2007)	The effects of high walnut and cashew nut diets on the antioxidant status of subjects with metabolic syndrome.	"The effects of high cashew nut and high walnut diets on the antioxidant status of subjects with metabolic syndrome are investigated."	4.162

Results obtained from step 5.4: References from the South African public health policy, programme and guideline list (PolList) were investigated to extract the citations made to the PubData documents. Five different themes of PolList documents were present. It is generally accepted that documents pertaining to laws and legislations do not present references. Of the remainder of the documents (n=44), 7 presented no references, 17 presented some references without presenting reference lists, and 27 presented compete reference lists. **Table 4-10** presents the results of citations within the PolList documents.

Within a three-year citation window, only three PubData documents were cited, while a total of 12 citations to PubData documents were made until August 2019. These 12 citations all occurred in the 2001 and 2013 food based dietary guidelines documents. Concurrently, references to WHO, UNICEF and the DoH were extracted as a gauge. Of the 70 documents, WHO, UNICEF and DoH documents were cited by 44.2% (n=31), 32.8% (n=23), and 41% (n=29) respectively.

Table 4-10: Summary of references presented within government documents and cross-references made to WHO, UNICEF, DoH or student documents

Type of government document (number of documents)	**References not applicable**	**Level of references presented in government documents**			**Cross-reference within government document to the following**			
		None	Some	All	**WHO documents**	**UNICEF documents**	**DoH documents**	**PubData**
Laws and Legislation (26)	26	-	-	-	-	-	-	0
Performance and strategic plans (14)	0	3	6	5	10	7	10	0
Policies (8)	0	1	7	7	6	5	6	0
Guidelines (20)	0	3	3	14	13	10	11	2
Programmes (2)	0	0	1	1	2	1	2	0
Totals (70)	*26*	*7*	*17*	*27*	*31*	*23*	*29*	*2*

"Some" – Sources mentioned, but not cited.
PubData – NWU post-graduate student publication database

The database prepared for the evidence maps is presented in the Annexure (Tables 0-1 to 0-17). The scope (nutrition themes), reach (national, international, and governmental) and impact (article relative impact) of the student documents are all presented.

4.7 Objective 6 – Evidence Maps

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Figure 4-1: Diagram of study objectives, steps… p.56

Objective 1 – Historical nutrition landscape p.55

Objective 2 – Predominant nutrition themes p.57

Objective 3 – NWU publication data: PubData p.62

Objective 4 – Scope of PubData according to nutritional themes p.64

Objective 5 – Impact and reach: citation analysis p.84

The purpose of an evidence map is to present a body of evidence in a user-friendly manner. Unfortunately, evidence maps in general are not always printer friendly. The following URL presents the evidence maps in a Google document: http://bit.ly/2nUDs9m_CEN1EM. In order to understand the use of the maps, please watch the explanatory videos.

Included in the online platform are the following:

1. Links to the online guide videos.
2. An average impact chart of articles where self-citation is excluded, showing the reach, impact, scope and number of publications. In order to read this map, please see the video embedded in **Figure 4-5**, explaining the use of the map. Alternatively, please visit the following URL, where the video is also hosted, and where the transcript of the video is shown: https://youtu.be/vfH_sXC8sDU. See a screenshot of the bubble chart in **Figure 4-8**. Please visit the online document to view the live map.

Figure 4-5: Guiding video to read the summary chart

3. The third sheet on the online document presents the averages map of impact and citations in the form of a bubble plot table. Here a map of averages is presented according to nutrition theme. In order to read this map, please see the video in **Figure 4-6**. The video continues with the example presented in the first video (see online alternative at https://youtu.be/K0hFSu-D-WE). **Figure 4-9** is a screen shot of this map.

Figure 4-6: Guiding video to read the averages chart

4. The fourth sheet on the online document presents the expanded averages data table evidence map of citations and impact averages, with individual publication information. In order to read this map, please see the video in **Figure 4-7** as it builds even further on the example presented in the first two videos (alternatively visit https://youtu.be/1tOgR0_gBEE). **Figure 4-10** presents an example of the visible evidence on this map.

Figure 4-7: Guiding video to read the expanded averages data table

In addition to these evidence maps, the sheet also contains additional supporting data:

5. The nutrition landscape – WHO and PolList document's name and references, according to theme as presented in this document in **Table 4-1** and **Table 0-1** in the annexure.
6. The student documents (PubData) – as presented in **Table 4-3**
7. Reference list

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Figure 4-1: Diagram of study objectives, steps… p.56

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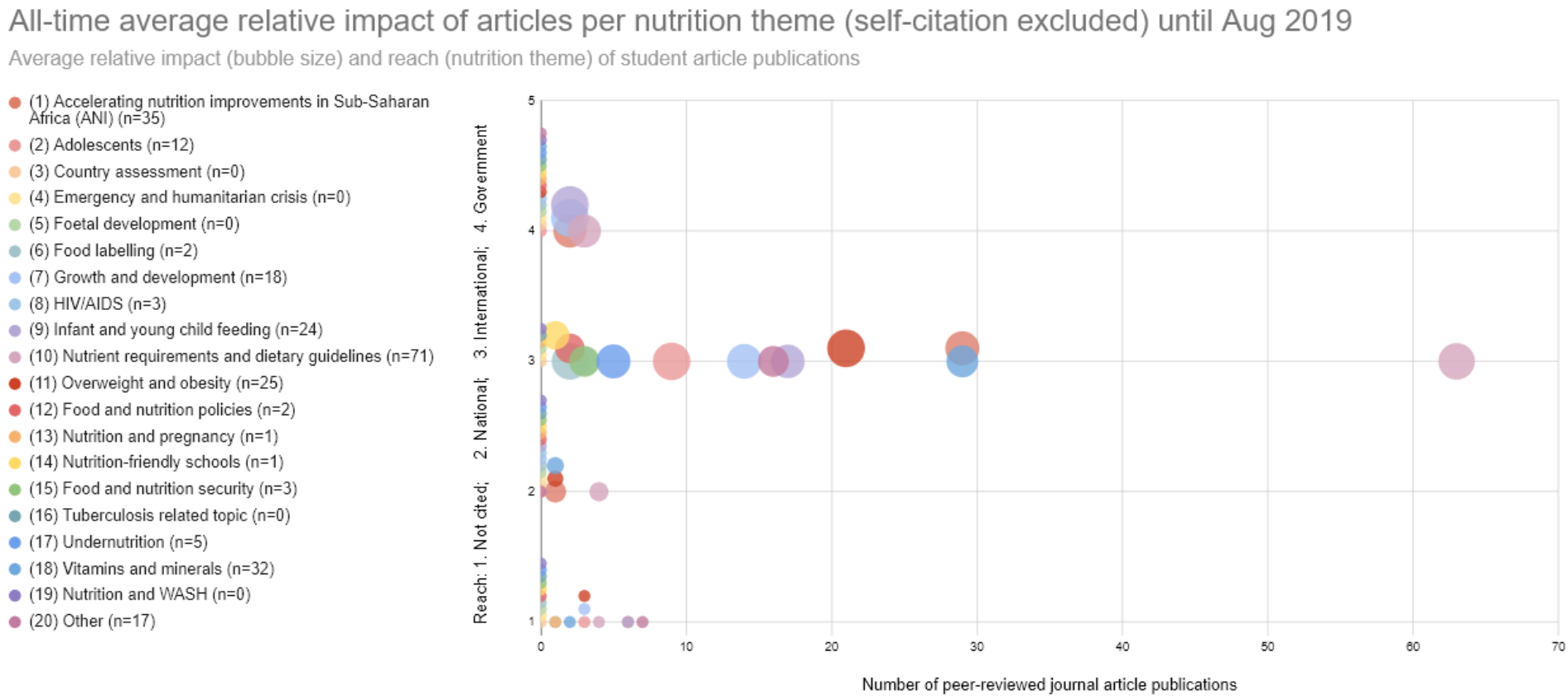

Figure 4-8: Screenshot of the summary chart of all-time average relative impacts of articles per nutrition theme (self-citation included)

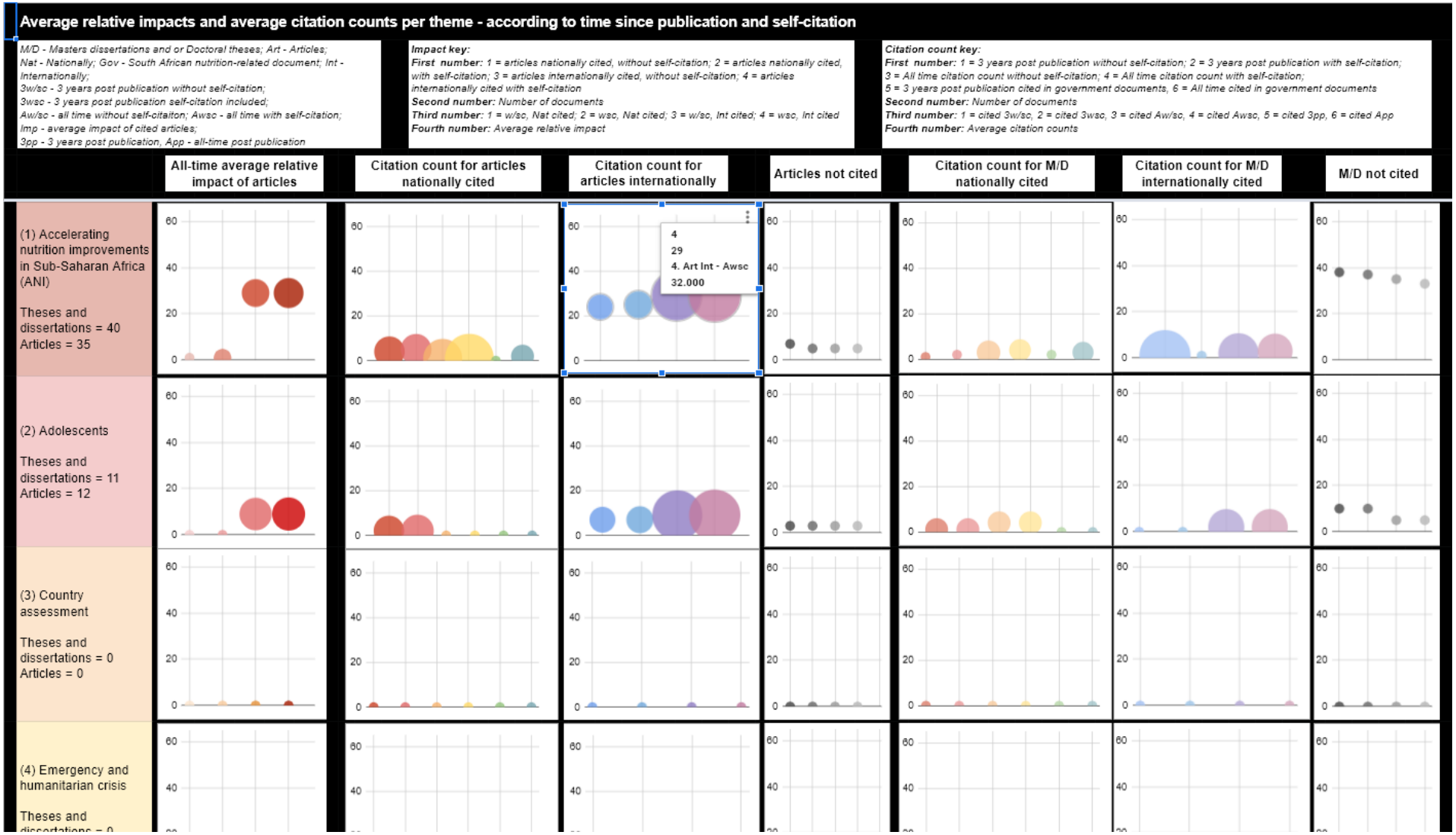

Figure 4-9: Screenshot of the average relative impact and citation counts map per theme - normalised according to time since publication and self-citation

Dietetics and nutrition student publications at the NWU - scope, reach and impact:
Expanded averages data table EM of average citation counts and relative impacts, with individual publication information

sc - self-citation, M/D - Masters dissertations and or Doctoral theses; Art - Articles, ACit - Average citation count; Almp - average relative impact of articles - normalized according to year of publication and sub-discipline,

	Scientific community																																										
	Scientific community - Nationally cited publications																				Scientific community - Internationally cited publications																				Publications not cited							
	3 years without sc				3 years with sc				All-time without sc					All-time with sc					3 years without sc				3 years with sc				All-time without sc					All-time with sc					3w/sc		3wsc		Aw/sc		Awsc	
	M/D	ACit	Art	ACit	M/D	ACit	Art	ACit	M/D	ACit	Art	ACit	Almp	M/D	ACit	Art	ACit	Almp	M/D	ACit	Art	ACit	M/D	ACit	Art	ACit	M/D	ACit	Art	ACit	Almp	M/D	ACit	Art	ACit	Almp	M/D	Art	M/D	Art	M/D	Art	M/D	Art
(1) Accelerating nutrition improvements in Sub-Saharan Africa (ANI)	1	1.00	4	2.50	2	1.00	5	2.60	3	2.00	1	5.00	0.223	4	1.75	1	9.00	0.402	1	41.00	24	4.36	1	1.00	25	5.56	2	22.50	29	28.75	1.110	3	15.60	29	32.00	1.349	38	7	37	5	35	5	33	5
(2) Adolescents	1	1.00	2	2.50	1	1.00	2	3.00	4	1.00	0	0.00	0.000	4	1.00	0	0.00	0.000	0	0.00	7	6.14	0	0.00	7	7.00	2	4.00	9	38.67	1.481	2	4.00	9	41.33	1.581	10	3	10	3	5	3	5	3
(3) Country assessment	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.000	0	0.00	0	0.00	0.000	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.000	0	0.00	0	0.00	0.000	0	0	0	0	0	0	0	0
(4) Emergency and humanitarian crisis	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.000	0	0.00	0	0.00	0.000	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.000	0	0.00	0	0.00	0.000	0	0	0	0	0	0	0	0
(5) Foetal development	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.000	0	0.00	0	0.00	0.000	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.000	0	0.00	0	0.00	0.000	1	0	1	0	1	0	1	0
(6) Food labelling	0	0.00	0	0.00	0	0.00	0	0.00	1	1.00	0	0.00	0.000	1	1.00	0	0.00	0.000	1	1.00	2	6.50	1	1.00	2	7.50	1	1.00	2	16.50	1.351	2	1.00	2	19.00	1.548	4	0	4	0	3	0	2	0
(7) Growth and development	1	1.00	2	4.00	2	1.00	2	4.00	1	1.00	0	0.00	0.000	1	1.00	0	0.00	0.000	0	0.00	12	5.42	1	1.00	13	5.85	4	3.25	14	16.24	1.176	5	3.40	15	16.73	1.405	24	4	22	3	20	4	19	3
(8) HIV/AIDS	1	1.00	0	0.00	1	1.00	0	0.00	1	1.00	0	0.00	0.000	1	1.00	0	0.00	0.000	0	0.00	3	2.33	0	0.00	3	1.33	0	0.00	3	16.33	0.610	0	0.00	3	18.67	0.688	9	0	9	0	9	0	9	0
(9) Infant and young child feeding	1	1.00	2	3.00	1	1.00	2	3.00	2	1.00	0	0.00	0.000	2	1.00	0	0.00	0.000	0	0.00	14	4.43	1	1.00	15	4.80	1	5.00	17	15.82	1.051	3	3.00	18	13.50	1.255	31	8	30	7	29	7	27	6
(10) Nutrient requirements and dietary guidelines	5	5.00	9	2.11	7	1.00	10	2.70	9	1.89	4	3.25	0.120	11	1.73	4	5.25	0.198																												4	50	3
(11) Overweight and obesity	2	1.00	1	1.00	2	1.00	2	1.50	4	1.25	1	1.00	0.040	4	1.25	1	6.00	0.243																												3	19	2
(12) Food and nutrition policies	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.000	0	0.00	0	0.00	0.000																												0	0	0
(13) Nutrition and pregnancy	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.000	0	0.00	0	0.00	0.000																												1	5	1
(14) Nutrition-friendly schools	0	0.00	0	0.00	0	0.00	0	0.00	1	1.00	0	0.00	0.000	1	1.00	0	0.00	0.000																												0	2	0
(15) Food and nutrition security	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.000	0	0.00	0	0.00	0.000																												0	1	0
(16) Tuberculosis related topic	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.000	0	0.00	0	0.00	0.000	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.000	0	0.00	0	0.00	0.000	0	0	0	0	0	0	0	0
(17) Undernutrition	0	0.00	1	1.00	0	0.00	1	1.00	0	0.00	0	0.00	0.000	0	0.00	0	0.00	0.000	0	0.00	4	4.50	0	0.00	4	5.25	0	0.00	5	31.60	1.110	0	0.00	5	34.00	1.192	2	0	2	0	2	0	2	0
(18) Vitamins and minerals	0	0.00	6	2.33	2	1.00	6	2.66	1	1.00	1	1.00	0.064	3	1.33	1	1.00	0.064	0	0.00	23	4.52	0	0.00	23	5.78	3	2.33	29	8.59	0.894	3	2.67	29	10.48	1.130	40	3	38	3	36	2	34	2
(19) Nutrition and WASH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.000	0	0.00	0	0.00	0.000	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.000	0	0.00	0	0.00	0.000	0	0	0	0	0	0	0	0
(20) Other	0	0.00	4	1.50	0	0.00	4	2.00	2	2.00	0	0.00	0.000	2	2.00	0	0.00	0.000	0	0.00	8	7.38	0	0.00	8	7.75	1	3.00	16	21.19	0.810	1	3.00	16	21.63	0.835	14	5	14	5	11	1	11	1

Articles (relative impact):

2004 Dietary macronutrient recommendations for optimal recovery post-exercise: Part I (0.093)
2004 Dietary macronutrient recommendations for optimal recovery post-exercise: Part II (0.154)
2008 Beliefs of South Africans regarding food and cardiovascular health (0.143)
2010 Relationships of alcohol intake with biological health outcomes in an African population in transition: the Transition and Health during Urbanisation in South Africa (THUSA) study (0.402)

Figure 4-10: Screenshot of the expanded averages data table of average citation and relative citation impacts, with individual publication information

CHAPTER 5: DISCUSSION, AND CONCLUSION

5.1 Introduction

This study was designed to evaluate the impact, determine the scope and indicate the reach of post-graduate student research conducted at the NWU between 1998 and 2018 in the context of WHO and South African government nutrition-related publications. Despite the field of nutrition and public health being much wider, the scope was set to the WHO nutrition themes used to classify their nutrition-related documents, with the addition of an *Other* category to account for publications not addressing the WHO themes. Evidence utilisation and impact were determined by means of citation analysis. The impact of the student article publications on the scientific community was measured by means of a relative citation count, normalised to other articles within the same sub-discipline over the same period of time. Impact and reach on the SA government documents (PolList) were measured according to citation counts. Reach was determined by means of author affiliation, where publications cited by authors affiliated with international organisations resulted in them being classified as reaching the international community. Time since publication and self-citation were accounted for throughout the study. For the purpose of this discussion all figures are presented with self-citation excluded. Because citations to theses and dissertations have been relatively uncommon until recent years, this discussion will specifically focus on student articles. The evidence maps created from this study aim to communicate these findings.

This discussion looks at the subsequent and striking impact of student article publications on the scientific community, highlighting the importance of research dissemination. Some reflections are made on impact evaluations by bibliometrics. Thereafter, the broadness of scope is discussed, as it aligns with WHO and PolList documents. The limitations of PolList document accessibility and use of references are discussed in terms of similar research findings. Limitations and recommendations relating to the nutrition landscape are also presented. The extent of the reach and reach-impact pertaining quality then follow, after which the importance of accessibility of evidence is unpacked in the light of strengthening the health system. Finally, some barriers to uptake of scientific evidence by policy-makers are discussed in the created evidence maps. The contribution that these evidence maps make to the body of evidence mapping methodology is presented along with suggested future improvements. Finally, the recommendations, limitations and a conclusion to the study completes the chapter.

5.2 Impact of student publications on the scientific community

Our results indicated that, from 180 degrees obtained, a publication proportion of 60.56% (109/180) disseminated their results in the form of at least one journal article. From the 180 theses

and dissertations, 185 listed articles titles were found (**Figure 4-3**). Sixty-five of the article titles, listed within the theses and dissertations, could be traced and were accepted by peer-reviewed journals. An additional 70 articles (**Figure 4-4**) were published, resulting in a total of 155 articles published. In other words, from the 180 obtained degrees, 155 articles were published.

High publication proportions consequently contribute to research impact, as available research articles can be utilised and cited. Of the 180 theses and dissertations, our results indicate that 20.5% impacted the scientific community. Article publications yielded much higher results. Within the first three years, a staggering 80.65% (n=125) of student articles impacted the scientific community, shooting up to an eventual 90.32% (n=140) to date (**Table 4-4**). Articles reaching and exceeding the expected citation count, consequently reaching world standard publication impact, were 32.7% (n=51) (**Table 4-8**). Of these, eight exceeded an impact amounting to four times the world average (**Table 4-9**). These publications covered a range of purposes and topics, some related to each other. Publication impact on science has been viewed by some as a proxy for quality (Abramo *et al.*, 2010:822; Gunashekar *et al.*, 2015:22), and despite its limitations and biases, it can be deduced that a third of student research publications impacted the scientific community at world average level. The element of research quality will be discussed in section 5.4.

Within the public health community, the PolList presented a challenge to assessing student impact, because of limited use of references (**Table 4-10**). A discussion on this will follow in section 5.4.

5.2.1 Justification for impact evaluation and bibliometrics

Citation analysis is not the only way to assess evidence utilisation, some might even argue that it is an inappropriate measure. Despite the obvious and not so obvious biases of citation analysis (MacRoberts & MacRoberts, 2018), it has been used for several decades in evaluative practices. MacRoberts and MacRoberts (2018:476) contend that, assuming that that which is cited is that which is used “may be correct with many caveats, exceptions, corrections, and qualifications”; however, assuming that that which is not cited is not used “is simply false”. With this, they point to the issue of knowledge-translation evaluation. Research in knowledge-translation remains a developing science intending to answer these criticisms. MacRoberts and MacRoberts (2018:477) further attest to the importance of interpreting citation counts in the light of all its biases, “from self-citation to field-related biased citing”. For this reason, the current study adjusted for self-citation, field-normalisation and time since publication. The results should therefore also be interpreted accordingly.

This study deliberately excluded journal metrics and only looked at citation counts as predictor of impact. This practice was suggested by Abramo and D'Angelo (2016:2064) who showed its greater predictive power when combined with journal metrics. A limitation to the current impact analysis was, however, that no consideration was given to specifications of studies included e.g. intervention, systematic reviews, observational etc.

5.3 Student research scope: nutrition landscape and themes, and student research and scope

The WHO website presented a total of 249 nutrition-specific documents relevant to South African public-health. Along with these, a total of 70 South African government nutrition related documents was collected. From the categories used by the WHO, 19 nutrition themes were extracted with a twentieth added. These themes primarily focused on public health issues, or accelerated nutrition improvements or actions. Theme cataloguing was determined by means of a thematic analysis of document titles, key words, abstracts or executive summaries, stated objectives or nutrition sections.

All but 31 of the student documents addressed at least one of the WHO nutrition themes. They included topics like genetics, physiology and psychology, consumer and food-service management and production, and research practices. Taking into account that nutrition research at the NWU is not solely focussed on public health, the scope of student research aligned well with the international and national nutrition agenda. Next to theme (*18) Vitamins and minerals,* the WHO addressed theme (*9) Infant and young child feeding* most often. For the SA government, theme (*10) Nutrient requirements and dietary guidelines* and (*9)Infant and young child feeding* were addressed most often (**Table 4-2**). Similarly, student research articles aligned well with these themes indicating their perceived importance (**Table 4-5**).

Some themes were not addressed by the PolList documents: *(1) Accelerating Nutrition Improvements in Sub-Saharan Africa (2) Adolescents,* and *(3) Country assessment.* Of these, *(1)* and *(3)* suggest some gaps in the effort of government to address local improvements in nutrition. Themes addressed by the government but either sporadically addressed or not addressed by the student documents[7] *(4, 8, 12, 13, 14, 16, 19)* present a shortfall of evidence regarding the themes. However, this study assessed only student research as a specific research institution. In addition, because this study presents a collection of nutrition-related documents and not a temporal development of themes, the timely availability of the evidence is not shown. Future research might

[7] *(4) Emergency and Humanitarian Crisis, (8) HIV/AIDS, (12) Food and nutrition policies, (13) Nutrition and pregnancy,* and *(14) Nutrition-friendly schools, (16) Tuberculosis related topic,* and *(19) Nutrition and WASH.*

investigate a temporal representation of the interaction between evidence and policy to address the major criticism towards scientific evidence - that of timeliness (Oliver *et al.*, 2014).

5.3.1 Availability of documents

In the light of the SDG (United Nations, 2018) and the South African National Development Plan (National Planning Commission, 2013b) evidence on nutrition and public health is expected to have been produced. As mentioned in the literature review, scientific evidence for decision-making regarding nutritional interventions is paramount, but available evidence in the form of policies, programmes and guidelines is just as important. A supporting element that has been shown to assist health system organisations in the use of evidence for decision-making is the creation of a climate for evidence use, assisted by formal positions or infrastructure to encourage knowledge use accountability and championing of evidence use (Aryeetey *et al.*, 2017:7; Ellen *et al.*, 2013:14). The availability of policy documents, as well as the practice of citing evidence in support of policy statements, are shown as areas where such championing is needed in South Africa.

From the process of compiling the nutrition landscape, the availability and accessibility of WHO documents for public use is deemed high. In contrast, only some of the South African documents are available on the DoH's website, while a third (n=23, 32.8%) were not publicly available. Apart from the fact that several of the documents arguably had no references (laws and regulations), many failed to provide transparency regarding source use. Of the PolList documents, two-thirds (n=44, 62.8%) contained some form of referencing, while about a third used unorthodox referencing styles or did not present references (n=24, 34.3%) (**Table 4-10**). These findings mirror those of an Australian study on the impact of research on Australian obesity policy. In that study, 28% of policy documents were not publicly available, 63% contained references, and 25.6% used unorthodox referencing styles (Newson *et al.*, 2018:6). Similar to the Australian study, the findings presented here fail to provide adequate grounds determining impact. This study, however, supports the idea of Newson *et al.* (2018:10) that the presence of a "research citation in a policy document is an indication of the research publication's accessibility to the document authors and its relevance to the policy topic, but not necessarily that the research had an impact on policy".

Almost all of the PolList documents providing references, referred to the WHO, UNICEF or, at least, to other DoH documents. References made to PubData (n=7) were limited to two documents co-authored by CEN-affiliated authors and published in peer-reviewed journals. Journals require the use of references, while documents published by SA government departments do not, possibly reflecting accepted practices. The phenomenon of referring to international organisations might be an example of the "tension between 'global' and 'local" health

research" (Malla *et al.*, 2018:5). It might mean that the value of locally produced research is not yet acknowledged or that global evidence outweighs locally produced evidence.

5.3.2 Nutrition landscape

Nutrition is at the heart of good health. Movements like SUN (SUN Movement, 2015) and strategies like the WHA's Comprehensive Implementation Plan on Maternal, Infant and Young Child Nutrition (WHO, 2014e) attest to its importance. However, limiting the landscape to public health as represented by the WHO documents might have been restricting. The documents included from the WHO were collected over a period of 20 years, presenting a historically grounded view of nutrition themes. The document collection is presented en masse and not in a temporal (time-related) way, limiting identification of the landscape configuration. In addition, local and global events pertaining to public health could also contribute to understanding the nutrition landscape as it pertains to different countries. Other entities also address nutrition issues and these documents could be included when determining a more comprehensive nutrition landscape. While UNICEF documents were often referred to by DoH documents, they were not included in the landscape as they were not as easily identifiable as those of the WHO.

From the data collected, many of the public health issues were addressed by the themes. Nutrition research, however, includes topics not directly related to public health, yet often indirectly linked. Research conducted by the students at the NWU over the past two decades might not have had prevailing public health issues as its main focus within nutrition and dietetics research. In 2008, the aim at CEN was to "generate *in depth* information about all aspects of malnutrition and its alleviation, in order to provide evidence for solutions to the scientific community and governmental bodies responsible for policies, strategies and intervention programmes" (CEN, 2008a:4). Nutrition and Dietetic students most often addressed the theme *10-Nutrient requirements and dietary guidelines* – a theme that might define the field of dietetics on its own: nutrient requirements under specific conditions. However, this theme might be an indication of the future direction of nutrition science as suggested by Mozaffarian *et al.* (2018:2). They suggest that nutrition science will increasingly investigate more complex systems within the human body, as well as diet-risk pathways, would look at the quality of diets rather than quantities, would rigorously study food processing and the use of additives, and would influence policy creation with the aim of uniting modern scientific advances with new approaches for communication and modern evidence on effective systems level behaviour change (Mozaffarian *et al.*, 2018:2).

An alternative presentation of the landscape comes in a scientometric-based co-word analysis of nutrition-related documents, as used by Blázquez-Ruiz *et al.* (2016:1040), who conducted such analysis on the field of Food Science. They investigated key words of published documents to

reveal publication patterns, including the development of different research lines over time. Through this thematic analysis, they presented a map of publication development patterns over a decade.

The present study was limited to nutrition-related documents pertaining to global issues as published by the WHO. However, WHO documents and subsequent categorisation of themes by the WHO seems to encapsulate most of the PubData and all of the PolList documents. Future inclusion of other organisations' documents, as well as events leading to scientific investigations and governmental interventions, would strengthen the compilation of a comprehensive temporal historical nutrition landscape. Despite the potential of the WHO categories to effectively categorise public health nutrition themes, co-word scientometric-based thematic analysis might present a further enhancement to interpretation of scope.

5.4 Student document reach: results, methodology and state of the nation

A very high percentage of student articles reached the international scientific community. Two thirds had reached the international community within three years of publication (67.7%) and eventually 86.5% reached this community (all-time) (**Table 4-4**). Within these two ranges, only 19.4% and eventually only 9.6% respectively were not cited. Over the course of all time, 8.3% of theses and dissertations reached the international community. This result is to a large extent better than expected, as online indexing of theses and dissertations is not yet properly established in South Africa. The importance of disseminating research findings as research articles should be noted here. Research on nutrition and dietetic student productivity is scarce, yet when compared to other medical student research the findings from this study are exceptional. Publication proportions in developing countries have been indicated to be very low. From Cameroon (Munung *et al.*, 2014:438), Uganda (Obuku *et al.*, 2017:6), Egypt (Nour-Eldein *et al.*, 2015), and India (Dhaliwal *et al.*, 2010) post-graduate publication proportions were 14%, 18%, 22% and 30% respectively. Higher-income countries reported slightly higher publication proportions. In Iran (Motamed-Jahromi & Dehghani, 2014:121), New Zealand (Bullen & Reeve, 2011:803), Canada (Andrews *et al.*, 2013:403), and Spain (Hollmann *et al.*, 2015:495) publication proportions were respectively 40%, 45%, 45%, and 60.5%. The publication proportion presented in this study could be ascribed to the fact that SA has been shown to have been the WHO's top county in the African Region producing health research between 2000 and 2014 (Uthman *et al.*, 2015:4). This highlights the importance of students committing to publishing their research findings as research articles.

In relation to the nutrition agendas, as mentioned earlier, student publications aligned well with top priority WHO and SA government themes. For the top priority themes of the WHO and PolList

documents, *18-Vitamins and minerals*, *10-Nutrient requirements and dietary guidelines*, and *9-Infant and young child feeding*, 90.6% (n=29), 90.1% (n=64) and 75% (n=18) of student articles respectively reached the international community (**Table 4-5**). From these articles, 28.1%, 35.2%, and 29.2% (**Table 4-8**) achieved an impact equal to the word average for similar publications. This could be used to rate such publications of "world class quality".

Similar investigations might prove valuable to the university in other applied departments for the determination of the impact of their student and researcher evidence base.

5.4.1 Importance of reaching the government: evidence to strengthen the system

The importance of evidence in public health has been well established, with the translation of scientific evidence into practice shown to be multidimensional and complex. Despite a myriad of research over several years, the challenge of evidence uptake by policy-makers still persists. Globally, much research is taking place on health systems: on the improvement of health systems (e.g. Health Policy and Systems Research), developing learning health systems (Rubin *et al.*, 2018), and the translation of knowledge within the public health and policy-making system. From a Health Policy and Systems Research perspective, a networks study indicated that the qualities of an organisation are a greater determinant of centrality to a network than the proximity of the organisation occupies in relation to the decision-making core (Koon *et al.*, 2012:17). It supports Ellen *et al.* (2013:14) in their contention that the connectedness increased the uptake of research evidence in policy. From the limited data available on policy references, the two documents citing student documents were co-authored by researchers affiliated with the NWU thus providing limited support to this theory.

Quality through relevance is identified as another factor influencing evidence uptake (Koon *et al.*, 2012:17). SA is pursuing the implementation of universal health care coverage and "requires contextualised scientific knowledge to guide the development of health system-strengthening strategies" as supported by the Health Research Policy and the National Development Plan (Department of Health, 2001a; National Planning Commission, 2013a:349; Senkubuge *et al.*, 2018:125). Some elements of performance of South Africa's National Health Research System are (1) leadership and governance, (2) the development and sustainment of resources for research for health, and (3) the production and use of research (Senkubuge *et al.*, 2018:126). One subdivision of producing and utilising research for health is the existence of knowledge-translation platforms. Knowledge translation "describe the process, or science, behind the transfer of research-based knowledge into a form that can be used to provide effective health services" (Malla *et al.*, 2018). This represents a key element in translating not only globally generated knowledge but also locally generated knowledge into practice. Improving the position of

universities within the National Health Research System with regards to these three elements might be considered as a strategic move for the improvement of evidence uptake.

Unfortunately, no memorandum of understanding governs the relationship between the DoH and university medical and health schools. Besides the South African MRC and the Health Systems Trust, universities are the major contributors to the development and sustainment of research for health (Senkubuge *et al.*, 2018:128). Despite the lack of a memorandum of understanding, universities often work closely with the DoH to undertake research when commissioned and to act as experts on advisory panels to the DoH (Senkubuge *et al.*, 2018:128). Policy-makers have targeted much criticism at the scientific community regarding the non-availability of scientific evidence for knowledge translation (Aryeetey *et al.*, 2017:2; Brownson *et al.*, 2006:167; Naude *et al.*, 2015:7; Oliver *et al.*, 2014:6). Yet the MRC, Health Systems Trust, and universities primarily disseminate their research for health evidence in peer-reviewed journals. It has been shown that access to research evidence occupies a support structure that facilitates evidence uptake for health system organisations (Ellen *et al.*, 2013:14). Increasing the accessibility and availability of current and relevant evidence would constitute a strategic measure for increasing the quality of information an organisation could provide decision-makers within the policy-making sphere.

As acknowledged earlier, policy making is complex and challenging and increasing accessibility and availability of evidence might only contribute to increasing the interchange of information from the scientific community to the policy-makers. As attested by Gluckman (2019), policies can and should be informed by scientific evidence, as the robust knowledge should provide the bases for understanding a system and the options available. But the choice between options are influenced by several other factors, including public values, political ideologies, electoral contracts, fiscal objective and obligations, diplomatic issues and any international obligations (Gluckman, 2018:93; Gluckman, 2019). Notwithstanding these factors, it might be possible that through the provision of knowledge-translation platform, for the presentation of relevant evidence, the NWU might make itself more central to the decision-making core and at least increase the potential of evidence uptake.

5.5 Evidence mapping: uses, contributions, and limitations

The evidence maps generated from this study illustrate the impact, scope and reach of local nutrition research undertaken by post-graduate students. These evidence maps seek to assist stakeholders in identifying gaps in knowledge production for certain nutrition themes and to allow them to access and extract available data on impact. Presenting the evidence maps in an interactive, user-friendly format requires that they are hosted online – both for ease of access and to harness existing software. Three visualisations presented different elements of the data,

despite platform restraints which limited the visualisation possibilities. The non-traditional method of dissemination of research findings is characteristic of evidence mapping methodology (National Department of Performance Monitoring and Evaluation, 2016:39). Other non-traditional elements include that evidence mapping methodology does not aim to provide detailed and definitive information, but rather to provide an objective representation of the research evidence already published. These maps "do not provide context-specific evidence and do not draw conclusions or recommendations for policy and practice; their interactive nature enables users to explore the evidence in more detail and to derive their own conclusions and implications for policy making and research agendas" (Snilstveit *et al.*, 2013:20). In addition, they present a "very broad overview of the evidence base, indicating areas in which research has been conducted, to help stakeholders interpret the state of the evidence to inform policy and clinical decision making" (Hempel *et al.*, 2014).

5.5.1 Contribution to the growing body of evidence mapping methodology

Through the adaptation of evidence mapping methodology, these maps contribute to the body of methodologies for evidence mapping, yet not in the form of mapping impact interventions or systematic reviews. Rather, this study adapted the evidence mapping methodology for use as an impact presentation tool. Contrary to other evidence maps (Snilstveit *et al.*, 2013:20), this study did not differentiate between types of studies, interventions, inclusions, or outcomes included in the maps. Evidence mapping metholodogies have been suggested for the provision of thematic collections of evidence pertaining to study interventions and outcomes (Miake-Lye *et al.*, 2016:3; Phillips *et al.*, 2017:v; Snilstveit *et al.*, 2016:120), yet can be easily adapted for other purposes (Snilstveit *et al.*, 2013:20). Evidence mapping methodology is often used to map impact evaluations and systematic reviews (Miake-Lye *et al.*, 2016:3). A summary of evidence maps on systematic reviews and impact studies over the last decade indicates that the sector of "Health, nutrition and population" contributed the highest number of available evidence maps (n=21, 38%) (Phillips *et al.*, 2017:12) and these regional maps contribute to this evidence base. The maps from this study, and similar ones in the future, offer the potential to present evidence over a multitude of fields, from as narrow as a certain study types addressing rare nutrition states, to as wide as presenting nutrition research across all nutrition themes globally. In addition, in conjunction with bibliometric indicators, research impact can extend more traditional evidence maps. Evidence mapping methodology might also prove valuable for the mapping not only of research evidence, but also of intervention documents. As with the nutrition landscape, mapping could include the reviews and interventions, but also guideline and policy documents from nutrition-focused organisations – especially when taking stakeholder needs into consideration. As a response to impact evaluation of schools, research entities, researchers, or groups of researchers, student-generated evidence maps could be used by other applied science department at universities. Not

only could it be useful in the health sector, but also in fields like engineering, environmental sciences, and agriculture.

5.5.2 Sustainability of maps

The final evidence maps of this study have been completed and disseminated and shall now remain static. This static presentation of the data is modifiable and might be considered when planning future evidence mapping endeavours. This is especially important when taking into account the cost of evidence map ownership, updating and maintenance and frequency of production, IT maintenance and software updating (National Department of Performance Monitoring and Evaluation, 2016:40). However, evidence is produced long after decisions have been made and lack of timeliness of relevant data remains a major criticism of scientific evidence (Oliver *et al.*, 2014). It seems standard practice that evidence maps are designed with a set end point. However, evidence maps have the potential to not only provide information of past research, but to present up-to-date evidence as it is published and present impact as documents are cited. With automation and machine learning the creation live and interactive such evidence maps might be possible, making them even more useful tools for stake-holders in both the scientific and public health communities. Ownership and funding, as well as stakeholder contribution, are elements that would need careful consideration for such a project (National Department of Performance Monitoring and Evaluation, 2016:40).

5.6 Recommendations

1. Research is needed to determine the effectiveness and sustainability of evidence mapping as a knowledge-translation tool for the South African public health community. This could include bibliometric research on research, or could include qualitative research. After the development of more evidence maps, they can then be assessed for effectiveness as knowledge-translation tools.
2. Future initiatives to map the nutrition landscape could include other nutrition-focussed organisations, movements, initiatives and events. Such organisations and movements would include, for example, UNICEF, FAO, WHO, NNI, SUN and initiatives like the SDG, the WHA nutrition targets, Evidence Informed Decision Making in Nutrition and Health – EVIDENT and other Evidence-informed decision-making initiatives in Africa, as well as historical events shaping the focus on nutrition.
3. To improve the accuracy and currency of the nutrition agenda and themes, a scientometric-based co-word analysis of nutrition landscape documents and published research could be used.

4. Improved impact analysis requires investigations into knowledge-translation and other bibliometric indicators for impact assessment.
5. For an improved and more comprehensive presentation of research evidence, an evidence map could be compiled comparing interventions, outcomes, or study types within the nutrition field across centres nationally and or internationally.
6. For optimisation of presenting available evidence, implementing automation and machine learning into evidence mapping practices.
7. CEN could benefit from doing a similar analysis for its publications. At the least, it could provide useful information for decision making and alignment of research efforts to relevant topics and its vision.
8. The DoH would profit from investing in the development and implementation of an accountability system to encourage and acknowledge the use of evidence.

5.7 Limitations

1. The field of nutrition is much wider and more complex than what has been investigated in this study. The impact and reach of student research might also be wider, such as contributing to international databases, from which changes over time can be determined. This information is key to take into account in the development of policies and programmes, but may not be reflected in WHO and national programme and policy documents. Future research could take this into account.
2. Classification of student publications to match nutrition themes and policy documents were done in a “direct” manner. The indirect impact of some of the research was not classified (and is often difficult to establish). An example is the classification of the 2017 thesis of Swanepoel “Sodium intake in South Africa: an analysis of food supply, 24-hour excretion and blood pressure in a tri-ethnic population” under *(18) Vitamins and minerals*. This could also indirectly speak to *(12) Food and nutrition policy*. Future research might qualitative aspects that investigate indirect influences of research on policy.
3. A limitation to the current impact analysis was, however, that no consideration was given to specifications of studies included e.g. intervention, systematic reviews, observational etc.
4. This study focussed only on student research publications only and did not include researcher outputs from faculty, staff and researchers at CEN. Some of the students continued as academic and research staff at the university, making it difficult to discern which articles resulted from their studies and which did not. Maiden name and surname changes between the completion of a study and the time of article publication could also contribute to articles not captured by the search strategies

5. Studies and resulting articles published before 2003 were not captured and listed by AUTHeR, resulting in much difficulty in determining connections between articles and studies. However, many of the studies were written in article format, making it easy to trace possible article publications flowing from them. Those written in chapter format have no direct connection to published articles and resulting articles might have been missed.

5.8 Conclusion

In South Africa, the drive for social justice has contributed to addressing previous and prevailing inequalities relating to public health and nutrition. Globally, many endeavours have targeted health issues through the utilisation of research, a practice acknowledged and supported by the South African government. Governmental initiatives are assumed to be more effective when relevant scientific research outputs are utilised to further scientific and technical advancement. Although evidence-based/informed practice is built on scientific research, it is widely accepted that evidence does not solely determine decision-making, but rather plays a major role in informing decision-making. Global organisations and local research institutions contribute to generating and sustaining (current and up-to-date) evidence. Research conducted by post-graduate students at local universities holds considerable potential in contributing to the alleviation of health issues.

The nutrition agenda has developed over the past few decades to address diverse issues, from nutrient requirements under physiological conditions to inter-sectoral public health systems. The growing emphasis on development and sustainability acknowledges the considerable role played by public health nutrition. Several global endeavours have resulted in targets towards which public health nutrition plays an important role. Some target dates have already passed but many are still being pursued.

This study presents a nascent attempt at mapping the impact, scope and reach of nutrition research of post-graduate student publications from the NWU in the context of the WHO nutrition-related publications and the SA nutrition-related policies and programmes.

Scientific publication impact was measured by the scientometric practice of citation analysis on citations extracted from Google Scholar, Web of Science, and Scopus. Findings from this study show that between 1997 and 2019, student research performance often reached and exceeded world averages. Within this time period, 67.9% of articles reached and impacted the international scientific community within three years of publication. All-time citations indicate that 91.6% of published student articles impacted the scientific community, of which 32.9% reached or

exceeded average world impact. Further investigations and knowledge-translation research is needed to indicate the specific contributions of scientific impact. It is certain, however, that student research is adding to and assisting in sustaining world class research evidence within the SA context. The scope of nutrition research is shown to address almost all public health nutrition themes, in addition to addressing topics beyond public health nutrition. Top priority themes addressed by the WHO and SA government are shown to have been equally important in student research. In addition, not only did the majority of student articles reach the international community, but those addressing the top priority themes achieved an impact performance above world average. Some theses and dissertations also reached the international community. Systematic reviews were particularly highly cited.

Citation analysis has also been suggested as a method for research impact evaluation of policy documents. Due to limited citations of source documents by the South African government community, the impact and reach of student research could not be evaluated by this method. Developing a climate at the DoH for the use and acknowledgement of evidence should be encouraged. What can be concluded is that student documents were addressing relevant nutrition issues and quality evidence was available. Despite being well connected with the DoH, no memorandum of understanding exists between the university and the National Health Research System. But when scientific evidence is summoned, its uptake of scientific evidence and impact is clearly seen visible through in the acknowledgement of sources. Increasing the accessibility of evidence might not only move the university strategically closer to the national public-health decision-making core, but, more specifically, place the available relevant evidence within reach of decision-makers.

Policy-makers have, however, indicated some barriers to scientific research evidence uptake relating to accessibility, availability, and relevance. In addressing these barriers, the practice of evidence mapping is on the rise, presenting available evidence bases as a means to inform stakeholders of the state of evidence for decision-making. The current study provides an example of such mapping, where available evidence from NWU Nutrition and Dietetics student publications is presented visually. The impact, scope, and reach of these documents are shown and will subsequently be presented to CEN, the director and the dean of Health Sciences at the NWU. More research is needed to evaluate student research impact and knowledge translation of scientific research outputs on policy documents.

ANNEXURE

Table 0-1: WHO document contributing to the Historical nutrition landscape: per nutrition theme

Year	WHO Nutrition document title	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary guidelines	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
1994	An evaluation of infant growth - WHO working group on infant growth	(WHO, 1994a)							■													
1994	FAO/WHO intercountry workshop on follow-up of the International Conference on Nutrition (ICN) report - Alexandria, Egypt, 25-29 September 1994	(WHO & FAO, 1994a)												■								
1994	Fats and oils in human nutrition - report of a joint FAO/WHO expert consultation	(WHO & FAO, 1994b)										■										
1994	Iodine and health - eliminating iodine deficiency disorders safely through salt iodization	(WHO, 1994b)																		■		
1995	An evaluation of infant growth: the use and interpretation of anthropometry in infants - WHO working group on infant growth	(WHO, 1995a)							■													
1995	Field guide on rapid nutritional assessment in emergencies	(WHO, 1995b)				■																
1995	Global prevalence of Vitamin A deficiency - micronutrient deficiency information system working paper no. 2	(WHO & UNICEF, 1995)																		■		
1995	Physical status: the use and interpretation of anthropometry - report of a WHO expert committee	(WHO, 1995c)							■													
1995	Vitamin A deficiency and its consequences A field guide to their detection and control - third edition	(Sommer, 1995)																		■		
1996	Indicators for assessing vitamin A deficiency and their application in monitoring and evaluating intervention programmes	(WHO, 1996a)																		■		
1996	Iodized oil during pregnancy - safe use of iodized oil to prevent iodine deficiency in pregnant women	(WHO, 1996c)																		■		
1996	Recommended iodine levels in salt and guidelines for monitoring their adequacy and effectiveness	(WHO *et al.*, 1996)																		■		
1996	The International Code of Marketing of Breast-Milk Substitutes - a common review and evaluation framework	(WHO, 1996b)									■											
1996	Trace elements in human nutrition and health	(WHO, 1996d)																		■		
1997	Breastfeeding : how to support success - a practical guide for health workers	(WHO, 1997a)									■											
1997	Joint WHO/UNICEF/ICCIDD consultation 8-9 July 1996, Geneva, Switzerland	(WHO, 1997b)																		■		
1997	Vitamin A supplements - a guide to their use in the treatment and prevention of vitamin A deficiency and xerophthalmia: second edition	(WHO *et al.*, 1997)																		■		
1998	Carbohydrates in human nutrition - report of a joint FAO/WHO expert consultation	(WHO & FAO, 1998a)										■										
1998	Complementary feeding of infants and young children - report of a technical consultation	(WHO, 1998a)									■											
1998	Complementary feeding of young children in developing countries - a review of current scientific knowledge	(WHO, 1998b)									■											
1998	Conference on sustainable elimination of iodine deficiency disorders in Africa by the year 2000 Harare, Zimbabwe, 22-24 April 1996	(WHO, 1998c)																		■		

Table 0-1: WHO document contributing to the Historical nutrition landscape: per nutrition theme *(Continued)*

Year	WHO Nutrition document title	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary guidelines	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
1998	Guidelines for the use of iron supplements to prevent and treat iron deficiency anemia	(International Nutritional Anemia Consultative Group (INACG) *et al.*, 1998)																				
1998	Micronutrient deficiencies in Africa WHO intercountry workshop for national programme managers	(WHO, 1998e)																				
1998	Preparation and use of food-based dietary guidelines - joint FAO/WHO consultation (WHO technical report series 880)	(WHO & FAO, 1998b)																				
1998	Safe vitamin A dosage during pregnancy and lactation - recommendations and report of a consultation	(WHO & The Micronutrient Initiative, 1998)																				
1998	The International Code of Marketing of Breast-Milk Substitutes - summary of action taken by WHO Member States and other interested parties	(WHO, 1998d)																				
1999	Caring for the nutritionally vulnerable during emergencies - an annotated bibliography	(WHO, 1999a)																				
1999	Management of severe malnutrition: a manual for physicians and other senior health workers	(WHO, 1999b)																				
1999	Progress towards the elimination of iodine deficiency disorders	(WHO *et al.*, 1999a)																				
1999	Scurvy and its prevention and control in major emergencies	(WHO, 1999c)																				
1999	The Baby-Friendly Hospital Initiative - monitoring and reassessment: tools to sustain progress	(WHO *et al.*, 1999b)																				
1999	Thiamine deficiency and its prevention and control in major emergencies	(WHO, 1999d)																				
2000	Complementary feeding: family foods for breastfed children	(WHO, 2000a)																				
2000	Obesity: preventing and managing the global epidemic - report of a WHO consultation (WHO technical report series 894)	(WHO, 2000b)																				
2000	Pellagra and its prevention and control in major emergencies	(WHO, 2000c)																				
2000	The management of nutrition in major emergencies	(WHO *et al.*, 2000)																				
2000	WHO multi-country study on improving household food and nutrition security for the vulnerable - South Africa	(WHO, 2000d)																				
2001	A follow-up to the International Conference on Nutrition (ICN) - report of an intercountry workshop	(WHO & FAO, 2001)																				
2001	Achieving household food and nutrition security in societies in transition	(WHO, 2001a)																				
2001	Assessment of iodine deficiency disorders and monitoring their elimination - a guide for programme managers, second edition	(WHO *et al.*, 2001a)																				
2001	Development of a global strategy on infant and young child feeding - report on a WHO/UNICEF consultation for the WHO European Region	(Pomerleau, 2011)																				
2001	Infant feeding in emergencies module 1 - for emergency relief staff	(WHO *et al.*, 2001b)																				
2001	Programming of chronic disease by impaired fetal nutrition - evidence and implications for policy and intervention strategies	(Delisle & WHO, 2001)																				
2001	The optimal duration of exclusive breastfeeding: a systematic review	(Kramer & Kakuma, 2001)																				
2001	The optimal duration of exclusive breastfeeding: report of the expert consultation	(WHO, 2001b)																				

Table 0-1: WHO document contributing to the Historical nutrition landscape: per nutrition theme *(Continued)*

Year	WHO Nutrition document title	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary guidelines	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
2002	Living well with HIV/AIDS - a manual on nutritional care and support for people living with HIV/AIDS	(WHO & FAO, 2002)																				
2002	Nutrient adequacy of exclusive breastfeeding for the term infant during the first six months of life	(Butte *et al.*, 2002)																				
2003	Complementary feeding: report of the global consultation - summary of guiding principles	(WHO, 2003a)																				
2003	Consultative meeting on nutrition interventions for improving the prevention, care and management of HIV/AIDS - 19-20 November 2003, Durban, South Africa	(WHO, 2003b)																				
2003	Diet, nutrition and the prevention of chronic diseases - report of a joint WHO/FAO expert consultation (WHO technical report series 916)	(WHO & FAO, 2003)																				
2003	Global strategy for infant and young child feeding	(WHO & UNICEF, 2003)																				
2003	Guidelines for the inpatient treatment of severely malnourished children	(WHO, 2003c)																				
2003	HIV and infant feeding - a guide for health care managers and supervisors	(WHO *et al.*, 2003)																				
2003	Implementing the global strategy for infant and young child feeding - meeting report, Geneva, Switzerland, 3-5 February 2003	(WHO, 2003d)																				
2003	Infant and young child feeding - a tool for assessing national practices, policies and programmes	(WHO & LINKAGES, 2003)																				
2003	Keep fit for life - meeting the nutritional needs of older persons	(WHO, 2002)																				
2004	Complementary feeding counselling: a training course	(WHO, 2004a)																				
2004	Diet, nutrition and the prevention of chronic diseases - special issue	(WHO & FAO, 2004a)																				
2004	Ensuring optimal feeding of infants and young children during emergencies - a summary of the policy of the World Health Organization	(WHO, 2004b)																				
2004	Feeding the non-breastfed child 6-24 months of age - meeting report, Geneva, Switzerland, 8-10 March 2004	(WHO, 2004c)																				
2004	Focusing on anaemia - towards an integrated approach for effective anaemia control	(WHO & UNICEF, 2004a)																				
2004	Food and nutrition needs in emergencies	(WHO *et al.*, 2004b)																				
2004	Guiding principles for feeding infants and young children during emergencies	(WHO, 2004d)																				
2004	Human energy requirements - report of a joint FAO/WHO/UNU expert consultation, Rome, Italy, 17-24 October 2001	(WHO *et al.*, 2004a)																				
2004	Iodine status worldwide - WHO global database on Iodine deficiency	(WHO, 2004e)																				
2004	Nutrient requirements for people living with HIV/AIDS - report of a technical consultation, 13-15 May 2003, Geneva, Switzerland	(WHO, 2004f)																				
2004	UNICEF and WHO call for stronger support - for the implementation of the joint United Nations HIV and infant feeding framework	(WHO & UNICEF, 2004b)																				
2004	Vitamin and mineral requirements in human nutrition - second edition	(WHO & FAO, 2004b)																				

Table 0-1: WHO document contributing to the Historical nutrition landscape: per nutrition theme *(Continued)*

Year	WHO Nutrition document title	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary guidelines	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
2005	Code of Practice for Food Premix Operations	(Pan American Health Organization, 2005)																				
2005	Consultation on nutrition and HIV/AIDS in Africa - evidence, lessons, and recommendations for action	(WHO, 2005a)																				
2005	Severe malnutrition: report of a consultation to review current literature, 6-7 September 2004	(WHO, 2005c)																				
2006	Development of a framework on the Nutrition-friendly Schools Initiative - report of the brainstorming session, Montreux, Switzerland, 27-28 February 2006	(WHO, 2006a)																				
2006	Guidelines on food fortification with micronutrients	(WHO & FAO, 2006)																				
2006	Informal consultation on community-based management of severe malnutrition in children WHO, UNICEF and SCN (Standing Committee on Nutrition)	(Prudhon *et al.*, 2006)																				
2006	Mental health and psychosocial well-being among children in severe food shortage situations	(WHO, 2006b)																				
2006	Promoting optimal fetal development - Report of a technical consultation	(WHO, 2006c)																				
2006	WHO child growth standards: methods and development - length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age	(WHO, 2006d)																				
2007	Assessing the iron status of populations - second edition, including literature reviews	(WHO & CDC, 2007)																				
2007	Assessment of iodine deficiency disorders and monitoring their elimination - a guide for programme managers, third edition (updated 1st September 2008	(WHO *et al.*, 2007b)																				
2007	Beyond survival - Integrated delivery care practices for long-term maternal and infant nutrition, health and development	(Pan American Health Organization, 2007)																				
2007	Community-based management of severe acute malnutrition - a joint statement	(WHO *et al.*, 2007d)																				
2007	Development of a WHO growth reference for school-aged children and adolescents	(WHO, 2007a)																				
2007	Infant and young child feeding in emergencies (version 2.1) - operational guidance for emergency relief staff and programme managers	(WHO *et al.*, 2007c)																				
2007	Infant feeding in emergencies module 2 version 1.1 - for health and nutrition workers in emergency situations for training, practice and reference	(Emergency Nutrition Network *et al.*, 2007)																				
2007	Joint FAO/WHO scientific update on carbohydrates in human nutrition - European Journal of Clinical Nutrition, Vol 61 (Supplement 1), December 2007	(WHO & FAO, 2007)																				
2007	Planning guide for national implementation of the global strategy for infant and young child feeding	(WHO & UNICEF, 2007)																				
2007	Protein and amino acid requirements in human nutrition - report of a joint FAO/WHO/UNU expert consultation (WHO technical report series 935)	(WHO *et al.*, 2007a)																				
2007	WHO child growth standards: methods and development - head circumference-for-age, arm circumference-for-age, triceps skinfold-for-age and subscapular skinfold-for-age	(WHO, 2007b)																				
2008	Eastern and Southern Africa regional meeting on nutrition and HIV/AIDS - meeting report, 2-4 May 2007, Nairobi, Kenya	(WHO & UNICEF, 2008)																				

Table 0-1: WHO document contributing to the Historical nutrition landscape: per nutrition theme *(Continued)*

Year	WHO Nutrition document title	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary guidelines	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
2008	HIV transmission through breastfeeding - a review of available evidence - update 2007	(WHO *et al.*, 2008b)								■												
2008	Indicators for assessing infant and young child feeding practices - part I: definitions	(WHO *et al.*, 2008c)									■											
2008	Learning from large-scale community-based programmes to improve breastfeeding practices	(WHO *et al.*, 2008a)									■											
2008	Salt as a vehicle for fortification - report of a WHO expert consultation	(WHO, 2008a)																		■		
2008	Strengthening action to improve feeding of infants and young children 6-23 months of age in nutrition and child health programmes - report of proceedings, Geneva, 6-9 October 2008	(WHO, 2008b)									■											
2008	Training course on child growth assessment - WHO child growth standards	(WHO, 2008c)							■													
2008	Worldwide prevalence of anaemia 1993-2005 - WHO global database on anaemia	(WHO & CDC, 2008)																		■		
2009	Acceptable medical reasons for use of breast-milk substitutes	(WHO & UNICEF, 2009a)									■											
2009	Consultation on the dietary management of moderate malnutrition in under-5 children - Food Nutrition Bulletin, Vol 30, No. 3, September 2009 (Supplement)	(WHO *et al.*, 2009)																	■			
2009	Fats and fatty acids in human in nutrition - joint FAO/WHO expert consultation, November 10-24, 2008, Geneva, Switzerland	(FAO & WHO, 2009)										■										
2009	Global prevalence of vitamin A deficiency in populations at risk 1995-2005 - WHO global database on vitamin A deficiency	(WHO, 2009a)																		■		
2009	Guidelines for an integrated approach to nutritional care of HIV-infected children (6 month-14 years) - preliminary version for country introduction	(WHO, 2009b)								■												
2009	Infant and young child feeding: model chapter	(WHO, 2009c)									■											
2009	Neonatal vitamin A supplementation research priorities - report of the WHO technical consultation	(WHO, 2009d)																		■		
2009	Nutritional care and support for people living with HIV/AIDS - a training course	(WHO & FAO, 2009)								■												
2009	Recommendations on wheat and maize flour fortification - meeting report: interim consensus statement	(WHO, 2009e)																		■		
2009	Training course on the management of severe malnutrition	(WHO, 2009f)																	■			
2009	WHO child growth standards and the identification of severe acute malnutrition in infants and children - a joint statement	(WHO & UNICEF, 2009b)							■										■			
2009	WHO child growth standards: methods and development - growth velocity based on weight, length and head circumference	(WHO Multicentre Growth Reference Study Group, 2009)							■													
2009	WHO scientific update on trans fatty acids (TFA) - European Journal of Clinical Nutrition, Volume 63 (Supplement 2), May 2009	(WHO, 2009g)										■										
2010	Indicators for assessing infant and young child feeding practices - Part II Measurement	(WHO *et al.*, 2010a)									■											
2010	Indicators for assessing infant and young child feeding practices - Part III Country profiles	(WHO *et al.*, 2010b)									■											
2010	Nutrient profiling: report of a technical meeting - London, United Kingdom, 4-6 October 2010	(WHO, 2010a)						■														

Table 0-1: WHO document contributing to the Historical nutrition landscape: per nutrition theme *(Continued)*

Year	WHO Nutrition document title	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary guidelines	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
2010	Scoping meeting for the development of guidelines on nutritional/food support to prevent TB and improve health status among TB patients - meeting report, Geneva, 2-4 November 2009	(WHO, 2010b)																				
2010	WHO global network of institutions for scientific advice on nutrition - report of the first meeting, 11-12 March 2010, Geneva, Switzerland	(WHO, 2010c)																				
2010	WHO meeting on estimating appropriate levels of vitamins and minerals for food fortification programmes	(WHO, 2010d)																				
2011	Facts for life - fourth edition	(UNICEF *et al.*, 2010)																				
2011	Fats and fatty acids in human nutrition - report of an expert consultation	(FAO, 2010)																				
2011	Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity	(WHO, 2011a)																				
2011	Intermittent iron and folic acid supplementation in menstruating women - guideline	(WHO, 2011b)																				
2011	Intermittent iron supplementation in preschool and school-age children - guideline	(WHO, 2011c)																				
2011	Neonatal vitamin A supplementation guideline	(WHO, 2011d)																				
2011	Serum ferritin concentrations for the assessment of iron status and iron deficiency in populations	(WHO, 2011e)																				
2011	Serum retinol concentrations for determining the prevalence of vitamin A deficiency in populations	(WHO, 2011f)																				
2011	Vitamin A supplementation during pregnancy for reducing the risk of mother-to-child transmission of HIV - guideline	(WHO, 2011g)																				
2011	Vitamin A supplementation for infants 1–5 months of age - guideline	(WHO, 2011h)																				
2011	Vitamin A supplementation for infants and children 6-59 months of age - guideline	(WHO, 2011i)																				
2011	Vitamin A supplementation in postpartum women – guideline	(WHO, 2011j)																				
2011	Waist circumference and waist–hip ratio - report of a WHO expert consultation, Geneva, 8-11 December 2008	(WHO, 2011k)																				
2012	Combined course on growth assessment and IYCF counselling	(WHO, 2012a)																				
2012	Combined course on growth assessment and IYCF counselling - Slides	(WHO, 2012a)																				
2012	HIV and infant feeding 2010: an updated framework for priority action - guidelines	(WHO, 2012b)																				
2012	Landscape analysis on countries' readiness to accelerate action in nutrition - Country assessment tools	(WHO, 2012c)																				
2012	Micronutrients 2010-2011	(WHO, 2012d)																				
2012	Potassium intake for adults and children - guideline	(WHO, 2012e)																				
2012	Priorities in the assessment of vitamin A and iron status in populations - report, 15-17 September 2010, Panama City, Panama	(WHO, 2012f)																				
2012	Sodium intake for adults and children - guideline	(WHO, 2012g)																				

Table 0-1: WHO document contributing to the Historical nutrition landscape: per nutrition theme *(Continued)*

Year	WHO Nutrition document title	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary guidelines	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
2012	Supplementary foods for the management of moderate acute malnutrition in infants and children 6-59 months of age - technical note	(WHO, 2012h)																	■			
2012	UNICEF-WHO-The World Bank: Joint child malnutrition estimates level and trends in child malnutrition	(UNICEF *et al.*, 2012)											■						■			
2012	Vitamin A in newborn health: mechanistic studies WHO technical consultation	(WHO, 2012i)																		■		
2013	Beyond survival: 2nd edition - Integrated delivery care practices for long-term maternal and infant nutrition, health and development	(Pan American Health Organization, 2013)									■											
2013	Country implementation of the International Code of Marketing of Breast-milk Substitutes - Status report 2011	(WHO, 2013a)									■											
2013	Essential nutrition actions - improving maternal, newborn, infant and young child health and nutrition	(WHO, 2013b)				■				■	■				■				■	■		
2013	Global nutrition policy review - what does it take to scale up nutrition action?	(WHO, 2013c)												■								
2013	Nutritional care and support for patients with tuberculosis - guideline	(WHO, 2013d)																■				
2013	Scientific and technical advisory group on Inappropriate promotion of foods for infants and young children - Meeting report, 24-25 June 2013, Geneva, Switzerland	(WHO, 2013e)						■			■	■		■								
2013	Updates on the management of severe acute malnutrition in infants and children - guideline	(WHO, 2013f)				■				■	■								■			
2013	Urinary iodine concentrations for determining iodine status in populations	(WHO, 2013g)																		■		
2014	2012-2013 Biennium report: Department of Nutrition for Health and Development evidence and programme guidance	(WHO, 2014a)																		■		
2014	Accelerating Nutrition Improvements (ANI): mapping of stakeholders and nutrition actions in three scaling-up countries in sub-Saharan Africa - report of a meeting	(WHO, 2014b)	■																			
2014	Birth defects surveillance: a manual for programme managers	(WHO *et al.*, 2014a)							■						■					■		
2014	Birth defects surveillance: atlas of selected congenital anomalies	(WHO *et al.*, 2014b)							■						■					■		
2014	C-reactive protein concentrations as a marker of inflammation or infection for interpreting biomarkers of micronutrient status	(WHO, 2014c)																		■		
2014	Childhood stunting: challenges and opportunities report - report of a colloquium	(WHO, 2014d)							■													
2014	Comprehensive implementation plan on maternal, infant and young child nutrition	(WHO, 2014e)							■		■		■						■	■		
2014	Delayed umbilical cord clamping for improved maternal and infant health and nutrition outcomes - guideline	(WHO, 2014f)									■				■					■		
2014	Effect and safety of salt iodization to prevent iodine deficiency disorders: a systematic review with meta-analyses	(Aburto *et al.*, 2014)									■				■					■		
2014	Fortification of food-grade salt with iodine for the prevention and control of iodine deficiency disorders - guideline	(WHO, 2014g)										■								■		
2014	Global Nutrition Targets 2025: Anaemia policy brief	(WHO, 2017h)							■		■		■						■	■		
2014	Global Nutrition Targets 2025: Breastfeeding policy brief	(WHO & UNICEF, 2014)							■		■		■						■	■		

Table 0-1: WHO document contributing to the Historical nutrition landscape: per nutrition theme *(Continued)*

Year	WHO Nutrition document title	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary guidelines	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
2014	Global Nutrition Targets 2025: Childhood overweight policy brief	(WHO, 2014h)																				
2014	Global Nutrition Targets 2025: Low birth weight policy brief	(WHO, 2014i)																				
2014	Global Nutrition Targets 2025: Policy brief series	(WHO, 2014j)																				
2014	Global Nutrition Targets 2025: Stunting policy brief	(WHO, 2014k)																				
2014	Global Nutrition Targets 2025: Wasting policy brief	(WHO *et al.*, 2014c)																				
2014	Goitre as a determinant of the prevalence and severity of iodine deficiency disorders in populations	(WHO, 2014l)																				
2014	Maternal, infant and young child nutrition in East and Southern African countries: moving to national implementation - report of a World Health Organization workshop	(WHO, 2014m)																				
2014	Methodological approaches to estimating global and regional prevalence of vitamin and mineral deficiencies - report on the joint WHO/USCDC technical consultation	(WHO & CDC, 2014)																				
2014	Nutritional care of children and adults with Ebola virus disease in treatment centres	(WHO *et al.*, 2014d)																				
2014	Salt reduction and iodine fortification strategies in public health - report of a joint technical meeting	(WHO, 2014n)																				
2014	Serum transferrin receptor levels for the assessment of iron status and iron deficiency in populations	(WHO, 2014o)																				
2014	Xerophthalmia and night blindness for the assessment of clinical vitamin A deficiency in individuals and populations	(WHO, 2014p)																				
2015	Birth defects surveillance training: facilitator's guide	(WHO *et al.*, 2015a)																				
2015	Improving nutrition outcomes with better water, sanitation and hygiene - practical solutions for policy and programmes	(WHO *et al.*, 2015b)																				
2015	Optimal serum and red blood cell folate concentrations in women of reproductive age for prevention of neural tube defects - guideline	(WHO, 2015b)																				
2015	Serum and red blood cell folate concentrations for assessing folate status in populations - updated	(WHO, 2015c)																				
2015	Sugars intake for adults and children - guideline	(WHO, 2015d)																				
2015	The global prevalence of anaemia in 2011	(WHO, 2015a)																				
2015	UNICEF-WHO-World Bank Group : Joint child malnutrition estimates - key findings of the 2015 edition	(UNICEF *et al.*, 2015)																				
2016	Daily iron supplementation in adult women and adolescent girls -guideline	(WHO, 2016b)																				
2016	Daily iron supplementation in infants and children - guideline	(WHO, 2016c)																				
2016	Daily iron supplementation in postpartum women - guideline	(WHO, 2016d)																				
2016	Effect of trans-fatty acid intake on blood lipids and lipoproteins: a systematic review and meta-regression analysis - systematic review	(Brouwer, 2016)																				

Table 0-1: WHO document contributing to the Historical nutrition landscape: per nutrition theme *(Continued)*

Year	WHO Nutrition document title	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary guidelines	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
2016	Effects of saturated fatty acids on serum lipids and lipoproteins: a systematic review and regression analysis - systematic review	(Mensink & WHO, 2016)																				
2016	Fortification of maize flour and corn meal with vitamins and minerals - guideline	(WHO, 2016e)																				
2016	Infant feeding in areas of Zika virus transmission – guideline	(WHO, 2016g)																				
2016	Marketing of breast-milk substitutes: National implementation of the international code - status report 2016	(WHO *et al.*, 2016)																				
2016	UNICEF-WHO-The World Bank Group: Joint child malnutrition estimates - levels and trends - key findings of the 2016 edition	(UNICEF *et al.*, 2017b)																				
2016	Updates on HIV and infant feeding - guideline	(WHO, 2016h)																				
2016	Use of multiple micronutrient powders for point-of-use fortification of foods consumed by infants and young children aged 6–23 months and children aged 2–12 years - guideline	(WHO, 2016i)																				
2016	Use of multiple micronutrient powders for point-of-use fortification of foods consumed by pregnant women guideline	(WHO, 2016j)																				
2016	WHO recommendations on antenatal care for a positive pregnancy experience	(WHO, 2016k)																				
2017	A healthy diet sustainably produced - information sheet	(WHO, 2018f)																				
2017	Accelerating Nutrition Improvements (ANI): mapping of stakeholders and nutrition actions in three scaling-up countries in sub-Saharan Africa - report of the second meeting	(WHO, 2016a)																				
2017	Accelerating Nutrition Improvements in sub-Saharan Africa (ANI): report of the baseline and end-line perception surveys in ten countries	(WHO, 2017b)																				
2017	Accelerating nutrition improvements in Sub-Saharan Africa: scaling up nutrition interventions - final report 2012-2016	(WHO, 2017a)																				
2017	Accelerating nutrition improvements in Sub-Saharan Africa: strengthening nutrition surveillance - final report 2012 - 2016	(WHO, 2017c)																				
2017	Assessing and managing children at primary health-care facilities to prevent overweight and obesity in the context of the double burden of malnutrition - Updates for the integrated management of childhood illness (IMCI) - guideline	(WHO, 2017d)																				
2017	Capture the moment - early initiation of breastfeeding: the best start for every newborn	(WHO & UNICEF, 2018a)																				
2017	Clarification on the classification of follow-up formulas for children 6-36 months as breastmilk substitutes - information note	(WHO & UNICEF, 2018b)																				
2017	Double-duty actions for nutrition: policy brief	(WHO, 2017e)																				
2017	Enabling women to breastfeed through better policies and programmes: global breastfeeding scorecard 2018	(WHO & UNICEF, 2018c)																				
2017	Global Breastfeeding Collective: a call to action	(WHO & UNICEF, 2017a)																				
2017	Global nutrition monitoring framework: operational guidance for tracking progress in meeting targets for 2025	(WHO, 2017g)																				
2017	Global nutrition policy review 2016-2017 Country progress in creating enabling policy environments for promoting healthy diets and nutrition	(WHO, 2018c)																				

Table 0-1: WHO document contributing to the Historical nutrition landscape: per nutrition theme *(Continued)*

Year	WHO Nutrition document title	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary guidelines	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
2017	Guidance on ending the inappropriate promotion of foods for infants and young children - implementation manual	(WHO, 2017i)																				
2017	Guideline: counselling of women to improve breastfeeding practices	(WHO, 2018d)																				
2017	Healthy diet - fact sheet no. 394	(WHO, 2018g)																				
2017	HIV and infant feeding in emergencies: operational guidance	(WHO & UNICEF, 2017b)																				
2017	Infant and young child feeding in emergencies (version 3.0) - operational guidance for emergency relief staff and programme managers	(WHO *et al.*, 2017b)																				
2017	Iodine thyroid blocking	(WHO, 2017k)																				
2017	Iodine thyroid blocking - guidelines for use in planning and responding to radiological and nuclear emergencies	(WHO, 2017l)																				
2017	Marketing of breast-milk substitutes: national implementation of the international code - status report 2018	(WHO *et al.*, 2018)																				
2017	Monitoring the marketing of breast-milk substitutes: protocol for ongoing monitoring systems - NetCode toolkit	(WHO & UNICEF, 2017c)																				
2017	Monitoring the marketing of breast-milk substitutes: protocol for periodic assessment - NetCode toolkit	(WHO & UNICEF, 2017d)																				
2017	National implementation of the Baby-friendly Hospital Initiative 2017	(WHO, 2017m)																				
2017	Nurturing the health and wealth of nations: the investment case for breastfeeding - global breastfeeding collective - executive summary	(UNICEF *et al.*, 2017a)																				
2017	Nutrition challenge badge	(Convention on Biological Diversity (CBD) *et al.*, 2017)																				
2017	Nutritional anaemias: tools for effective prevention and control	(WHO, 2017n)																				
2017	Policy brief: Ensuring equitable access to human milk for all infants - a comprehensive approach to essential newborn care	(WHO *et al.*, 2017a)																				
2017	Preventive chemotherapy to control soil-transmitted helminth infections in at-risk population groups - guideline	(WHO, 2017o)																				
2017	Protecting, promoting and supporting breastfeeding in facilities providing maternity and newborn services - guideline	(WHO, 2017p)																				
2017	Protecting, promoting, and supporting breastfeeding in facilities providing maternity and newborn services: the revised Baby-friendly Hospital Initiative 2018 - implementation guidance	(WHO & UNICEF, 2018e)																				
2017	Strengthening nutrition action: a resource guide for countries based on the policy recommendations of the second International Conference on Nutrition (ICN2)	(WHO & FAO, 2018c)																				
2017	Sugars and dental caries - technical information note	(WHO, 2017q)																				
2017	Taking action on childhood obesity report	(WHO, 2018i)																				
2017	The double burden of malnutrition: policy brief	(WHO, 2017f)																				
2017	The International Code of Marketing of Breast-Milk Substitutes - 2017 update frequently asked questions	(WHO, 2017j)																				

Table 0-1: WHO document contributing to the Historical nutrition landscape: per nutrition theme *(Continued)*

Year	WHO Nutrition document title	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary guidelines	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
2017	The nutrition challenge: food system solutions	(WHO & FAO, 2018b)																				
2017	The state of food security and nutrition in the world 2017 - building resilience for peace and food security	(FAO *et al.*, 2017)																				
2017	The state of food security and nutrition in the world 2018 - building climate resilience for food security and nutrition	(FAO *et al.*, 2018)																				
2017	Tracking progress for breastfeeding policies and programmes: global breastfeeding scorecard 2017	(WHO & UNICEF, 2017e)																				
2017	UNICEF-WHO-The World Bank Group: Joint child malnutrition estimates - levels and trends in child malnutrition - key findings of the 2017 edition	(UNICEF *et al.*, 2016)																				
2017	UNICEF/WHO/The World Bank Group Joint child malnutrition estimates - levels and trends in child malnutrition - key findings of the 2018 edition	(UNICEF *et al.*, 2018)																				
2018	Developing and validating an iron and folic acid supplementation indicator for tracking progress towards global nutrition monitoring framework targets final report - June 2018	(WHO, 2018a)																				
2018	Driving commitment for nutrition within the UN Decade of Action on Nutrition Policy brief	(WHO & FAO, 2018a)																				
2018	Fortification of rice with vitamins and minerals in public health - guideline	(WHO, 2018b)																				
2018	Guideline: implementing effective actions for improving adolescent nutrition	(WHO, 2018e)																				
2018	HIV and infant feeding in emergencies: operational guidance - the duration of breastfeeding and support from health services to improve feeding practices among mothers living with HIV	(WHO & UNICEF, 2018d)																				
2018	Reducing stunting in children: equity considerations for achieving the global targets 2025	(WHO, 2018h)																				
2018	Weekly iron and folic acid supplementation as an anaemia-prevention strategy in women and adolescent girls - lessons learnt from implementation of programmes among non-pregnant women of reproductive age	(WHO, 2018j)																				
2018	WHO recommendation: calcium supplementation during pregnancy for prevention of pre-eclampsia and its complications	(WHO, 2018k)																				
2019	Advocacy brief: Breastfeeding and family-friendly policies Global breastfeeding collective	(WHO & UNICEF, 2019a)																				
2019	Advocacy brief: Breastfeeding and HIV - Global breastfeeding collective	(WHO & UNICEF, 2019b)																				
2019	Cross-promotion of infant formula and toddler milks Information note	(WHO, 2019a)																				
2019	Increasing commitment to breastfeeding through funding and improved policies and programmes: global breastfeeding scorecard 2019	(WHO & UNICEF, 2019c)																				
2019	Nutrition-related health products and the World Health Organization Model List of Essential Medicines – practical considerations and feasibility meeting report	(WHO, 2019b)																				
2019	Recommendations for data collection, analysis and reporting on anthropometric indicators in children under 5 years old	(WHO & UNICEF, 2019d)																				
2019	UNICEF-WHO Low birthweight estimates: levels and trends 2000–2015	(WHO & UNICEF, 2019e)																				

Table 0-1: WHO document contributing to the Historical nutrition landscape: per nutrition theme *(Continued)*

Year	WHO Nutrition document title	Reference	ANI	Adolescents	Country Assessment	Emergency and humanitarian crisis	Foetal Development	Food Labelling	Growth and development	HIV/AIDS	Infant and young child feeding	Nutrient requirements and dietary guidelines	Overweight and obesity	Food and nutrition policies	Nutrition and Pregnancy	Nutrition-friendly Schools	Food and Nutrition Security	Tuberculosis related topics	Undernutrition	Vitamins and Minerals	Nutrition and WASH	Other
2019	UNICEF/WHO/The World Bank Group Joint child malnutrition estimates - levels and trends in child malnutrition - key findings of the 2019 edition	(UNICEF *et al.*, 2019)																				

Table 0-2 (1) Accelerating nutrition improvements in Sub-Saharan Africa (ANI) - impact and reach of student publications on the scientific and public health communities

(1) Accelerating nutrition improvements in Sub-Saharan Africa (ANI)				Scientific community										Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact				
							3 years post-publication		All-time						
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc		3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,															
1998	Dietary intakes of Africans in transition in the North West province	Doc	(MacIntyre, 1998)	Not applicable	Int	Int	1	1	41	41				1	2
1998	Changes in risk factors of breast cancer in African women during urbanisation	Mast	(Burger, 1998)	Not applicable	0	0	0	Nat	2	2					
1998	The glycemic index of indigenous South African foods	Doc	(Mbhenyane, 1998)	Not applicable	0	0	0	0	0	0					
1999	The development and standardisation of a scale to measure food security	Mast	(Hanekom, 1999)	Not applicable	0	0	0	0	0	0					
1999	The puzzle of obesity in African women: contributing factors and associated risk factors.	Doc	(Kruger, 1999)	Not applicable	Nat	Int	1	1	4	4					
2000	Changes in levels of plasma fibrinogen and macromolecular protein complex among Africans in transition in the North-West Province of South Africa	Doc	(James, 2000)	Not applicable	0	0	0	0	0	0					
2000	The development and testing of a food portion photograph book for use in an African population.	Art	(Venter *et al.*, 2000)	Nutrition Dietetics	Int	Int	5	5	113	113	3.342	3.342			
2000	The effect of urbanisation on bone turnover in black postmenopausal women.	Mast	(Vorster, 2000)	Not applicable	0	0	0	0	0	0				1	1
2001	The metabolic syndrome, does it exist in Africans in transition in the North West Province?	Doc	(Kruger, 2001)	Not applicable	0	0	0	0	0	0					
2001	A culture-sensitive quantitative food frequency questionnaire used in an African population: 1. Development and reproducibility	Art	(MacIntyre *et al.*, 2001a)	Nutrition Dietetics	Int	Int	3	4	76	95	2.314	2.892			
2001	A culture-sensitive quantitative food frequency questionnaire used in an African population: 2. Relative validation by 7-day weighed records and biomarkers	Art	(MacIntyre *et al.*, 2001b)	Nutrition Dietetics	Int	Int	4	6	85	103	2.588	3.136			
2001	A combination of statistical methods for the analysis of the relative validation data of the quantitative food frequency questionnaire used in the THUSA study	Art	(MacIntyre *et al.*, 2001c)	Nutrition Dietetics	Nat	Int	0	1	54	54	1.644	1.644			
2001	The glycemic index of indigenous South African foods	Art	(Mbhenyane *et al.*, 2001)	Nutrition Dietetics	Int	Int	2	2	9	9	0.274	0.274			
2002	Dietary intakes of an African population in different stages of transition in the North West Province, South Africa: the THUSA study	Art	(MacIntyre *et al.*, 2002)	Nutrition Dietetics	Nat	Int	2	2	126	144	3.705	4.234		0	1
2003	Demographics and beliefs of consumers indicating preference for healthy food or dietary supplements	Mast	(Du Toit, 2003)	Not applicable	0	Nat	0	0	1	1					
2003	The effect of vitamin A status on the iron status of African females in the North West Province: the THUSA study	Doc	(Hanekom, 2003)	Not applicable	0	0	0	0	0	0					
2003	Development of a model for the monitoring and evaluation of nutrition and nutrition-related programmes in South Africa	Doc	(Wentzel-Viljoen, 2003)	Not applicable	0	Nat	0	0	3	3				0	2
2005	The association between black tea consumption and iron status of African women in the North West Province : THUSA study	Mast	(Muller, 2005)	Not applicable	0	0	0	0	0	0					
2006	Poverty and household food security of black South African farm workers: legacy of social inequalities.	Art	(Kruger *et al.*, 2006a)	Nutrition Dietetics	Int	Int	7	8	43	46	1.220	1.305			
2006	The determinants of overweight and obesity among 10- to 15- year-old schoolchildren in the North West Province, South Africa – the THUSA BANA (Transition and Health during Urbanisation of South Africans; BANA, children) study.	Art	(Kruger *et al.*, 2006b)	Nutrition Dietetics	Int	Int	11	12	166	176	4.709	4.992			
2010	Relationships of alcohol intake with biological health outcomes in an African population in transition: the Transition and Health during Urbanisation in South Africa (THUSA) study	Art	(Gopane *et al.*, 2010)	Nutrition Dietetics	Nat	Nat	4	6	5	9	0.223	0.402		0	1
2008	The association between specific genetic, demographic and lifestyle factors related to homocysteine concentrations in black South Africans undergoing an epidemiological transition	Doc	(Nienaber, 2010)	Not applicable	0	0	0	0	0	0					

Table 0-2 (1) Accelerating nutrition improvements in Sub-Saharan Africa (ANI) - impact and reach of student publications on the scientific and public health communities

(Continued)

(1) Accelerating nutrition improvements in Sub-Saharan Africa (ANI)				Scientific community									Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact			
							3 years post-publication		All-time					
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc	3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,														
2008	Associations between biological alcohol consumption markers, reported alcohol intakes, and biological health outcomes in an African population in transition.	Doc	(Pisa, 2008)	Not applicable	Int	Int	0	1	0	2				
2008	Micronutrient dilution associated with alcohol and added sugar intake in the THUSA population	Mast	(Serfontein, 2008)	Not applicable	0	0	0	0	0	0				
2009	The validity of a short questionnaire on Iron intake and Iron status in humans	Doc	(Kunneke, 2009)	Not applicable	0	0	0	0	0	0				
2010	The association between alcohol consumption, PAI-1 activity and fibrinogen concentration in black South Africans	Mast	(De Lange, 2010)	Not applicable	0	0	0	0	0	0				
2010	Triglyceride concentration and waist circumference influence alcohol-related plasminogen activator inhibitor-1 activity increase in black South Africans.	Art	(Pieters *et al.*, 2010)	Nutrition Dietetics	Int	Int	2	3	6	8	0.268	0.357		
2010	Dietary fat intake and blood lipid profiles of South African communities in transition in the North–West Province : the PURE study	Mast	(Richter, 2010)	Not applicable	0	0	0	0	0	0				
2010	Alcohol intake and micronutrient density in a population in transition: the transition and health during urbanisation in South Africa (THUSA) study	Art	(Serfontein *et al.*, 2010)	Nutrition Dietetics	Nat	Int	1	1	5	5	0.223	0.223		
2011	The social drift phenomenon : associations between the socio–economic status and cardiovascular disease risk in an African population undergoing a health transition	Mast	(Behanan, 2011)	Not applicable	0	0	0	0	0	0				
2011	The relevance of glycosylated haemoglobin in screening for non–insulin dependent diabetes mellitus in a black South African population	Mast	(Pieterse, 2011)	Not applicable	0	0	0	0	0	0				
2012	Plasma clot lysis time and its association with cardiovascular risk factors in black South Africans	Art	(De Lange *et al.*, 2012)	Multidisciplinary sciences	Int	Int	4	7	8	15	0.590	1.105		
2012	Measuring micronutrient intakes at different levels of sugar consumption in a population in transition: the Transition and Health during Urbanisation in South Africa (THUSA) study.	Art	(MacIntyre *et al.*, 2012)	Nutrition Dietetics	Int	Int	3	4	14	14	0.675	0.675		
2012	Social drift of cardiovascular disease risk factors in Africans from the North West Province of South Africa: the PURE study	Art	(Pisa *et al.*, 2012)	Cardiac Cardiovascular Systems	Int	Int	6	7	24	30	2.154	2.692		
2013	Global fibrinolytic potential of black South Africans in the North West Province	Doc	(De Lange, 2013)	Not applicable	0	0	0	0	0	0				
2013	In black South Africans from rural and urban communities, the 4G/5G PAI-1 polymorphism influences PAI-1 activity, but not plasma clot lysis time	Art	(De Lange *et al.*, 2013)	Multidisciplinary sciences	Int	Int	1	1	4	7	0.281	0.492		
2013	The role of diet in cardiovascular disease in black South Africans : both sides of the story	Doc	(Dolman, 2013)	Not applicable	0	0	0	0	0	0				
2013	Lifestyle risk factors and bone mineral density of urban postmenopausal women in the North West Province	Mast	(Ellis, 2013)	Not applicable	0	0	0	0	0	0				
2013	Gene–environment and gene–gene interactions of specific MTHFR, MTR and CBS gene variants in relation to homocysteine in black South Africans.	Art	(Nienaber-Rousseau *et al.*, 2013a)	Genetics Heredity	Int	Int	15	16	28	30	1.282	1.373		
2013	Nutritional genetics: the case of alcohol and the MTHFR C677T polymorphism in relation to homocysteine in a black South African population.	Art	(Nienaber-Rousseau *et al.*, 2013b)	Nutrition Dietetics	Int	Int	4	5	7	8	0.522	0.597		
2013	The relevance of specific c-reactive protein genetic variants towards cardiovascular disease risk in a black South African population undergoing an epidemiological transition	Mast	(Swanepoel, 2013)	Not applicable	Nat	Nat	0	1	0	1				
2013	Studies since 2005 on South African primary schoolchildren suggest lower anaemia prevalence in some regions	Art	(Taljaard *et al.*, 2013)	Nutrition Dietetics	Nat	Int	3	3	7	9	0.522	0.672		
2013	The association of LDLR and PCSK9 variants with LDL-c levels in a black South African population in epidemiological transition	Doc	(Van Zyl, 2013)	Not applicable	0	0	0	0	0	0				

Table 0-2 (1) Accelerating nutrition improvements in Sub-Saharan Africa (ANI) - impact and reach of student publications on the scientific and public health communities

(Continued)

(1) Accelerating nutrition improvements in Sub-Saharan Africa (ANI)				Scientific community										Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact			
							3 years post-publication		All-time					
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc	3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,														
2014	Evaluation of common genetic variants associated with type 2 diabetes susceptibility in a black South African population	Mast	(Chikowore, 2014)	Not applicable	0	0	0	0	0	0				
2014	The use of predefined diet quality scores in the context of CVD risk during urbanization in the South African Prospective Urban and Rural Epidemiological (PURE) study	Art	(Dolman *et al.*, 2014)	Public Environmental Occupational Health	Int	Int	2	5	8	11	0.812	1.116		
2014	A strategy for scaling up vitamin A supplementation for young children in a remote rural setting in Zimbabwe.	Art	(Dube *et al.*, 2014)	Nutrition Dietetics	0	0	0	0	0	0	0.000	0.000		
2014	The influence of genetic polymorphisms of fibrinogen genes on changes in total fibrinogen and fibrinogen gamma prime concentrations over time in black South Africans	Mast	(Jobse, 2014)	Not applicable	0	0	0	0	0	0				
2014	Fibrinogen functionality in black South Africans: the PURE study	Doc	(Kotzé, 2014)	Not applicable	0	0	0	0	0	0				
2014	Associations between specific ApoE genetic variants and their interactions with environmental factors in relation to the lipid profile of black South Africans	Mast	(Meades, 2014)	Not applicable	0	0	0	0	0	0				
2014	Different dietary fatty acids are associated with blood lipids in healthy South African men and women: The PURE study	Art	(Richter *et al.*, 2014)	Nutrition Dietetics	Int	Int	3	4	7	10	0.446	0.638		
2014	Body composition, bone health and vitamin D status of African adults in the North West Province	Doc	(Sotunde, 2014)	Not applicable	0	0	0	0	0	0				
2014	Common and rare single nucleotide polymorphisms in the LDLR gene are present in a black South African population and associate with low-density lipoprotein cholesterol levels	Art	(Van Zyl *et al.*, 2014)	Genetics Heredity	Int	Int	4	4	7	8	0.417	0.477		
2015	Common variants associated with type 2 diabetes in a Black South African population of Setswana descent: African populations diverge	Art	(Chikowore *et al.*, 2015)	Genetics Heredity	Int	Int	4	5	4	5	0.318	0.397		
2015	Associations between specific measures of adiposity and high blood pressure in black South African women	Mast	(Doubell, 2015)	Not applicable	0	0	0	0	0	0				
2015	UNICEF Training Package for Scaling Up Skilled Community Infant and Young Child Feeding Counselors: Zimbabwe Experience	Art	(Dube *et al.*, 2015)	Nutrition Dietetics	0	0	0	0	0	0	0.000	0.000		
2015	The contribution of genetic and environmental factors to changes in total and γ' fibrinogen over 5 years.	Art	(Jobse *et al.*, 2015)	Nutrition Dietetics	Int	Int	1	2	1	2	0.091	0.182		
2015	Genetic polymorphisms influencing total and γ' fibrinogen levels and fibrin clot properties in Africans	Art	(Kotzé *et al.*, 2015)	Nutrition Dietetics	Int	Int	4	7	5	9	0.454	0.817		
2015	Association of Alcohol Consumption with Specific Biomarkers: A Cross-sectional Study in South Africa.	Art	(Pisa *et al.*, 2015)	Public Environmental Occupational Health	Int	Int	4	4	8	8	1.113	1.113		
2016	Genetic and dietary determinants of type 2 diabetes in a black South African population	Doc	(Chikowore, 2016)	Not applicable	0	0	0	0	0	0				
2016	Predictive utility of a genetic risk score of common variants associated with type 2 diabetes in a black South African population	Art	(Chikowore *et al.*, 2016)	EnDocrinology Matabolism	Int	Int	2	2	2	2	0.300	0.300		
2016	Genotypic exploration of the fibrinogen phenotype in a black South African population	Mast	(Cronjé, 2016)	Not applicable	0	0	0	0	0	0				
2016	Sodium and potassium intake in South Africa: an evaluation of 24-hour urine collections in a white, black, and Indian population	Art	(Swanepoel *et al.*, 2016)	Nutrition Dietetics	Int	Int	7	17	9	20	0.998	2.217		
2017	Nutrient patterns associated with fasting glucose and glycated haemoglobin levels in a black South African population	Art	(Chikowore *et al.*, 2017)	Nutrition Dietetics	Int	Int	5	6	5	6	0.996	1.196		
2017	Adherence challenges encountered in an intervention programme to combat chronic noncommunicable diseases in an urban black community, Cape Town	Art	(Solomons *et al.*, 2017)	Health Care Sciences Services	Int	Int	2	2	2	2	0.873	0.873		

Table 0-2 (1) Accelerating nutrition improvements in Sub-Saharan Africa (ANI) - impact and reach of student publications on the scientific and public health communities

(Continued)

(1) Accelerating nutrition improvements in Sub-Saharan Africa (ANI)				Scientific community										Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact				
							3 years post-publication		All-time						
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc		3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,															
2017	Sodium intake in South Africa: an analysis of food supply, 24-hour excretion and blood pressure in a tri-ethnic population	Doc	(Swanepoel, 2017)	Not applicable	0	0	0	0	0	0					
2018	Dietary intake practices of adults with intellectual disability in a controlled care centre environment	Mast	(Dreyer, 2018)	Not applicable	0	0	0	0	0	0					
2018	Dietary intake of the African-PREDICT study population	Mast	(Jordaan, 2018)	Not applicable	0	0	0	0	0	0					
2018	The relationship between blood lipids, fatty acids and plasma clot properties in black South Africans	Mast	(Kahler, 2018)	Not applicable	0	0	0	0	0	0					
2018	Utilisation of traditional and indigenous foods and potential contribution to consumers' nutrition and vendors' income in Botswana	Doc	(Kasimba, 2018)	Not applicable	0	0	0	0	0	0					
2018	Household access to traditional and indigenous foods positively associated with food security and dietary diversity in Botswana	Art	(Kasimba *et al.*, 2018)	Nutrition Dietetics	Int	Int	0	1	1	2	0.382	0.764			
2018	Interactions of CRP-SNPs with selected contributing factors in determining CRP concentrations in black South Africans	Doc	(Myburgh, 2018)	Not applicable	0	0	0	0	0	0					
2018	Challenges with implementation of nutrition interventions aimed at non-communicable diseases among black urban South Africans	Doc	(Solomons, 2018)	Not applicable	0	0	0	0	0	0					
2018	Association between dietary adherence anthropometric measurements and blood pressure in an urban black population South Africa	Art	(Solomons *et al.*, 2018)	Nutrition Dietetics	0	0	0	0	0	0	0.000	0.000			
2019	Consumption of traditional and indigenous foods and their contribution to nutrient intake among children and women in Botswana	Art	(Kasimba *et al.*, 2019)	Nutrition Dietetics	0	0	0	0	0	0	0.000	0.000			
2019	Contribution of commercial infant products and fortified staple foods to nutrient intake at ages 6, 12, and 18 months in a cohort of children from a low socio-economic community in South Africa	Art	(Swanepoel *et al.*, 2019)	Nutrition Dietetics	0	0	0	0	0	0	0.000	0.000			
Number of articles equal to or exceeding the average expected citation counts for this theme:											n=10	n=14			

ANNEXURE | Table 0-2 | Table 0-3 | Table 0-4 | Table 0-5 | Table 0-6 | Table 0-7 | Table 0-8 | Table 0-9 | Table 0-10 | Table 0-11 | Table 0-12 | Table 0-13 | Table 0-14 | Table 0-15 | Table 0-16 | Table 0-17

Table 0-3: (2) Adolescence - impact and reach of student publications on the scientific and public health communities

(2) Adolescence				Scientific community									Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact			
							3 years post-publication		All-time					
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc	3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,														
2001	The impact of vitamin A fortified sugar on the nutritional status and intakes of 13 - 25 years females in the Vaal Triangle	Mast	(Selepe, 2001)	Not applicable	0	0	0	0	0	0				
2003	The determinants of overweight among 10-15 year old schoolchildren in the North West Province	Doc	(Kruger, 2003)	Not applicable	0	Nat	0	0	1	1				
2003	The association between stunting and overweight among 10-15 year old children in the North West Province	Mast	(Mukuddem-Petersen, 2003)	Not applicable	0	0	0	0	0	0				
2004	Association between stunting and overweight among 10–15-y-old children in the North West Province of South Africa: the THUSA BANA Study	Art	(Mukuddem-Petersen & Kruger, 2004)	Nutrition Dietetics	Int	Int	7	9	81	89	2.499	2.746		
2005	Energy expenditure, dietary intake and nutritional knowledge of elite, school-aged gymnasts	Mast	(Joubert, 2005)	Not applicable	0	Int	0	0	2	2				
2005	Eating habits and nutrient intakes of 10-15 year old children in the North West Province	Mast	(Rossouw, 2005)	Not applicable	0	Nat	0	0	1	1				
2006	Haemostatic variables in African adolescents : the PLAY study	Mast	(Nienaber, 2006)	Not applicable	0	Nat	0	0	1	1				
2006	The determinants of overweight and obesity among 10- to 15- year-old schoolchildren in the North West Province, South Africa – the THUSA BANA (Transition and Health during Urbanisation of South Africans; BANA, children) study.	Art	(Kruger *et al.*, 2006)	Nutrition Dietetics	Int	Int	11	12	166	176	4.709	4.992		
2006	Body composition and systematic low-grade inflammation in children : the PLAY study	Mast	(Pretorius, 2006)	Not applicable	0	0	0	0	0	0				
2008	Overfatness, stunting and physical inactivity are determinants of plasminogen activator inhibitor-1activity, fibrinogen and thrombin – antithrombin complex in African adolescents.	Art	(Nienaber *et al.*, 2008)	Hematology	Int	Int	3	4	13	14	0.779	0.839		
2008	The validity and reproducibility of the 24–hour recall dietary assessment method amongst adolescents in North–West Province, South Africa	Doc	(Rankin, 2008)	Not applicable	0	Nat	0	0	1	1				
2009	The effects of highly active antiretroviral therapy on body composition in children 3 to 16 years old	Mast	(Jooste, 2009)	Not applicable	0	0	0	0	0	0				
2010	Stunting, adiposity and low-grade inflammation in African adolescents from a township high school.	Art	(Kruger *et al.*, 2010)	Nutrition Dietetics	Int	Int	6	6	25	26	1.116	1.161		
2010	Comparison of waist circumference distribution of South African black children from different study populations	Doc	(Motswagole, 2010)	Not applicable	0	0	0	0	0	0				
2010	Dietary assessment methodology for adolescents: a review of reproducibility and validation studies.	Art	(Rankin *et al.*, 2010)	Nutrition Dietetics	Int	Int	4	5	20	21	0.893	0.938		
2011	The sensitivity of waist-to-height ratio in identifying children with high blood pressure	Art	(Motswagole *et al.*, 2011)	Cardiac Cardiovascular Systems	Int	Int	10	11	29	31	2.380	2.544		
2011	Dietary intakes assessed by 24-hrecalls in peri-urban African adolescents: validity of energy intake compared with estimated energy expenditure.	Art	(Rankin *et al.*, 2011)	Nutrition Dietetics	Nat	Int	2	3	6	7	0.313	0.365		
2012	Body composition in stunted, compared to non-stunted, black South African children, from two rural communities.	Art	(Motswagole *et al.*, 2012)	Nutrition Dietetics	Int	Int	2	2	2	2	0.096	0.096		
2012	Reproducibility of two, three, four and five 24-hour recalls in peri-urban African adolescents in the North West province.	Art	(Rankin *et al.*, 2012)	Nutrition Dietetics	0	0	0	0	0	0	0.000	0.000		
2014	The intake and quality of breakfast consumption among adolescents attending public secondary schools in Potchefstroom	Mast	(Tee, 2014)	Not applicable	Nat	Int	1	1	6	6				
2015	The intake and quality of breakfast consumption in adolescents attending public secondary schools in the North West province, South Africa	Art	(Tee *et al.*, 2015)	Nutrition Dietetics	Nat	Int	3	3	6	6	0.545	0.545		
2019	Consumption of traditional and indigenous foods and their contribution to nutrient intake among children and women in Botswana	Art	(Kasimba *et al.*, 2019)	Nutrition Dietetics	0	0	0	0	0	0	0.000	0.000		
2019	Waist circumference percentiles of black South African children aged 10-14 years from different study sites	Art	(Motswagole *et al.*, 2019)	Pediatrics	0	0	0	0	0	0	0.000	0.000		
Number of articles equal to or exceeding the average expected citation counts for this theme:											n=4	n=4		

Annexure | Table 0-2 | Table 0-3 | Table 0-4 | Table 0-5 | Table 0-6 | Table 0-7 | Table 0-8 | Table 0-9 | Table 0-10 | Table 0-11 | Table 0-12 | Table 0-13 | Table 0-14 | Table 0-15 | Table 0-16 | Table 0-17

Table 0-4: (5) Foetal development - impact and reach of student publications on the scientific and public health communities

(5) Foetal development			Scientific community									Government documents Citation count	
			Normalisation category	Publication reach		Citation counts				Impact			
						3 years post-publication		All-time					
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc	3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,														
2018	Effects of pre-and postnatal iron and n-3 fatty acid depletion, alone and in combination, on bone development in rats	Mast	(Strydom, 2018)	Not applicable	0	0	0	0	0	0				
Number of articles equal to or exceeding the average expected citation counts for this theme:											n=0	n=0		

Annexure | Table 0-2 | Table 0-3 | Table 0-4 | Table 0-5 | Table 0-6 | Table 0-7 | Table 0-8 | Table 0-9 | Table 0-10 | Table 0-11 | Table 0-12 | Table 0-13 | Table 0-14 | Table 0-15 | Table 0-16 | Table 0-17

Table 0-5: (6) Food labelling - impact and reach of student publications on the scientific and public health communities

(6) Food labelling			Scientific community									Government documents Citation count	
			Normalisation category	Publication reach		Citation counts				Impact			
						3 years post-publication		All-time					
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc	3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,														
2004	Beliefs and practices related to label reading and its implications for functional foods in South Africa	Mast	(Badham, 2004)	Not applicable	0	Nat	0	0	1	1				
2012	A critical analysis of the labels of processed complementary foods for infants and young children in South Africa against international marketing guidelines	Mast	(Sweet, 2012)	Not applicable	0	Int	0	0	0	1				
2013	Field-testing of guidance on the appropriate labelling of processed complementary foods for infants and young children in South Africa	Art	(Sweet *et al.*, 2013)	Nutrition Dietetics	Int	Int	5	5	9	12	0.672	0.895		
2014	South African adult metropolitan consumer's opinions and use of health information on Food Labels.	Art	(Bosman *et al.*, 2014)	Food Science Technology	Int	Int	8	10	24	26	2.031	2.200		
2015	Branding and cArtoon character usage in food marketing to children : the South African picture	Mast	(Delport, 2015)	Not applicable	Int	Int	1	1	1	1				
2015	Monitoring the reduction of sodium content of selected food items using label information in South Africa	Mast	(Hattingh, 2015)	Not applicable	0	0	0	0	0	0				
2018	Consumers' attitudes regarding the use of the salt information on food labels	Mast	(Van Staden, 2018)	Not applicable	0	0	0	0	0	0				
Number of articles equal to or exceeding the average expected citation counts for this theme:											n=1	n=1		

Annexure | Table 0-2 | Table 0-3 | Table 0-4 | Table 0-5 | Table 0-6 | Table 0-7 | Table 0-8 | Table 0-9 | Table 0-10 | Table 0-11 | Table 0-12 | Table 0-13 | Table 0-14 | Table 0-15 | Table 0-16 | Table 0-17

Table 0-6: (7) Growth and development - impact and reach of student publications on the scientific and public health communities

(7) Growth and development				Scientific community										Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact			
							3 years post-publication		All-time					
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc	3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,														
1999	Breastfeeding practices in Potchefstroom Hospital according to the babyfriendly hospital initiative.	Mast	(Waanders, 1999)	Not applicable	0	0	0	0	0	0				
2003	A comparison between the effects of black tea and rooibos on the iron status of primary school children	Mast	(Breet, 2003)	Not applicable	0	0	0	0	0	0				
2003	The effectiveness of micronutrient fortification of maize meal in improving the nutritional status of children	Doc	(Nesamvuni, 2003)	Not applicable	0	0	0	0	0	0				
2004	Association between stunting and overweight among 10–15-y-old children in the North West Province of South Africa: the THUSA BANA Study	Art	(Mukuddem-Petersen & Kruger, 2004)	Nutrition Dietetics	Int	Int	7	9	81	89	2.499	2.746		
2005	Fortification of maize meal improved nutritional status of 1-3 year old African children.	Art	(Nesamvuni *et al.*, 2005)	Nutrition Dietetics	Nat	Int	5	5	36	37	1.146	1.178		
2006	Body composition, physical activity and C-reactive protein in children : the PLAY study	Mast	(Harmse, 2006)	Not applicable	0	0	0	0	0	0				
2009	The effects of highly active antiretroviral therapy on body composition in children 3 to 16 years old	Mast	(Jooste, 2009)	Not applicable	0	0	0	0	0	0				
2009	Factors associated with nutritional status of children aged 0-60 months residing in Eastern Cape and KwaZulu-Natal provinces	Mast	(Lesiapeto, 2009)	Not applicable	0	Int	0	0	5	5				
2009	Testing the preliminary paediatric food-based dietary guidelines amongst Xhosa- and Zulu-speaking mothers/caregivers of children aged 1-7 years	Mast	(van Zyl, 2009)	Not applicable	0	0	0	0	0	0				
2010	Significant differences between serum CRP levels in children in different categories of physical activity: the PLAY study	Art	(Harmse & Kruger, 2010)	Nutrition Dietetics	Int	Int	7	8	17	18	0.759	0.804		
2010	The use of a musical play in the transfer of knowledge on nutrition, a healthy lifestyle and the prevention of obesity	Mast	(Kruger, 2010)	Not applicable	0	0	0	0	0	0				
2010	Risk factors of poor anthropometric status in children under five years of age living in rural districts of the Eastern Cape and KwaZulu-Natal provinces, South Africa	Art	(Lesiapeto *et al.*, 2010)	Nutrition Dietetics	Int	Int	1	1	32	32	1.429	1.429	0	2
2011	Effects of iron and omega–3 fatty acid supplementation on physical activity of iron deficient primary school children residing in KwaZulu–Natal	Mast	(Greeff, 2011)	Not applicable	0	0	0	0	0	0				
2011	Iron status, anthropometric status and cognitive performance of black African school children aged 6-11 years in the Klerksdorp area	Mast	(Taljaard, 2011)	Not applicable	Nat	Int	0	1	1	2				
2012	The role of attitude and barriers on the implementation of a nutrition intervention in primary school children	Mast	(Harris, 2012)	Not applicable	0	Nat	0	0	1	1				
2012	Body composition in stunted, compared to non-stunted, black South African children, from two rural communities.	Art	(Motswagole *et al.*, 2012)	Nutrition Dietetics	Int	Int	2	2	2	2	0.096	0.096		
2012	Potential contribution of African leafy vegetables to the nutritional status of children	Mast	(Osei, 2012)	Not applicable	0	Int	0	0	1	1				
2012	Effect of a micronutrient–fortified beverage on cognition and nutritional status of primary school children	Doc	(Taljaard, 2012)	Not applicable	0	0	0	0	0	0				
2013	Fatty acid status and dietary intake of children and their caregivers from three distinct communities	Mast	(Ford, 2013)	Not applicable	0	0	0	0	0	0				
2013	Effects of a multi-micronutrient-fortified beverage, with and without sugar, on growth and cognition in South African schoolchildren: a randomised, double-blind, controlled intervention	Art	(Taljaard *et al.*, 2013)	Nutrition Dietetics	Int	Int	7	8	20	25	1.492	1.865		
2014	A critical analysis of iron status indicators in three independent studies of South African primary school children	Mast	(Harris, 2014)	Not applicable	0	0	0	0	0	0				
2014	Iron status, inflammation and anthropometric nutritional status of four–to–thirteen month old black infants from a rural South African population	Mast	(Nel, 2014)	Not applicable	0	0	0	0	0	0				
2014	The intake and quality of breakfast consumption among adolescents attending public secondary schools in Potchefstroom	Mast	(Tee, 2014)	Not applicable	Nat	Int	1	1	6	6				
2015	UNICEF Training Package for Scaling Up Skilled Community Infant and Young Child Feeding Counselors: Zimbabwe Experience	Art	(Dube *et al.*, 2015)	Nutrition Dietetics	0	0	0	0	0	0	0.000	0.000		

Table 0-6: (7) Growth and development - impact and reach of student publications on the scientific and public health communities

(Continued)

(7) Growth and development				Scientific community										Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact				
							3 years post-publication		All-time						
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc		3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,															
2015	Nutritional status, feeding practices and motor development of 6-month-old infants	Doc	(Rothman, 2015)	Not applicable	Int	Int	0	1	0	3					
2015	The intake and quality of breakfast consumption in adolescents attending public secondary schools in the North West province, South Africa	Art	(Tee *et al.*, 2015)	Nutrition Dietetics	Nat	Int	3	3	6	6	0.545	0.545			
2016	Effects of zinc fortification on the plasma fatty acid composition of Beninese school children : a randomised, double-blind controlled trial	Mast	(Chimhasha, 2016)	Not applicable	0	0	0	0	0	0					
2016	Dietary fat intake and red blood cell fatty acid composition of children and women from three different geographical areas in South Africa.	Art	(Ford *et al.*, 2016)	Nutrition Dietetics	Int	Int	6	6	7	7	0.776	0.776			
2016	Nutrition-related concerns of the primary caregiver regarding children with spastic cerebral palsy	Mast	(Lourens, 2016)	Not applicable	0	0	0	0	0	0					
2016	Breast-milk iodine concentrations, iodine status, and thyroid function of breastfed infants aged 2-4 months and their mothers residing in a South African township	Art	(Osei *et al.*, 2016)	EnDocrinology Metabolism	Int	Int	12	12	11	13	1.647	1.947			
2017	Efficacy of lipid nutrient supplements on growth and micronutrient status in infants	Doc	(Matsungo, 2017)	Not applicable	0	0	0	0	0	0					
2017	The prevalence and factors associated with stunting among infants aged 6 months in a peri-urban South African community	Art	(Matsungo *et al.*, 2017a)	Nutrition Dietetics	Int	Int	0	2	0	2	0.000	0.399			
2017	Lipid-based nutrient supplements and linear growth in children under 2 years: A review	Art	(Matsungo *et al.*, 2017b)	Nutrition Dietetics	Int	Int	6	7	6	7	1.196	1.395			
2017	Iodine status and associations with feeding practices and psychomotor milestone development in six-month-old South African infants	Art	(Osei *et al.*, 2017)	Nutrition Dietetics	Int	Int	4	6	4	6	0.797	1.196			
2018	Sensitivity of fatty acid desaturation and elongation to plasma zinc concentration: A randomised controlled trial in Beninese children	Art	(Chimhashu *et al.*, 2018)	Nutrition Dietetics	Int	Int	2	2	2	2	0.764	0.764			
2018	Sodium content of processed foods frequently consumed by children in early childhood development centres in the North-West Province	Mast	(Korff, 2018)	Not applicable	0	0	0	0	0	0					
2018	Infant Development at the Age of 6 Months in Relation to Feeding Practices, Iron Status, and Growth in a Peri-Urban Community of South Africa	Art	(Rothman *et al.*, 2018)	Nutrition Dietetics	Int	Int	1	2	1	2	0.382	0.764			
2018	Long-chain polyunsaturated fatty acid nutrition in breastfed and complementary fed South African infants	Doc	(Siziba, 2018)	Not applicable	0	0	0	0	0	0					
2018	Associations of plasma total phospholipid fatty acid patterns with feeding practices, growth, and psychomotor development in 6-month-old South African infants	Art	(Siziba *et al.*, 2018)	Nutrition Dietetics	0	0	0	0	0	0	0.000	0.000			
2018	Effects of pre-and postnatal iron and n-3 fatty acid depletion, alone and in combination, on bone development in rats	Mast	(Strydom, 2018)	Not applicable	0	0	0	0	0	0					
2018	Dietary intake of infants followed from age 6 to 18 months from a low socio-economic peri-urban community	Mast	(Swanepoel, 2018)	Not applicable	0	0	0	0	0	0					
2019	Effect of small-quantity lipid-based nutrient supplements on growth, psychomotor development, iron status, and morbidity among 6-to 12-mo-old infants in South Africa: a randomized controlled trial.	Art	(Smuts *et al.*, 2019)	Nutrition Dietetics	Int	Int	2	3	2	3	3.449	5.173			
2019	Contribution of commercial infant products and fortified staple foods to nutrient intake at ages 6, 12, and 18 months in a cohort of children from a low socio-economic community in South Africa	Art	(Swanepoel *et al.*, 2019)	Nutrition Dietetics	0	0	0	0	0	0	0.000	0.000			
Number of articles equal to or exceeding the average expected citation counts for this theme:											n=7	n=8			

Annexure | Table 0-2 | Table 0-3 | Table 0-4 | Table 0-5 | Table 0-6 | Table 0-7 | Table 0-8 | Table 0-9 | Table 0-10 | Table 0-11 | Table 0-12 | Table 0-13 | Table 0-14 | Table 0-15 | Table 0-16 | Table 0-17

Table 0-7: (8) HIV/AIDS - impact and reach of student publications on the scientific and public health communities

(8) HIV/AIDS				Scientific community										Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact			
							3 years post-publication		All-time					
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc		
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,													3 years	All-time
1998	Plasma fibrinogen of black South Africans: the BRISK study	Art	(Vorster *et al.*, 1998)	Nutrition Dietetics	Int	Int	1	3	15	20	0.525	0.700		
2001	Die effek van mikronutriëntsupplementasie op merkers van verworwe immuniteitsgebreksindroom	Mast	(Dercksen, 2001)	Not applicable	0	0	0	0	0	0				
2001	Evaluation of the effects of an instant soy and maize meal supplement on the vitamin A status of patients infected with the human immune deficient virus.	Mast	(Hanson, 2001)	Not applicable	0	0	0	0	0	0				
2001	Die effek van 'n dieetsupplement op die lipiedprofiele van MIV-positiewe pasiënte in die Noordwes Provinsie	Mast	(Labuschagne, 2001)	Not applicable	0	0	0	0	0	0				
2001	Acceptability of an instant soy maize porridge by HIV-positive and -negative consumers	Mast	(Mooko, 2001)	Not applicable	0	0	0	0	0	0				
2001	Die ysterstatus van pasiënte met menslike immuniteitsgebreksvirus voor en na mikronitriëntsupplemenering	Mast	(Steyn, 2001)	Not applicable	0	0	0	0	0	0				
2006	Professional nurses' perceptions of their ability to render effective nutritional care and support to people living with HIV/AIDS	Mast	(Chasauka, 2006)	Not applicable	0	0	0	0	0	0				
2006	Polyunsaturated fatty acid intake is adversely related to liver function in HIV-infected subjects: the THUSA study.	Art	(Oosthuizen *et al.*, 2006)	Nutrition Dietetics	Int	Int	2	3	13	15	0.369	0.425		
2007	What is the optimum diet for asymptomatic HIV-infected people (AHIV)? : a public health approach	Doc	(Van Graan, 2007)	Not applicable	0	0	0	0	0	0				
2009	The effects of highly active antiretroviral therapy on body composition in children 3 to 16 years old	Mast	(Jooste, 2009)	Not applicable	0	0	0	0	0	0				
2010	Factors affecting mothers' choice of breastfeeding vs. formula feeding in the lower Umfolozi district war memorial hospital, KwaZulu-Natal.	Art	(Swarts *et al.*, 2010)	Nutrition Dietetics	Int	Int	1	1	21	21	0.938	0.938		
2016	The comparison of antenatal education, breastfeeding knowledge and neonatal positioning and attachment of HIV reactive and HIV non-reactive primgravidae	Mast	(Greyvenstein, 2016)	Not applicable	0	0	0	0	0	0				
2018	Comparison of weight gain to age-and sex-specific norms in children 2 to 10 years old on highly active anti-retroviral treatment	Mast	(Scholtz, 2018)	Not applicable	Nat	Nat	1	1	1	1				
Number of articles equal to or exceeding the average expected citation counts for this theme:											n=0	n=0		

Annexure | Table 0-2 | Table 0-3 | Table 0-4 | Table 0-5 | Table 0-6 | Table 0-7 | Table 0-8 | Table 0-9 | Table 0-10 | Table 0-11 | Table 0-12 | Table 0-13 | Table 0-14 | Table 0-15 | Table 0-16 | Table 0-17

Table 0-8: (9) Infant and young child feeding - impact and reach of student publications on the scientific and public health communities

(9) Infant and young child feeding				Scientific community										Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact				
							3 years post-publication		All-time						
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc		3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,															
1999	Breastfeeding practices in Potchefstroom Hospital according to the babyfriendly hospital initiative.	Mast	(Waanders, 1999)	Not applicable	0	0	0	0	0	0					
2005	Actions of black tea and Rooibos on iron status of primary school children.	Art	(Breet *et al.*, 2005)	Nutrition Dietetics	0	Int	0	0	19	20	0.605	0.637			
2005	Fortification of maize meal improved nutritional status of 1-3 year old African children.	Art	(Nesamvuni *et al.*, 2005)	Nutrition Dietetics	Nat	Int	5	5	36	37	1.146	1.178			
2006	Body composition, physical activity and C-reactive protein in children : the PLAY study	Mast	(Harmse, 2006)	Not applicable	0	0	0	0	0	0					
2008	Factors affecting mothers' choice of infant feeding method	Mast	(Schoonwinkel, 2008)	Not applicable	0	0	0	0	0	0					
2009	Factors associated with nutritional status of children aged 0-60 months residing in Eastern Cape and KwaZulu-Natal provinces	Mast	(Lesiapeto, 2009)	Not applicable	0	Int	0	0	5	5					
2009	The feasibility of implementing a point-of-use micronutrient fortification among African pre-school children : a pilot study.	Mast	(Ogunlade, 2009)	Not applicable	0	0	0	0	0	0					
2009	Testing the preliminary paediatric food-based dietary guidelines amongst Xhosa- and Zulu-speaking mothers/caregivers of children aged 1-7 years	Mast	(van Zyl, 2009)	Not applicable	0	0	0	0	0	0					
2010	Significant differences between serum CRP levels in children in different categories of physical activity: the PLAY study	Art	(Harmse & Kruger, 2010)	Nutrition Dietetics	Int	Int	7	8	17	18	0.759	0.804			
2010	Risk factors of poor anthropometric status in children under five years of age living in rural districts of the Eastern Cape and KwaZulu-Natal provinces, South Africa	Art	(Lesiapeto *et al.*, 2010)	Nutrition Dietetics	Int	Int	1	1	32	32	1.429	1.429		0	2
2010	Factors affecting mothers' choice of breastfeeding vs. formula feeding in the lower Umfolozi district war memorial hospital, KwaZulu-Natal.	Art	(Swarts *et al.*, 2010)	Nutrition Dietetics	Int	Int	1	1	21	21	0.938	0.938			
2011	Effects of iron and omega–3 fatty acid supplementation on physical activity of iron deficient primary school children residing in KwaZulu–Natal	Mast	(Greeff, 2011)	Not applicable	0	0	0	0	0	0					
2011	Point-of-use micronutrient fortification: lessons learned in implementing a preschool-based pilot trial in South Africa	Art	(Ogunlade *et al.*, 2011)	Nutrition Dietetics	Int	Int	5	7	20	24	1.042	1.250			
2012	The role of attitude and barriers on the implementation of a nutrition intervention in primary school children	Mast	(Harris, 2012)	Not applicable	0	Nat	0	0	1	1					
2012	A critical analysis of the labels of processed complementary foods for infants and young children in South Africa against international marketing guidelines	Mast	(Sweet, 2012)	Not applicable	0	Int	0	0	0	1					
2013	Fatty acid status and dietary intake of children and their caregivers from three distinct communities	Mast	(Ford, 2013)	Not applicable	0	0	0	0	0	0					
2013	Field-testing of guidance on the appropriate labelling of processed complementary foods for infants and young children in South Africa	Art	(Sweet *et al.*, 2013)	Nutrition Dietetics	Int	Int	5	5	9	12	0.672	0.895			
2013	Indigenous and traditional plants: South African caregivers' knowledge, perceptions and uses and their children's sensory acceptance .	Art	(Van der Hoeven *et al.*, 2013)	Nutrition Dietetics	Int	Int	8	8	23	26	1.716	1.940			
2014	UNICEF infant and young child feeding training in Zimbabwe : analysis and recommendations	Mast	(Dube, 2014)	Not applicable	0	0	0	0	0	0					
2014	A strategy for scaling up vitamin A supplementation for young children in a remote rural setting in Zimbabwe.	Art	(Dube *et al.*, 2014)	Nutrition Dietetics	0	0	0	0	0	0	0.000	0.000			
2014	Violations of the International Code of Marketing of Breast Milk Substitutes in South African health facilities	Mast	(Muravha, 2014)	Not applicable	0	0	0	0	0	0					
2014	Iron status, inflammation and anthropometric nutritional status of four–to–thirteen month old black infants from a rural South African population	Mast	(Nel, 2014)	Not applicable	0	0	0	0	0	0					
2014	Stakeholder attitudes and acceptability on donating and receiving donated human breast milk	Mast	(Oosthuizen, 2014)	Not applicable	0	0	0	0	0	0					
2014	Assessing the extent of violations of the International Code of Marketing of Breast Milk Substitutes in South African advertising media.	Mast	(Radebe, 2014)	Not applicable	Nat	Nat	1	1	1	1					

Table 0-8: (9) Infant and young child feeding - impact and reach of student publications on the scientific and public health communities
(Continued)

(9) Infant and young child feeding				Scientific community										Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact				
							3 years post-publication		All-time						
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc		3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,															
2014	Feeding practices of mothers and/or caregivers of infants below the age of 6 months in South Africa	Mast	(Siziba, 2014)	Not applicable	0	0	0	0	0	0					
2015	UNICEF Training Package for Scaling Up Skilled Community Infant and Young Child Feeding Counselors: Zimbabwe Experience	Art	(Dube *et al.*, 2015)	Nutrition Dietetics	0	0	0	0	0	0	0.000	0.000			
2015	Development of an implementation tool for a breast milk bank in the North West Province	Mast	(Pretorius, 2015)	Not applicable	0	0	0	0	0	0					
2015	Nutritional status, feeding practices and motor development of 6-month-old infants	Doc	(Rothman, 2015)	Not applicable	Int	Int	0	1	0	3					
2015	Acceptability of Novel Small-Quantity Lipid-Based Nutrient Supplements for Complementary Feeding in a Peri-Urban South African Community	Art	(Rothman *et al.*, 2015)	Nutrition Dietetics	Nat	Int	1	1	4	6	0.363	0.545			
2016	Effects of zinc fortification on the plasma fatty acid composition of Beninese school children : a randomised, double-blind controlled trial	Mast	(Chimhasha, 2016)	Not applicable	0	0	0	0	0	0					
2016	Dietary fat intake and red blood cell fatty acid composition of children and women from three different geographical areas in South Africa.	Art	(Ford *et al.*, 2016)	Nutrition Dietetics	Int	Int	6	6	7	7	0.776	0.776			
2016	The comparison of antenatal education, breastfeeding knowledge and neonatal positioning and attachment of HIV reactive and HIV non-reactive primgravidae	Mast	(Greyvenstein, 2016)	Not applicable	0	0	0	0	0	0					
2016	Nutrition-related concerns of the primary caregiver regarding children with spastic cerebral palsy	Mast	(Lourens, 2016)	Not applicable	0	0	0	0	0	0					
2016	Iodine nutrition in mothers and their infants during breastfeeding and complementary feeding	Doc	(Osei, 2016)	Not applicable	0	0	0	0	0	0					
2016	Breast-milk iodine concentrations, iodine status, and thyroid function of breastfed infants aged 2-4 months and their mothers residing in a South African township	Art	(Osei *et al.*, 2016)	EnDocrinology Metabolism	Int	Int	12	12	11	13	1.647	1.947			
2016	Development and validation of portion size food photographs to determine maize intake of young children in rural Eastern Cape Province	Mast	(Rasekhala, 2016)	Not applicable	0	0	0	0	0	0					
2016	Restricting the marketing of foods and non-alcoholic beverages to children in South Africa: Are all nutrient profiling models the same?	Art	(Wicks *et al.*, 2016)	Nutrition Dietetics	Int	Int	2	2	5	5	0.554	0.554			
2017	Effects of lipid-based nutrient supplements on the immunity of 6-month old infants: a randomised controlled trial	Mast	(Joosten, 2017)	Not applicable	0	0	0	0	0	0					
2017	Efficacy of lipid nutrient supplements on growth and micronutrient status in infants	Doc	(Matsungo, 2017)	Not applicable	0	0	0	0	0	0					
2017	The prevalence and factors associated with stunting among infants aged 6 months in a peri-urban South African community	Art	(Matsungo *et al.*, 2017a)	Nutrition Dietetics	Int	Int	0	2	0	2	0.000	0.399			
2017	Lipid-based nutrient supplements and linear growth in children under 2 years: A review	Art	(Matsungo *et al.*, 2017b)	Nutrition Dietetics	Int	Int	6	7	6	7	1.196	1.395			
2017	Iodine status and associations with feeding practices and psychomotor milestone development in six-month-old South African infants	Art	(Osei *et al.*, 2017)	Nutrition Dietetics	Int	Int	4	6	4	6	0.797	1.196			
2017	A 4-day test weighing study to assess volume and variations in fat and energy content of breast milk	Mast	(Siro, 2017)	Not applicable	0	0	0	0	0	0					
2017	The development of food based dietary guidelines (FBDGs) for 6 to 23 month old Rwandan children	Doc	(Umungwangeza, 2017)	Not applicable	0	0	0	0	0	0					
2017	A framework to regulate the marketing of foods and beverages to children in South Africa	Doc	(Wicks, 2017)	Not applicable	0	0	0	0	0	0					
2018	Assessment and evaluation of in-patient diagnosis and discharge protocols of Ghanaian infant and children (0-59months) diagnosed with severe acute malnutrition - the SAMAC study	Mast	(Carboo, 2018)	Not applicable	0	0	0	0	0	0					
2018	Sensitivity of fatty acid desaturation and elongation to plasma zinc concentration: A randomised controlled trial in Beninese children	Art	(Chimhashu *et al.*, 2018)	Nutrition Dietetics	Int	Int	2	2	2	2	0.764	0.764			
2018	Sodium content of processed foods frequently consumed by children in early childhood development centres in the North-West Province	Mast	(Korff, 2018)	Not applicable	0	0	0	0	0	0					

Table 0-8: (9) Infant and young child feeding - impact and reach of student publications on the scientific and public health communities

(Continued)

(9) Infant and young child feeding				Scientific community										Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact			
							3 years post-publication		All-time					
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc		3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,															
2018	Infant Development at the Age of 6 Months in Relation to Feeding Practices, Iron Status, and Growth in a Peri-Urban Community of South Africa	Art	(Rothman *et al.*, 2018)	Nutrition Dietetics	Int	Int	1	2	1	2	0.382	0.764			
2018	Long-chain polyunsaturated fatty acid nutrition in breastfed and complementary fed South African infants	Doc	(Siziba, 2018)	Not applicable	0	0	0	0	0	0					
2018	Associations of plasma total phospholipid fatty acid patterns with feeding practices, growth, and psychomotor development in 6-month-old South African infants	Art	(Siziba *et al.*, 2018)	Nutrition Dietetics	0	0	0	0	0	0	0.000	0.000			
2018	Dietary intake of infants followed from age 6 to 18 months from a low socio-economic peri-urban community	Mast	(Swanepoel, 2018)	Not applicable	0	0	0	0	0	0					
2019	Consumption of traditional and indigenous foods and their contribution to nutrient intake among children and women in Botswana	Art	(Kasimba *et al.*, 2019)	Nutrition Dietetics	0	0	0	0	0	0	0.000	0.000			
2019	Stakeholder Attitudes towards Donating and Utilizing Donated Human Breastmilk	Art	(Lubbe *et al.*, 2019)	Environmental Sciences	0	0	0	0	0	0	0.000	0.000			
2019	Effect of small-quantity lipid-based nutrient supplements on growth, psychomotor development, iron status, and morbidity among 6-to 12-mo-old infants in South Africa: a randomized controlled trial.	Art	(Smuts *et al.*, 2019)	Nutrition Dietetics	Int	Int	2	3	2	3	3.449	5.173			
2019	Contribution of commercial infant products and fortified staple foods to nutrient intake at ages 6, 12, and 18 months in a cohort of children from a low socio-economic community in South Africa	Art	(Swanepoel *et al.*, 2019)	Nutrition Dietetics	0	0	0	0	0	0	0.000	0.000			
Number of articles equal to or exceeding the average expected citation counts for this theme:											n=7	n=8			

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Table 0-9: (10) Nutrient requirements and dietary guidelines - impact and reach of student publications on the scientific and public health communities

(10) Nutrient requirements and dietary guidelines				Scientific community									Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact			
							3 years post-publication		All-time					
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc	3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,														
1997	The effect of Simvastatin on the plasma antioxidant concentrations in patients with hypercholesterolaemia	Art	(Human *et al.*, 1997)	Biochemistry Molecular Biology	Int	Int	4	4	74	74	1.421	1.421		
1997	Effect of simvastatin, a 3-hydroxy-3-methylglutaryl coenzyme A reductase inhibitor, on the haemostatic balance of familial hypercholesterolaemic subjects.	Art	(Jerling *et al.*, 1997)	Biochemistry Molecular Biology	Int	Int	4	5	7	8	0.134	0.154		
1997	Dietary pectin influences fibrin network structure in hypercholesterolaemic subjects	Art	(Veldman *et al.*, 1997)	Peripheral Vascular Disease	Int	Int	4	5	30	34	1.522	1.725		
1997	Soluble-fibre concentrate lowers plasminogen activator inhibitor-1 in baboons (Papio ursinus)	Art	(Venter *et al.*, 1997)	Nutrition Dietetics	Int	Int	1	2	9	10	0.364	0.405		
1998	Changes in risk factors of breast cancer in African women during urbanisation	Mast	(Burger, 1998)	Not applicable	0	Nat	0	0	2	2				
1998	Die effek van simvastatien, 'n HMG-KoA-reduktase-inhibeerder op die hemostatiese balans in hipercholesterolemiese pasiënte	Doc	(Jerling, 1998)	Not applicable	Nat	Nat	1	1	1	1				
1998	The glycemic index of indigenous South African foods	Doc	(Mbhenyane, 1998)	Not applicable	0	0	0	0	0	0				
1998	Changes in dietary risk factors of colon cancer in Africans during urbanisation	Mast	(Nell, 1998)	Not applicable	0	Nat	0	0	1	1				
1998	Lecithin has no effect on serum lipoprotein, plasma fibrinogen and macro molecular protein complex levels in hyperlipidaemic men in a double-blind controlled study	Art	(Oosthuizen *et al.*, 1998)	Nutrition Dietetics	Int	Int	3	3	51	52	1.785	1.820		
1998	Die effekte van geëkstrueerde droëbone op lipoproteïen- en hemostatiese veranderlikes	Mast	(Scholtz, 1998)	Not applicable	0	0	0	0	0	0				
1998	Plasma fibrinogen of black South Africans: the BRISK study	Art	(Vorster *et al.*, 1998)	Nutrition Dietetics	Int	Int	1	3	15	20	0.525	0.700		
1999	The effect of the glycaemic index of a pre-exercise meal on serum triglycerides during acute exercise in male athletes	Mast	(Badenhorst, 1999)	Not applicable	0	0	0	0	0	0				
1999	Apolipoprotein E and methylenetetrahydrofolate reductase genetic polymorphisms in relation to other risk factors for cardiovascular disease in UK Caucasians and Black South Africans	Art	(Loktionov *et al.*, 1999)	Cardiac Cardiovascular Systems	Int	Int	6	7	42	47	1.779	1.991		
1999	The effect of nutrition on risk factors for coronary heArt disease	Doc	(Oosthuizen, 1999)	Not applicable	0	0	0	0	0	0				
1999	The effect of the glycaemic index of a pre-exercise meal on the glycaemic and insulin responses during acute exercise	Mast	(Pieters, 1999)	Not applicable	0	0	0	0	0	0				
1999	Changes in Factor (VIIc) and fibrinogen during acute exercise in young male athletes and controls: Influence of the glycaemic index of the pre-exercise meal.	Mast	(Snyman, 1999)	Not applicable	0	0	0	0	0	0				
1999	Possible mechanisms through which dietary pectin influences fibrin network architecture in hypercholesterolaemic subjects	Art	(Veldman *et al.*, 1999)	Nutrition Dietetics	Int	Int	4	4	26	28	0.837	0.902		
2000	Nutritional status influences plasma fibrinogen concentration: evidence from the THUSA survey.	Art	(James *et al.*, 2000)	Nutrition Dietetics	Int	Int	4	2	26	34	0.769	1.006		
2000	Changes in levels of plasma fibrinogen and macromolecular protein complex among Africans in transition in the North-West Province of South Africa	Doc	(James, 2000)	Not applicable	0	0	0	0	0	0				
2000	Extruded dry beans and serum lipoprotein and plasma haemostatic factors in hyperlipidaemic men	Art	(Oosthuizen *et al.*, 2000)	Nutrition Dietetics	Int	Int	3	3	27	29	0.799	0.858		
2000	The effect of urbanisation on bone turnover in black postmenopausal women.	Mast	(Vorster, 2000)	Not applicable	0	0	0	0	0	0			1	1
2001	Obesity in African women in the North West Province, South Africa is associated with an increased risk of non-communicable diseases: the THUSA study. Transition and Health during Urbanisation of South Africans	Art	(Kruger *et al.*, 2001)	Nutrition Dietetics	Int	Int	2	3	82	92	2.496	2.801		
2001	The metabolic syndrome, does it exist in Africans in transition in the North West Province?	Doc	(Kruger, 2001)	Not applicable	0	0	0	0	0	0				

Table 0-9: (10) Nutrient requirements and dietary guidelines - impact and reach of student publications on the scientific and public health communities

(Continued)

(10) Nutrient requirements and dietary guidelines				Scientific community										Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact				
							3 years post-publication		All-time						
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc		3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,															
2001	The glycemic index of indigenous South African foods	Art	(Mbhenyane *et al.*, 2001)	Nutrition Dietetics	Int	Int	2	2	9	9	0.274	0.274			
2001	Acceptability of an instant soy maize porridge by HIV-positive and -negative consumers	Mast	(Mooko, 2001)	Not applicable	0	0	0	0	0	0					
2001	The variation and application of the glycaemic index of foods	Doc	(Nell, 2001)	Not applicable	Nat	Nat	1	1	4	4					
2001	Vitamien C se effek op serumlipiede in hiperlipidemiese pasiënte	Mast	(Spies, 2001)	Not applicable	0	0	0	0	0	0					
2002	The effect of a sports drink on muscle glycogen and blood glucose, insulin and lactate responses after multiple exercise sessions	Mast	(de Jager, 2002)	Not applicable	0	0	0	0	0	0					
2002	Differences in N-acetylation genotypes between Caucasians and Black South Africans: implications for cancer prevention.	Art	(Loktionov *et al.*, 2002)	Oncology	Int	Int	5	5	50	50	1.371	1.371			
2002	Impact of urbanisation on serum lipid profiles--the THUSA survey	Art	(Oosthuizen *et al.*, 2002)	Nutrition Dietetics	Nat	Int	1	1	31	33	0.912	0.970			
2002	Fibrin network characteristics and red palm oil in hyperfibrinogenaemic, hypercholesterolaemic subjects.	Doc	(Pieters, 2002)	Not applicable	0	0	0	0	0	0					
2003	The glycaemic index of muffins baked with extruded dried bean flour compared to muffins baked with whole wheat flour	Mast	(Gouws, 2003)	Not applicable	0	0	0	0	0	0					
2003	The relationship between calcium, vitamin D status, anthropometry, physical activity and bone density in Black men : a case control study	Mast	(Groenewald, 2003)	Not applicable	0	0	0	0	0	0					
2003	Physical inactivity as a risk factor for cardiovascular disease in communities undergoing rural to urban transition: the THUSA study.	Art	(Kruger *et al.*, 2003)	Nutrition Dietetics	Nat	Int	0	2	55	60	1.468	1.601			
2003	Avocados: consumer beliefs and effect on weight loss and markers of cardiovascular health	Mast	(Pieterse, 2003)	Not applicable	0	0	0	0	0	0					
2003	Developing and evaluating a food supplement to optimise post-exercise recovery	Doc	(Wright, 2003)	Not applicable	0	0	0	0	0	0					
2004	Insulin resistance and the metabolic syndrome in obese black South African women : a focus on risk factors	Doc	(Jonker, 2004)	Not applicable	0	0	0	0	0	0					
2004	Risk factors for osteoporotic fractures in Black South African men : a case control study	Mast	(Leach, 2004)	Not applicable	0	0	0	0	0	0					
2004	Foodstate vitamin C complex may beneficially affect haemostasis and fibrin network structure in hyperlipidaemic patients	Art	(Loots *et al.*, 2004)	Nutrition Dietetics	Int	Int	1	1	6	8	0.185	0.247			
2004	The development of nutrition knowledge and good dietary practices among farm dwellers	Mast	(Phometsi, 2004)	Not applicable	0	Nat	0	0	1	1					
2004	South African consumers' beliefs about the link between food and health	Mast	(Reid, 2004)	Not applicable	0	Nat	0	0	2	2					
2004	The effect of red palm olein and refined palm olein on lipids and haemostatic factors in hyperfibrinogenaemic subjects	Art	(Scholtz *et al.*, 2004)	Nutrition Dietetics	Int	Int	1	1	22	24	0.679	0.740			
2004	Dietary macronutrient recommendations for optimal recovery post-exercise: PArt I	Art	(Wright *et al.*, 2004b)	Nutrition Dietetics	Nat	Nat	1	1	2	3	0.062	0.093			
2005	The effects of a high walnut and unsalted cashew nut diet on the antioxidant status of subjects with diagnosed metabolic syndrome	Mast	(Davis, 2005)	Not applicable	0	0	0	0	0	0					
2005	The development of a strategy to promote fruit and vegetable consumption in South Africa	Mast	(De Witt, 2005)	Not applicable	0	Nat	0	0	2	2					
2005	Beliefs of South Africans regarding food and cardiovascular health	Mast	(Dolman, 2005)	Not applicable	0	Int	0	0	0	1					
2005	Comparison of the association of PAI-1 act with the metabolic syndrome markers in caucasian and black South African women	Mast	(Greyling, 2005)	Not applicable	0	0	0	0	0	0					
2005	The process towards development of an integrated National Nutrition Policy framework for Lesotho	Doc	(Hanson, 2005)	Not applicable	0	0	0	0	0	0					
2005	Nutrient intake and consumption of indigenous foods by college students in the Northern Province.	Art	(Mbhenyane *et al.*, 2005)	Nutrition Dietetics	Nat	Int	2	2	24	24	0.764	0.764			
2008	Beliefs of South Africans regarding food and cardiovascular health	Art	(Jerling *et al.*, 2008)	Nutrition Dietetics	0	Nat	0	0	2	4	0.071	0.143			

Table 0-9: (10) Nutrient requirements and dietary guidelines - impact and reach of student publications on the scientific and public health communities

(Continued)

(10) Nutrient requirements and dietary guidelines				Scientific community									Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact			
							3 years post-publication		All-time					
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc	3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,														
2005	The effects of nuts on markers of the metabolic syndrome	Doc	(Mukuddem-Petersen, 2005)	Not applicable	0	0	0	0	0	0				
2005	A systematic review of the effects of nuts on blood lipid profiles in humans.	Art	(Mukuddem-Petersen *et al.*, 2005)	Nutrition Dietetics	Int	Int	18	19	265	266	8.436	8.468		
2005	The association between black tea consumption and iron status of African women in the North West Province : THUSA study	Mast	(Muller, 2005)	Not applicable	0	0	0	0	0	0				
2005	Dietary Challenges For Optimal Control Of Type 2 Diabetes.	Art	(Opperman *et al.*, 2005)	Nutrition Dietetics	0	0	0	0	0	0	0.000	0.000		
2005	Nutrition knowledge and barriers to good dietary practices among primary school children in a farming community.	Art	(Phometsi *et al.*, 2006)	Nutrition Dietetics	Nat	Int	3	3	17	17	0.541	0.541		
2005	Substitution of high monounsaturated fatty acid avocado for mixed dietary fats during an energy restricted diet: Effects on weight loss, serum lipids, fibrinogen and vascular function.	Art	(Pieterse *et al.*, 2005)	Nutrition Dietetics	0	Int	0	0	65	65	2.069	2.069		
2005	Clustering of haemostatic variables and the effect of high cashew and walnut diets on these variables in metabolic syndrome patients.	Art	(Pieters *et al.*, 2005)	Hematology	Int	Int	2	5	25	29	1.194	1.385		
2005	Consumer acceptance of high-fibre muffins and rusks baked with red palm olein	Art	(Scholtz & Bosman, 2005)	Nutrition Dietetics	0	Int	0	0	8	11	0.255	0.350		
2004	Dietary macronutrient recommendations for optimal recovery post-exercise: PArt II	Art	(Wright *et al.*, 2004a)	Nutrition Dietetics	Nat	Nat	1	1	4	5	0.123	0.154		
2006	Fibrinogen glycation and glycaemic control in type 2 diabetic subjects	Mast	(Göttsche, 2006)	Not applicable	0	0	0	0	0	0				
2006	Effects of a policosanol supplement on serum lipid concentrations in hypercholesterolaemic and heterozygous familial hypercholesterolaemic subjects.	Art	(Greyling *et al.*, 2006)	Nutrition Dietetics	Int	Int	22	22	64	64	1.815	1.815		
2006	Phytosterols/Stanols Lower Cholesterol Concentrations in Familial Hypercholesterolemic Subjects: A Systematic Review with Meta-Analysis.	Art	(Moruisi *et al.*, 2006)	Nutrition Dietetics	Int	Int	24	25	142	143	4.028	4.056		
2006	Effect of dietary fibre on selected haemostatic variables and C-reactive protein	Doc	(North, 2006)	Not applicable	0	0	0	0	0	0				
2006	Polyunsaturated fatty acid intake is adversely related to liver function in HIV-infected subjects: the THUSA study.	Art	(Oosthuizen *et al.*, 2006)	Nutrition Dietetics	Int	Int	2	3	13	15	0.369	0.425		
2006	The effect of glycaemic control on fibrin network structure of type 2 diabetic subjects.	Art	(Pieters *et al.*, 2006)	Peripheral Vascular Disease	Int	Int	0	2	32	36	1.803	2.028		
2006	Implementation of hazard analysis and critical control point (HACCP) system in a food service unit serving immuno-suppressed patient diets	Mast	(Vermeulen, 2006)	Not applicable	0	0	0	0	0	0				
2007	The effects of high walnut and cashew nut diets on the antioxidant status of subjects with metabolic syndrome	Art	(Davis *et al.*, 2007)	Nutrition Dietetics	Int	Int	19	19	115	115	4.162	4.162		
2010	Relationships of alcohol intake with biological health outcomes in an African population in transition: the Transition and Health during Urbanisation in South Africa (THUSA) study	Art	(Gopane *et al.*, 2010)	Nutrition Dietetics	Nat	Nat	4	6	5	9	0.223	0.402	0	1
2007	Aloe ferox Leaf Gel Phytochemical Content, Antioxidant Capacity and Possible Health Benefits	Art	(Loots *et al.*, 2007)	Health Care Sciences Services	Int	Int	6	7	111	113	6.351	6.465		
2007	Effects of a high walnut and high cashew nut diet on selected markers of the metabolic syndrome: A controlled feeding trial.	Art	(Mukuddem-Petersen *et al.*, 2007)	Nutrition Dietetics	Int	Int	10	10	105	105	3.801	3.801		
2007	Glycation of fibrinogen in uncontrolled diabetic patients and the effects of glycaemic control on fibrinogen glycation.	Art	(Pieters *et al.*, 2007)	Peripheral Vascular Disease	Int	Int	3	5	40	42	1.910	2.005		
2008	The effect of blood glucose control on fibrin network characteristics of African subjects with uncontrolled type 2 diabetes	Mast	(Covic, 2008)	Not applicable	0	0	0	0	0	0				

Table 0-9: (10) Nutrient requirements and dietary guidelines - impact and reach of student publications on the scientific and public health communities

(Continued)

(10) Nutrient requirements and dietary guidelines				Scientific community										Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact				
							3 years post-publication		All-time						
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc		3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,															
2008	Glycaemic control improves fibrin network characteristics in type 2 diabetes – A purified fibrinogen model.	Art	(Pieters *et al.*, 2008)	Peripheral Vascular Disease	Int	Int	8	8	51	56	3.233	3.550			
2008	Associations between biological alcohol consumption markers, reported alcohol intakes, and biological health outcomes in an African population in transition.	Doc	(Pisa, 2008)	Not applicable	Int	Int	0	1	0	2					
2008	Opinion of South African pre-and post-menopausal women on the potential menopause-related health benefits of soy and soy products	Art	(Van Aardt *et al.*, 2008)	Nutrition Dietetics	0	0	0	0	0	0	0.000	0.000			
2008	Effects of policosanol supplements on serum lipid concentrations : a systematic review	Mast	(Walsh, 2008)	Not applicable	0	Int	0	0	1	1					
2009	The phytochemical content and anti-diabetic properties of Aloe ferox and Aloe greatheadii var. davyana.	Doc	(Botes, 2009)	Not applicable	Nat	Int	1	1	2	2					
2009	Towards a responsible food-based dietary guideline for alcohol consumption for South Africa	Doc	(Gopane, 2009)	Not applicable	0	0	0	0	0	0					
2009	The effect of ethanol and products of its metabolism on haemostatic modifications following moderate alcohol consumption	Mast	(Kotze, 2009)	Not applicable	0	0	0	0	0	0					
2009	The prevalence of selected risk markers for noncommunicable diseases and associations with lifestyle behaviours in an Indian community in KwaZulu-Natal	Doc	(Naicker, 2009)	Not applicable	0	Nat	0	0	3	3					
2009	The effects of dietary fibre on C-reactive protein, an inflammation marker predicting cardiovascular disease.	Art	(North *et al.*, 2009)	Nutrition Dietetics	Int	Int	19	19	99	99	4.568	4.568			
2010	The association between alcohol consumption, PAI-1 activity and fibrinogen concentration in black South Africans	Mast	(De Lange, 2010)	Not applicable	0	0	0	0	0	0					
2010	Triglyceride concentration and waist circumference influence alcohol-related plasminogen activator inhibitor-1 activity increase in black South Africans.	Art	(Pieters *et al.*, 2010a)	Nutrition Dietetics	Int	Int	2	3	6	8	0.268	0.357			
2010	The effect of ethanol and its metabolism on fibrinolysis	Art	(Pieters *et al.*, 2010b)	Peripheral Vascular Disease	Int	Int	2	3	10	12	0.684	0.821			
2010	Alcohol consumption and cardiovascular disease risk in an African population: The PURE study.	Art	(Pisa *et al.*, 2010)	Nutrition Dietetics	Int	Int	4	6	14	19	0.625	0.848		0	1
2011	Associations between indices of iron status, anthropometric and biological markers of cardiovascular disease risk	Doc	(Aderibigbe, 2011)	Not applicable	0	Int	0	0	1	1					
2011	The relationship between indices of iron status and selected anthropometric cardiovascular disease risk markers in an African population: the THUSA study	Art	(Aderibigbe *et al.*, 2011a)	Cardiac Cardiovascular Systems	Int	Int	5	6	16	18	1.313	1.477			
2011	Iron status and cardiovascular disease risk in black South African women: the PURE study	Art	(Aderibigbe *et al.*, 2011b)	Public Environmental Occupational Health	0	Int	0	0	2	3	0.156	0.233			
2011	Disordered eating and menstrual patterns in female university netball players.	Art	(Havemann *et al.*, 2011)	Nutrition Dietetics	Int	Int	1	1	4	5	0.208	0.261			
2011	Risk factor profile of coronary Artery disease in black South Africans.	Art	(Jerling *et al.*, 2011)	Nutrition Dietetics	Nat	Int	1	3	3	5	0.156	0.261			
2011	Antidiabetic effects of Aloe ferox and Aloe greatheadii var. davyana leaf gel extracts in a low-dose streptozotocin diabetes rat model	Art	(Loots *et al.*, 2011)	Nutrition Dietetics	Int	Int	2	2	16	16	0.834	0.834			
2011	The sensitivity of waist-to-height ratio in identifying children with high blood pressure	Art	(Motswagole *et al.*, 2011)	Cardiac Cardiovascular Systems	Int	Int	10	11	29	31	2.380	2.544			
2011	The relevance of glycosylated haemoglobin in screening for non–insulin dependent diabetes mellitus in a black South African population	Mast	(Pieterse, 2011)	Not applicable	0	0	0	0	0	0					

Table 0-9: (10) Nutrient requirements and dietary guidelines - impact and reach of student publications on the scientific and public health communities

(Continued)

(10) Nutrient requirements and dietary guidelines				Scientific community										Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact				
							3 years post-publication		All-time						
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc		3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,															
2012	Body composition in stunted, compared to non-stunted, black South African children, from two rural communities.	Art	(Motswagole *et al.*, 2012)	Nutrition Dietetics	Int	Int	2	2	2	2	0.096	0.096			
2012	Potential contribution of African leafy vegetables to the nutritional status of children	Mast	(Osei, 2012)	Not applicable	0	Int	0	0	1	1					
2012	Social drift of cardiovascular disease risk factors in Africans from the North West Province of South Africa: the PURE study	Art	(Pisa *et al.*, 2012)	Cardiac Cardiovascular Systems	Int	Int	6	7	24	30	2.154	2.692			
2013	The role of diet in cardiovascular disease in black South Africans : both sides of the story	Doc	(Dolman, 2013)	Not applicable	0	0	0	0	0	0					
2013	Lifestyle risk factors and bone mineral density of urban postmenopausal women in the North West Province	Mast	(Ellis, 2013)	Not applicable	0	0	0	0	0	0					
2013	Fatty acid status and dietary intake of children and their caregivers from three distinct communities	Mast	(Ford, 2013)	Not applicable	0	0	0	0	0	0					
2013	Nutritional genetics: the case of alcohol and the MTHFR C677T polymorphism in relation to homocysteine in a black South African population.	Art	(Nienaber-Rousseau *et al.*, 2013)	Nutrition Dietetics	Int	Int	4	5	7	8	0.522	0.597			
2013	Effectiveness of probiotic Bifidobacterium animalis DN-173010 in the management of constipation-predominant irritable bowel syndrome in black South African women	Mast	(Rammbwa, 2013)	Not applicable	0	Int	0	0	1	1					
2013	The relevance of specific c-reactive protein genetic variants towards cardiovascular disease risk in a black South African population undergoing an epidemiological transition	Mast	(Swanepoel, 2013)	Not applicable	Nat	Nat	0	1	0	1					
2013	Indigenous and traditional plants: South African caregivers' knowledge, perceptions and uses and their children's sensory acceptance .	Art	(Van der Hoeven *et al.*, 2013)	Nutrition Dietetics	Int	Int	8	8	23	26	1.716	1.940			
2014	The relationship between iron status and adiposity in women from developing countries: a review	Art	(Aderibigbe *et al.*, 2014)	Nutrition Dietetics	Int	Int	7	7	14	16	0.893	1.020			
2014	Evaluation of common genetic variants associated with type 2 diabetes susceptibility in a black South African population	Mast	(Chikowore, 2014)	Not applicable	0	0	0	0	0	0					
2014	The use of predefined diet quality scores in the context of CVD risk during urbanization in the South African Prospective Urban and Rural Epidemiological (PURE) study	Art	(Dolman *et al.*, 2014)	Public Environmental Occupational Health	Int	Int	2	5	8	11	0.812	1.116			
2014	CVD risk factors are related to plasma fibrin clot properties independent of total and or γ' fibrinogen concentration	Art	(Kotzé *et al.*, 2014)	Nutrition Dietetics	Int	Int	10	10	17	17	1.084	1.084			
2014	Iron and zinc bioaccessibility from African leafy vegetables: implications for nutrition	Mast	(Mongwaketse, 2014)	Not applicable	0	0	0	0	0	0					
2014	Interactions between C-Reactive Protein Genotypes with Markers of Nutritional Status in Relation to Inflammation.	Art	(Nienaber-Rousseau *et al.*, 2014)	Nutrition Dietetics	Int	Int	7	7	10	12	0.638	0.765			
2014	Evidence that fibrinogen γ' regulates plasma clot structure and lysis and relationship to cardiovascular risk factors in black Africans	Art	(Pieters *et al.*, 2014)	Peripheral Vascular Disease	Int	Int	8	20	12	28	1.387	3.237			
2014	Associations between plasma fatty acids, dietary fatty acids and cardiovascular risk factors: The PURE study	Doc	(Richter, 2014)	Not applicable	Nat	Nat	1	1	1	1					
2014	Different dietary fatty acids are associated with blood lipids in healthy South African men and women: The PURE study	Art	(Richter *et al.*, 2014)	Nutrition Dietetics	Int	Int	3	4	7	10	0.446	0.638			
2014	The intake and quality of breakfast consumption among adolescents attending public secondary schools in Potchefstroom	Mast	(Tee, 2014)	Not applicable	Nat	Int	1	1	6	6					
2014	The effect of African leafy vegetables on the alleviation of micronutrient deficiencies in school children residing in the North West Province of South Africa	Doc	(Van der Hoeven, 2014)	Not applicable	Nat	Nat	0	1	0	1					
2015	Common variants associated with type 2 diabetes in a Black South African population of Setswana descent: African populations diverge	Art	(Chikowore *et al.*, 2015)	Genetics Heredity	Int	Int	4	5	4	5	0.318	0.397			

Table 0-9: (10) Nutrient requirements and dietary guidelines - impact and reach of student publications on the scientific and public health communities

(Continued)

(10) Nutrient requirements and dietary guidelines				Scientific community										Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact				
							3 years post-publication		All-time						
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc		3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,															
2015	Associations between specific measures of adiposity and high blood pressure in black South African women	Mast	(Doubell, 2015)	Not applicable	0	0	0	0	0	0					
2015	Dietary intake, energy availability and weight control practices of male apprentice jockeys residing at the SA Jockey Academy	Mast	(Krog, 2015)	Not applicable	0	0	0	0	0	0					
2015	Potential contribution of African green leafy vegetables and maize porridge composite meals to iron and zinc nutrition	Art	(Kruger *et al.*, 2015)	Nutrition Dietetics	Nat	Int	3	5	11	16	0.999	1.452			
2015	Plasma glutamine levels in critically ill intensive care patients	Mast	(Nienaber, 2015)	Not applicable	0	0	0	0	0	0					
2015	Prevalence of glutamine deficiency in ICU patients: a cross-sectional analytical study.	Art	(Nienaber *et al.*, 2015)	Nutrition Dietetics	Int	Int	3	3	9	9	0.817	0.817			
2015	The intake and quality of breakfast consumption in adolescents attending public secondary schools in the North West province, South Africa	Art	(Tee *et al.*, 2015)	Nutrition Dietetics	Nat	Int	3	3	6	6	0.545	0.545			
2015	Effect of African leafy vegetables on the micronutrient status of mildly deficient farm-school children in South Africa: a randomized controlled study.	Art	(Van der Hoeven *et al.*, 2016)	Nutrition Dietetics	Int	Int	2	3	4	6	0.363	0.545			
2016	Genetic and dietary determinants of type 2 diabetes in a black South African population	Doc	(Chikowore, 2016)	Not applicable	0	0	0	0	0	0					
2016	Predictive utility of a genetic risk score of common variants associated with type 2 diabetes in a black South African population	Art	(Chikowore *et al.*, 2016)	EnDocrinology Matabolism	Int	Int	2	2	2	2	0.300	0.300			
2016	Dietary fat intake and red blood cell fatty acid composition of children and women from three different geographical areas in South Africa.	Art	(Ford *et al.*, 2016)	Nutrition Dietetics	Int	Int	6	6	7	7	0.776	0.776			
2016	Nutrition-related concerns of the primary caregiver regarding children with spastic cerebral palsy	Mast	(Lourens, 2016)	Not applicable	0	0	0	0	0	0					
2016	Association of 25-hydroxyvitamin D and parathyroid hormone with the metabolic syndrome in black South African women	Art	(Sotunde *et al.*, 2016)	Nutrition Dietetics	Int	Int	1	1	1	1	0.111	0.111			
2016	Knowledge and perceptions of North-West University rugby players on timing of protein ingestion	Mast	(Swanepoel, 2016)	Not applicable	0	0	0	0	0	0					
2016	Dietary adherence amongst adults with type 2 diabetes mellitus : a South African urban population perspective	Mast	(Winskill, 2016)	Not applicable	0	0	0	0	0	0					
2017	Nutrient patterns associated with fasting glucose and glycated haemoglobin levels in a black South African population	Art	(Chikowore *et al.*, 2017)	Nutrition Dietetics	Int	Int	5	6	5	6	0.996	1.196			
2017	Agreement between specific measures of adiposity and associations with high blood pressure in black South African women	Art	(Kruger *et al.*, 2017)	Biology	Int	Int	0	1	0	1	0.000	0.327			
2017	Adherence challenges encountered in an intervention programme to combat chronic noncommunicable diseases in an urban black community, Cape Town	Art	(Solomons *et al.*, 2017)	Health Care Sciences Services	Int	Int	2	2	2	2	0.873	0.873			
2017	The development of food based dietary guidelines (FBDGs) for 6 to 23 month old Rwandan children	Doc	(Umungwangeza, 2017)	Not applicable	0	0	0	0	0	0					
2018	Dietary intake practices of adults with intellectual disability in a controlled care centre environment	Mast	(Dreyer, 2018)	Not applicable	0	0	0	0	0	0					
2018	Effect of omega-3 fatty acids on the clinical outcomes of mechanically ventilated critically ill patients : a systematic review	Mast	(Greyling, 2018)	Not applicable	0	0	0	0	0	0					
2018	Household access to traditional and indigenous foods positively associated with food security and dietary diversity in Botswana	Art	(Kasimba *et al.*, 2018)	Nutrition Dietetics	Int	Int	0	1	1	2	0.382	0.764			
2018	Sodium content of processed foods frequently consumed by children in early childhood development centres in the North-West Province	Mast	(Korff, 2018)	Not applicable	0	0	0	0	0	0					
2018	Challenges with implementation of nutrition interventions aimed at non-communicable diseases among black urban South Africans	Doc	(Solomons, 2018)	Not applicable	0	0	0	0	0	0					

Table 0-9: (10) Nutrient requirements and dietary guidelines - impact and reach of student publications on the scientific and public health communities

(Continued)

(10) Nutrient requirements and dietary guidelines			Scientific community										Government documents Citation count	
			Normalisation category	Publication reach		Citation counts				Impact				
						3 years post-publication		All-time						
Year	Title	Document type	Reference	3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc	3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,														
2018	Gene-diet interactions in relation to circulating homocysteine concentrations	Mast	(Van Schalkwyk, 2018)	Not applicable	0	0	0	0	0	0				
2019	Consumption of traditional and indigenous foods and their contribution to nutrient intake among children and women in Botswana	Art	(Kasimba *et al.*, 2019)	Nutrition Dietetics	0	0	0	0	0	0	0.000	0.000		
Number of articles equal to or exceeding the average expected citation counts for this theme:											n=23	n=28		

Annexure Table 0-2 Table 0-3 Table 0-4 Table 0-5 Table 0-6 Table 0-7 Table 0-8 Table 0-9 Table 0-10 Table 0-11 Table 0-12 Table 0-13 Table 0-14 Table 0-15 Table 0-16 Table 0-17

Table 0-10: (11) Overweight and obesity - impact and reach of student publications on the scientific and public health communities

(11) Overweight and obesity			Scientific community										Government documents Citation count	
			Normalisation category	Publication reach		Citation counts				Impact				
						3 years post-publication		All-time						
Year	Title	Document type	Reference	3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc	3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,														
1997	Dietitian's attitude towards fat substitutes and the acceptability of high-fibre muffins containing Simplesse®	Art	(Bosman *et al.*, 1997)	Nutrition Dietetics	0	Nat	0	0	1	6	0.040	0.243		
1997	Soluble-fibre concentrate lowers plasminogen activator inhibitor-1 in baboons (Papio ursinus)	Art	(Venter *et al.*, 1997)	Nutrition Dietetics	Int	Int	1	2	9	10	0.364	0.405		
1999	The development and evaluation of a low-fat high-fibre muffin using Simplesse as a fat substitute	Doc	(Bosman, 1999)	Not applicable	0	0	0	0	0	0				
1999	The puzzle of obesity in African women: contributing factors and associated risk factors.	Doc	(Kruger, 1999)	Not applicable	Nat	Int	1	1	4	4				
2000	The effect of batter refrigeration on the characteristics of high-fibre muffins with oil replaced by a protein-based fat substitute	Art	(Bosman *et al.*, 2000)	Nutrition Dietetics	0	Int	0	0	3	4	0.089	0.118		
2000	Changes in levels of plasma fibrinogen and macromolecular protein complex among Africans in transition in the North-West Province of South Africa	Doc	(James, 2000)	Not applicable	0	0	0	0	0	0				
2001	Obesity in African women in the North West Province, South Africa is associated with an increased risk of non-communicable diseases: the THUSA study. Transition and Health during Urbanisation of South Africans	Art	(Kruger *et al.*, 2001)	Nutrition Dietetics	Int	Int	2	3	82	92	2.496	2.801		
2001	The metabolic syndrome, does it exist in Africans in transition in the North West Province?	Doc	(Kruger, 2001)	Not applicable	0	0	0	0	0	0				
2001	Co-existence of over-and undernutrition related diseases in low income, high-burden countries: a contribution towards the 17th IUNS congress of nutrition, Vienna 2001	Art	(Rutengwe *et al.*, 2001)	Nutrition Dietetics	Int	Int	2	2	8	8	0.244	0.244		
2002	Physical inactivity is the major determinant of obesity in black women in the North West Province, South Africa: the THUSA study. Transition and Health During Urbanisation of South Africa.	Art	(Kruger *et al.*, 2002)	Nutrition Dietetics	Int	Int	10	10	176	185	5.175	5.440		
2002	Impact of urbanisation on serum lipid profiles--the THUSA survey	Art	(Oosthuizen *et al.*, 2002)	Nutrition Dietetics	Nat	Int	1	1	31	33	0.912	0.970		
2003	Physical inactivity as a risk factor for cardiovascular disease in communities undergoing rural to urban transition: the THUSA study.	Art	(Kruger *et al.*, 2003)	Nutrition Dietetics	Nat	Int	0	2	55	60	1.468	1.601		

Table 0-10: (11) Overweight and obesity - impact and reach of student publications on the scientific and public health communities

(Continued)

(11) Overweight and obesity				Scientific community										Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact				
							3 years post-publication		All-time						
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc		3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,															
2003	The determinants of overweight among 10-15 year old schoolchildren in the North West Province	Doc	(Kruger, 2003)	Not applicable	0	Nat	0	0	1	1					
2003	The association between stunting and overweight among 10-15 year old children in the North West Province	Mast	(Mukuddem-Petersen, 2003)	Not applicable	0	0	0	0	0	0					
2003	Avocados: consumer beliefs and effect on weight loss and markers of cardiovascular health	Mast	(Pieterse, 2003)	Not applicable	0	0	0	0	0	0					
2004	Insulin resistance and the metabolic syndrome in obese black South African women : a focus on risk factors	Doc	(Jonker, 2004)	Not applicable	0	0	0	0	0	0					
2004	Association between stunting and overweight among 10–15-y-old children in the North West Province of South Africa: the THUSA BANA Study	Art	(Mukuddem-Petersen & Kruger, 2004)	Nutrition Dietetics	Int	Int	7	9	81	89	2.499	2.746			
2004	Dietary calcium intake and obesity in adult women : the POWIRS study	Mast	(Rautenbach, 2004)	Not applicable	0	0	0	0	0	0					
2004	Pregnancy weight gain and outcomes	Mast	(Rheeder, 2004)	Not applicable	0	0	0	0	0	0					
2005	The development of a strategy to promote fruit and vegetable consumption in South Africa	Mast	(De Witt, 2005)	Not applicable	0	Nat	0	0	2	2					
2006	The determinants of overweight and obesity among 10- to 15- year-old schoolchildren in the North West Province, South Africa – the THUSA BANA (Transition and Health during Urbanisation of South Africans; BANA, children) study.	Art	(Kruger *et al.*, 2006)	Nutrition Dietetics	Int	Int	11	12	166	176	4.709	4.992			
2006	Body composition and systematic low-grade inflammation in children : the PLAY study	Mast	(Pretorius, 2006)	Not applicable	0	0	0	0	0	0					
2006	The characteristics of underreporting women in the POWIRS II study	Mast	(Raubenheimer, 2006)	Not applicable	0	0	0	0	0	0					
2007	An inverse association between calcium intake and adiposity in women with high fat and calcium intakes.	Art	(Kruger *et al.*, 2007)	Nutrition Dietetics	Int	Int	3	3	13	14	0.471	0.507			
2008	Overfatness, stunting and physical inactivity are determinants of plasminogen activator inhibitor-1activity, fibrinogen and thrombin – antithrombin complex in African adolescents.	Art	(Nienaber *et al.*, 2008)	Hematology	Int	Int	3	4	13	14	0.779	0.839			
2010	The use of a musical play in the transfer of knowledge on nutrition, a healthy lifestyle and the prevention of obesity	Mast	(Kruger, 2010)	Not applicable	0	0	0	0	0	0					
2010	Stunting, adiposity and low-grade inflammation in African adolescents from a township high school.	Art	(Kruger *et al.*, 2010)	Nutrition Dietetics	Int	Int	6	6	25	26	1.116	1.161			
2010	Comparison of waist circumference distribution of South African black children from different study populations	Doc	(Motswagole, 2010)	Not applicable	0	0	0	0	0	0					
2010	Triglyceride concentration and waist circumference influence alcohol-related plasminogen activator inhibitor-1 activity increase in black South Africans.	Art	(Pieters *et al.*, 2010)	Nutrition Dietetics	Int	Int	2	3	6	8	0.268	0.357			
2011	Associations between indices of iron status, anthropometric and biological markers of cardiovascular disease risk	Doc	(Aderibigbe, 2011)	Not applicable	0	Int	0	0	1	1					
2011	The relationship between indices of iron status and selected anthropometric cardiovascular disease risk markers in an African population: the THUSA study	Art	(Aderibigbe *et al.*, 2011)	Cardiac Cardiovascular Systems	Int	Int	5	6	16	18	1.313	1.477			
2011	The social drift phenomenon : associations between the socio–economic status and cardiovascular disease risk in an African population undergoing a health transition	Mast	(Behanan, 2011)	Not applicable	0	0	0	0	0	0					
2011	The sensitivity of waist-to-height ratio in identifying children with high blood pressure	Art	(Motswagole *et al.*, 2011)	Cardiac Cardiovascular Systems	Int	Int	10	11	29	31	2.380	2.544			
2012	The role of attitude and barriers on the implementation of a nutrition intervention in primary school children	Mast	(Harris, 2012)	Not applicable	0	Nat	0	0	1	1					
2012	Body composition in stunted, compared to non-stunted, black South African children, from two rural communities.	Art	(Motswagole *et al.*, 2012)	Nutrition Dietetics	Int	Int	2	2	2	2	0.096	0.096			
2014	The relationship between iron status and adiposity in women from developing countries: a review	Art	(Aderibigbe *et al.*, 2014)	Nutrition Dietetics	Int	Int	7	7	14	16	0.893	1.020			
2014	The association between fibrinolysis markers and body composition in black adults in the North West Province of South Africa	Mast	(Eksteen, 2014)	Not applicable	0	0	0	0	0	0					
2014	Body composition, bone health and vitamin D status of African adults in the North West Province	Doc	(Sotunde, 2014)	Not applicable	0	0	0	0	0	0					

Table 0-10: (11) Overweight and obesity - impact and reach of student publications on the scientific and public health communities

(Continued)

(11) Overweight and obesity				Scientific community									Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact			
							3 years post-publication		All-time					
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc	3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,														
2015	Associations between specific measures of adiposity and high blood pressure in black South African women	Mast	(Doubell, 2015)	Not applicable	0	0	0	0	0	0				
2015	The association of clot lysis time with total obesity is pArtly independent from the association of PAI-1 with central obesity in African adults.	Art	(Eksteen *et al.*, 2015)	Nutrition Dietetics	Int	Int	3	4	3	5	0.272	0.454		
2015	Lean mass appears to be more strongly associated with bone health than fat mass in urban black South African women	Art	(Sotunde *et al.*, 2015)	Nutrition Dietetics	Int	Int	9	9	15	17	1.663	1.885		
2016	Plasminogen activator inhibitor-1 in black South Africans, methodological and clinical considerations	Doc	(Barnard, 2016)	Not applicable	0	0	0	0	0	0				
2016	Degree of obesity influences the relationship of PAI-1 with body fat distribution and metabolic variables in African women	Art	(Barnard *et al.*, 2016b)	Peripheral Vascular Disease	Int	Int	2	2	3	3	0.698	0.698		
2016	The contribution of different adipose tissue depots to plasma plasminogen activator inhibitor-1 (PAI-1) levels	Art	(Barnard *et al.*, 2016a)	Hematology	Int	Int	13	13	16	16	3.714	3.714		
2017	Agreement between specific measures of adiposity and associations with high blood pressure in black South African women	Art	(Kruger *et al.*, 2017)	Biology	Int	Int	0	1	0	1	0.000	0.327		
2017	The relationship between female adiposity and physical attractiveness amongst adults in Ranaka village, Botswana	Mast	(Seru, 2017)	Not applicable	0	0	0	0	0	0				
2018	The relationship between female adiposity and physical attractiveness amongst adults in rural Ranaka village, Botswana	Art	(Kruger *et al.*, 2018)	Nutrition Dietetics	0	0	0	0	0	0	0.000	0.000		
2018	The association between anthropometric measures and physical performance in black adults of the North West Province, South Africa	Mast	(Mamphwe, 2018)	Not applicable	0	0	0	0	0	0				
2018	Comparison of weight gain to age-and sex-specific norms in children 2 to 10 years old on highly active anti-retroviral treatment	Mast	(Scholtz, 2018)	Not applicable	Nat	Nat	1	1	1	1				
2019	Waist circumference percentiles of black South African children aged 10-14 years from different study sites	Art	(Motswagole *et al.*, 2019)	Pediatrics	0	0	0	0	0	0	0.000	0.000		
Number of articles equal to or exceeding the average expected citation counts for this theme:											n=10	n=11		

[Annexure](#) Table 0-2 Table 0-3 Table 0-4 Table 0-5 Table 0-6 Table 0-7 Table 0-8 Table 0-9 Table 0-10 Table 0-11 Table 0-12 Table 0-13 Table 0-14 Table 0-15 Table 0-16 Table 0-17

Table 0-11: (12) Food and nutrition policies - impact and reach of student publications on the scientific and public health communities

(12) Food and nutrition policies				Scientific community										Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact			
							3 years post-publication		All-time					
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc		
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,															
2010	Factors affecting mothers' choice of breastfeeding vs. formula feeding in the lower Umfolozi district war memorial hospital, KwaZulu-Natal.	Art	(Swarts *et al.*, 2010)	Nutrition Dietetics	Int	Int	1	1	21	21	0.938	0.938		
2012	A critical analysis of the labels of processed complementary foods for infants and young children in South Africa against international marketing guidelines	Mast	(Sweet, 2012)	Not applicable	0	Int	0	0	0	1				
2017	Sodium content of foodstuffs included in the sodium reduction regulation of South Africa	Art	(Swanepoel *et al.*, 2017)	Food Science Technology	Int	Int	2	2	2	2	0.456	0.456		
Number of articles equal to or exceeding the average expected citation counts for this theme:											n=0	n=0		

Annexure | Table 0-2 | Table 0-3 | Table 0-4 | Table 0-5 | Table 0-6 | Table 0-7 | Table 0-8 | Table 0-9 | Table 0-10 | Table 0-11 | Table 0-12 | Table 0-13 | Table 0-14 | Table 0-15 | Table 0-16 | Table 0-17

Table 0-12: (13) Nutrition and pregnancy - impact and reach of student publications on the scientific and public health communities

(13) Nutrition and Pregnancy				Scientific community										Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact			
							3 years post-publication		All-time					
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc		
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,															
2004	Pregnancy weight gain and outcomes	Mast	(Rheeder, 2004)	Not applicable	0	0	0	0	0	0				
2005	Dietary intake and pregnancy outcome of pregnant women in an outpatient clinic	Mast	(Van der Walt, 2005)	Not applicable	0	Int	0	0	4	4				
2016	The comparison of antenatal education, breastfeeding knowledge and neonatal positioning and attachment of HIV reactive and HIV non-reactive primgravidae	Mast	(Greyvenstein, 2016)	Not applicable	0	0	0	0	0	0				
2018	Iron status in relation to morbidity when considering iron supplementation among urban pregnant women in South Africa	Mast	(Goodchild, 2018)	Not applicable	0	0	0	0	0	0				
2018	Effects of pre-and postnatal iron and n-3 fatty acid depletion, alone and in combination, on bone development in rats	Mast	(Strydom, 2018)	Not applicable	0	0	0	0	0	0				
2018	Fatty acid and micronutrient intake and status in association with allergy among pregnant urban women in South Africa	Mast	(Van Zyl, 2018)	Not applicable	0	0	0	0	0	0				
2019	Consumption of traditional and indigenous foods and their contribution to nutrient intake among children and women in Botswana	Art	(Kasimba *et al.*, 2019)	Nutrition Dietetics	0	0	0	0	0	0	0.000	0.000		
Number of articles equal to or exceeding the average expected citation counts for this theme:											n=0	n=0		

Annexure | Table 0-2 | Table 0-3 | Table 0-4 | Table 0-5 | Table 0-6 | Table 0-7 | Table 0-8 | Table 0-9 | Table 0-10 | Table 0-11 | Table 0-12 | Table 0-13 | Table 0-14 | Table 0-15 | Table 0-16 | Table 0-17

Table 0-13: (14) Nutrition-friendly schools - impact and reach of student publications on the scientific and public health communities

(14) Nutrition-friendly schools				Scientific community										Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact				
							3 years post-publication		All-time						
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc		3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,															
2003	A comparison between the effects of black tea and rooibos on the iron status of primary school children	Mast	(Breet, 2003)	Not applicable	0	0	0	0	0	0					
2005	Actions of black tea and Rooibos on iron status of primary school children.	Art	(Breet *et al.*, 2005)	Nutrition Dietetics	0	Int	0	0	19	20	0.605	0.637			
2009	Assessment of hazard analysis and critical control points principles in primary school feeding schemes in the Western Region of Gauteng	Mast	(Müller, 2009)	Not applicable	0	0	0	0	0	0					
2012	The role of attitude and barriers on the implementation of a nutrition intervention in primary school children	Mast	(Harris, 2012)	Not applicable	0	Nat	0	0	1	1					
Number of articles equal to or exceeding the average expected citation counts for this theme:											n=0	n=0			
Annexure	Table 0-2	Table 0-3	Table 0-4	Table 0-5	Table 0-6	Table 0-7	Table 0-8	Table 0-9	Table 0-10	Table 0-11	Table 0-12	Table 0-13	Table 0-14	Table 0-15	Table 0-16	Table 0-17

Table 0-14: (15) Food and nutrition security - impact and reach of student publications on the scientific and public health communities

(15) Food and nutrition security				Scientific community										Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact				
							3 years post-publication		All-time						
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc		3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,															
1999	The development and standardisation of a scale to measure food security	Mast	(Hanekom, 1999)	Not applicable	0	0	0	0	0	0					
2014	The use of predefined diet quality scores in the context of CVD risk during urbanization in the South African Prospective Urban and Rural Epidemiological (PURE) study	Art	(Dolman *et al.*, 2014)	Public Environmental Occupational Health	Int	Int	2	5	8	11	0.812	1.116			
2018	Household access to traditional and indigenous foods positively associated with food security and dietary diversity in Botswana	Art	(Kasimba *et al.*, 2018)	Nutrition Dietetics	Int	Int	0	1	1	2	0.382	0.764			
2006	Poverty and household food security of black South African farm workers: legacy of social inequalities.	Art	(Kruger *et al.*, 2006)	Nutrition Dietetics	Int	Int	7	8	43	46	1.220	1.305			
Number of articles equal to or exceeding the average expected citation counts for this theme:											n=1	n=1			
Annexure	Table 0-2	Table 0-3	Table 0-4	Table 0-5	Table 0-6	Table 0-7	Table 0-8	Table 0-9	Table 0-10	Table 0-11	Table 0-12	Table 0-13	Table 0-14	Table 0-15	Table 0-16	Table 0-17

Table 0-15: (17) Undernutrition - impact and reach of student publications on the scientific and public health communities

(17) Undernutrition				Scientific community									Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact			
							3 years post-publication		All-time					
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc	3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,														
2001	Co-existence of over-and undernutrition related diseases in low income, high-burden countries: a contribution towards the 17th IUNS congress of nutrition, Vienna 2001	Art	(Rutengwe *et al.*, 2001)	Nutrition Dietetics	Int	Int	2	2	8	8	0.244	0.244		
2002	Impact of urbanisation on serum lipid profiles--the THUSA survey	Art	(Oosthuizen *et al.*, 2002)	Nutrition Dietetics	Nat	Int	1	1	31	33	0.912	0.970		
2003	The association between stunting and overweight among 10-15 year old children in the North West Province	Mast	(Mukuddem-Petersen, 2003)	Not applicable	0	0	0	0	0	0				
2004	Association between stunting and overweight among 10–15-y-old children in the North West Province of South Africa: the THUSA BANA Study	Art	(Mukuddem-Petersen & Kruger, 2004)	Nutrition Dietetics	Int	Int	7	9	81	89	2.499	2.746		
2008	Overfatness, stunting and physical inactivity are determinants of plasminogen activator inhibitor-1activity, fibrinogen and thrombin – antithrombin complex in African adolescents.	Art	(Nienaber *et al.*, 2008)	Hematology	Int	Int	3	4	13	14	0.779	0.839		
2010	Stunting, adiposity and low-grade inflammation in African adolescents from a township high school.	Art	(Kruger *et al.*, 2010)	Nutrition Dietetics	Int	Int	6	6	25	26	1.116	1.161		
2018	Assessment and evaluation of in-patient diagnosis and discharge protocols of Ghanaian infant and children (0-59months) diagnosed with severe acute malnutrition - the SAMAC study	Mast	(Carboo, 2018)	Not applicable	0	0	0	0	0	0				
Number of articles equal to or exceeding the average expected citation counts for this theme:											n=2	n=2		

Annexure | Table 0-2 | Table 0-3 | Table 0-4 | Table 0-5 | Table 0-6 | Table 0-7 | Table 0-8 | Table 0-9 | Table 0-10 | Table 0-11 | Table 0-12 | Table 0-13 | Table 0-14 | Table 0-15 | Table 0-16 | Table 0-17

Table 0-16: (18) Vitamins and minerals - impact and reach of student publications on the scientific and public health communities

(18) Vitamins and minerals				Scientific community										Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact			
							3 years post-publication		All-time					
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc		3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,															
2001	Die effek van mikronutriëntsupplementasie op merkers van verworwe immuniteitsgebreksindroom	Mast	(Dercksen, 2001)	Not applicable	0	0	0	0	0	0					
2001	Evaluation of the effects of an instant soy and maize meal supplement on the vitamin A status of patients infected with the human immune deficient virus.	Mast	(Hanson, 2001)	Not applicable	0	0	0	0	0	0					
2014	Low immune cell ARA and high plasma 12-HETE and 17-HDHA in iron-deficient South African school children with allergy.	Art	(Malan *et al.*, 2014a)	Nutrition Dietetics	Nat	Nat	1	1	1	1	0.064	0.064			
2001	Evaluation of the fortification of sugar with vitamin A	Doc	(Oldewage-Theron, 2001)	Not applicable	0	Nat	0	0	0	2					
2001	The impact of vitamin A fortified sugar on the nutritional status and intakes of 13 - 25 years females in the Vaal Triangle	Mast	(Selepe, 2001)	Not applicable	0	0	0	0	0	0					
2001	Vitamien C se effek op serumlipiede in hiperlipidemiese pasiënte	Mast	(Spies, 2001)	Not applicable	0	0	0	0	0	0					
2001	Die ysterstatus van pasiënte met menslike immuniteitsgebreksvirus voor en na mikronitriëntsupplemenering	Mast	(Steyn, 2001)	Not applicable	0	0	0	0	0	0					
2003	A comparison between the effects of black tea and rooibos on the iron status of primary school children	Mast	(Breet, 2003)	Not applicable	0	0	0	0	0	0					
2003	The relationship between calcium, vitamin D status, anthropometry, physical activity and bone density in Black men : a case control study	Mast	(Groenewald, 2003)	Not applicable	0	0	0	0	0	0					
2003	The effect of vitamin A status on the iron status of African females in the North West Province: the THUSA study	Doc	(Hanekom, 2003)	Not applicable	0	0	0	0	0	0					
2003	The effects of vitamin C on the haemostatic system	Mast	(Loots, 2003)	Not applicable	0	0	0	0	0	0					
2003	The effectiveness of micronutrient fortification of maize meal in improving the nutritional status of children	Doc	(Nesamvuni, 2003)	Not applicable	0	0	0	0	0	0					
2004	Foodstate vitamin C complex may beneficially affect haemostasis and fibrin network structure in hyperlipidaemic patients	Art	(Loots *et al.*, 2004)	Nutrition Dietetics	Int	Int	1	1	6	8	0.185	0.247			
2004	Dietary calcium intake and obesity in adult women : the POWIRS study	Mast	(Rautenbach, 2004)	Not applicable	0	0	0	0	0	0					
2005	The association between black tea consumption and iron status of African women in the North West Province : THUSA study	Mast	(Muller, 2005)	Not applicable	0	0	0	0	0	0					
2005	Fortification of maize meal improved nutritional status of 1-3 year old African children.	Art	(Nesamvuni *et al.*, 2005)	Nutrition Dietetics	Nat	Int	5	5	36	37	1.146	1.178			
2007	Polyphenols, ascorbate and antioxidant capacity of the Kei-apple (Dovyalis caffra)	Mast	(De Beer, 2007)	Not applicable	0	Int	0	0	5	5					
2007	An inverse association between calcium intake and adiposity in women with high fat and calcium intakes.	Art	(Kruger *et al.*, 2007)	Nutrition Dietetics	Int	Int	3	3	13	14	0.471	0.507			
2007	Bioavailability of iron from fortified maize using stable isotope techniques	Doc	(White, 2007)	Not applicable	0	0	0	0	0	0					
2008	Micronutrient dilution associated with alcohol and added sugar intake in the THUSA population	Mast	(Serfontein, 2008)	Not applicable	0	0	0	0	0	0					
2009	The validity of a short questionnaire on Iron intake and Iron status in humans	Doc	(Kunneke, 2009)	Not applicable	0	0	0	0	0	0					
2009	The feasibility of implementing a point-of-use micronutrient fortification among African pre-school children : a pilot study.	Mast	(Ogunlade, 2009)	Not applicable	0	0	0	0	0	0					
2010	Alcohol intake and micronutrient density in a population in transition: the transition and health during urbanisation in South Africa (THUSA) study	Art	(Serfontein *et al.*, 2010)	Nutrition Dietetics	Nat	Int	1	1	5	5	0.223	0.223			
2011	Associations between indices of iron status, anthropometric and biological markers of cardiovascular disease risk	Doc	(Aderibigbe, 2011)	Not applicable	0	Int	0	0	1	1					

Table 0-16: (18) Vitamins and minerals - impact and reach of student publications on the scientific and public health communities
(Continued)

(18) Vitamins and minerals				Scientific community									Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact			
							3 years post-publication		All-time					
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc	3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,														
2011	The relationship between indices of iron status and selected anthropometric cardiovascular disease risk markers in an African population: the THUSA study	Art	(Aderibigbe *et al.*, 2011a)	Cardiac Cardiovascular Systems	Int	Int	5	6	16	18	1.313	1.477		
2011	Iron status and cardiovascular disease risk in black South African women: the PURE study	Art	(Aderibigbe *et al.*, 2011b)	Public Environmental Occupational Health	0	Int	0	0	2	3	0.156	0.233		
2011	Effects of iron and omega–3 fatty acid supplementation on physical activity of iron deficient primary school children residing in KwaZulu–Natal	Mast	(Greeff, 2011)	Not applicable	0	0	0	0	0	0				
2011	Point-of-use micronutrient fortification: lessons learned in implementing a preschool-based pilot trial in South Africa	Art	(Ogunlade *et al.*, 2011)	Nutrition Dietetics	Int	Int	5	7	20	24	1.042	1.250		
2011	Iron status, anthropometric status and cognitive performance of black African school children aged 6-11 years in the Klerksdorp area	Mast	(Taljaard, 2011)	Not applicable	Nat	Int	0	1	1	2				
2012	Measuring micronutrient intakes at different levels of sugar consumption in a population in transition: the Transition and Health during Urbanisation in South Africa (THUSA) study.	Art	(MacIntyre *et al.*, 2012)	Nutrition Dietetics	Int	Int	3	4	14	14	0.675	0.675		
2012	Effect of a micronutrient–fortified beverage on cognition and nutritional status of primary school children	Doc	(Taljaard, 2012)	Not applicable	0	0	0	0	0	0				
2013	Studies since 2005 on South African primary schoolchildren suggest lower anaemia prevalence in some regions	Art	(Taljaard *et al.*, 2013a)	Nutrition Dietetics	Nat	Int	3	3	7	9	0.522	0.672		
2013	Effects of a multi-micronutrient-fortified beverage, with and without sugar, on growth and cognition in South African schoolchildren: a randomised, double-blind, controlled intervention	Art	(Taljaard *et al.*, 2013b)	Nutrition Dietetics	Int	Int	7	8	20	25	1.492	1.865		
2014	The relationship between iron status and adiposity in women from developing countries: a review	Art	(Aderibigbe *et al.*, 2014)	Nutrition Dietetics	Int	Int	7	7	14	16	0.893	1.020		
2014	A critical analysis of iron status indicators in three independent studies of South African primary school children	Mast	(Harris, 2014)	Not applicable	0	0	0	0	0	0				
2014	A strategy for scaling up vitamin A supplementation for young children in a remote rural setting in Zimbabwe.	Art	(Dube *et al.*, 2014)	Nutrition Dietetics	0	0	0	0	0	0	0.000	0.000		
2014	Effects of iron and omega-3 supplementation on the immune system of iron deficient children in South Africa: a randomised controlled trial	Doc	(Malan, 2014)	Not applicable	0	0	0	0	0	0				
2014	n–3 Long-chain PUFAs reduce respiratory morbidity caused by iron supplementation in iron-deficient South African schoolchildren: a randomized, double-blind, placebo-controlled intervention	Art	(Malan *et al.*, 2014b)	Biochemistry Molecular Biology	Int	Int	7	13	9	15	0.559	0.931		
2014	Iron and zinc bioaccessibility from African leafy vegetables: implications for nutrition	Mast	(Mongwaketse, 2014)	Not applicable	0	0	0	0	0	0				
2014	Iron status, inflammation and anthropometric nutritional status of four–to–thirteen month old black infants from a rural South African population	Mast	(Nel, 2014)	Not applicable	0	0	0	0	0	0				
2014	Body composition, bone health and vitamin D status of African adults in the North West Province	Doc	(Sotunde, 2014)	Not applicable	0	0	0	0	0	0				
2014	The effect of African leafy vegetables on the alleviation of micronutrient deficiencies in school children residing in the North West Province of South Africa	Doc	(Van der Hoeven, 2014)	Not applicable	Nat	Nat	0	1	0	1				
2015	Monitoring the reduction of sodium content of selected food items using label information in South Africa	Mast	(Hattingh, 2015)	Not applicable	0	0	0	0	0	0				
2015	Potential contribution of African green leafy vegetables and maize porridge composite meals to iron and zinc nutrition	Art	(Kruger *et al.*, 2015)	Nutrition Dietetics	Nat	Int	3	5	11	16	0.999	1.452		
2015	Differential ferritin interpretation methods that adjust for inflammation yield discrepant iron-deficiency prevalence	Art	(Nel *et al.*, 2015)	Nutrition Dietetics	Int	Int	6	6	7	7	0.635	0.635		
2015	Acceptability of Novel Small-Quantity Lipid-Based Nutrient Supplements for Complementary Feeding in a Peri-Urban South African Community	Art	(Rothman *et al.*, 2015)	Nutrition Dietetics	Nat	Int	1	1	4	6	0.363	0.545		

Table 0-16: (18) Vitamins and minerals - impact and reach of student publications on the scientific and public health communities
(Continued)

(18) Vitamins and minerals				Scientific community										Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact			
							3 years post-publication		All-time					
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc		3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,															
2015	Long-chain n-3 PUFA supplementation decreases physical activity during class time in iron-deficient South African school children.	Art	(Smuts *et al.*, 2015)	Nutrition Dietetics	Int	Int	6	7	8	9	0.726	0.817			
2015	Effect of African leafy vegetables on the micronutrient status of mildly deficient farm-school children in South Africa: a randomized controlled study.	Art	(Van der Hoeven *et al.*, 2016)	Nutrition Dietetics	Int	Int	2	3	4	6	0.363	0.545			
2015	Relationship of salt usage behaviours and urinary sodium excretion in normotensive South African adults	Mast	(Visser, 2015)	Not applicable	0	Nat	0	0	1	1					
2016	Effects of zinc fortification on the plasma fatty acid composition of Beninese school children : a randomised, double-blind controlled trial	Mast	(Chimhasha, 2016)	Not applicable	0	0	0	0	0	0					
2016	Iron and a mixture of DHA and EPA supplementation, alone and in combination, affect bioactive lipid signalling and morbidity of iron deficient South African school children in a two-by-two randomised controlled trial.	Art	(Malan *et al.*, 2016)	Nutrition Dietetics	Int	Int	3	4	3	4	0.333	0.443			
2016	Iodine nutrition in mothers and their infants during breastfeeding and complementary feeding	Doc	(Osei, 2016)	Not applicable	0	0	0	0	0	0					
2016	Breast-milk iodine concentrations, iodine status, and thyroid function of breastfed infants aged 2-4 months and their mothers residing in a South African township	Art	(Osei *et al.*, 2016)	EnDocrinology Metabolism	Int	Int	12	12	11	13	1.647	1.947			
2016	Association of 25-hydroxyvitamin D and parathyroid hormone with the metabolic syndrome in black South African women	Art	(Sotunde *et al.*, 2016)	Nutrition Dietetics	Int	Int	1	1	1	1	0.111	0.111			
2016	Sodium and potassium intake in South Africa: an evaluation of 24-hour urine collections in a white, black, and Indian population	Art	(Swanepoel *et al.*, 2016)	Nutrition Dietetics	Int	Int	7	17	9	20	0.998	2.217			
2017	Effects of lipid-based nutrient supplements on the immunity of 6-month old infants: a randomised controlled trial	Mast	(Joosten, 2017)	Not applicable	0	0	0	0	0	0					
2017	Efficacy of lipid nutrient supplements on growth and micronutrient status in infants	Doc	(Matsungo, 2017)	Not applicable	0	0	0	0	0	0					
2017	Lipid-based nutrient supplements and linear growth in children under 2 years: A review	Art	(Matsungo *et al.*, 2017)	Nutrition Dietetics	Int	Int	6	7	6	7	1.196	1.395			
2017	Iodine status and associations with feeding practices and psychomotor milestone development in six-month-old South African infants	Art	(Osei *et al.*, 2017)	Nutrition Dietetics	Int	Int	4	6	4	6	0.797	1.196			
2017	Sodium content of foodstuffs included in the sodium reduction regulation of South Africa	Art	(Swanepoel *et al.*, 2017)	Food Science Technology	Int	Int	2	2	2	2	0.456	0.456			
2017	Sodium intake in South Africa: an analysis of food supply, 24-hour excretion and blood pressure in a tri-ethnic population	Doc	(Swanepoel, 2017)	Not applicable	0	0	0	0	0	0					
2018	Sensitivity of fatty acid desaturation and elongation to plasma zinc concentration: A randomised controlled trial in Beninese children	Art	(Chimhashu *et al.*, 2018)	Nutrition Dietetics	Int	Int	2	2	2	2	0.764	0.764			
2018	Iron status in relation to morbidity when considering iron supplementation among urban pregnant women in South Africa	Mast	(Goodchild, 2018)	Not applicable	0	0	0	0	0	0					
2018	Sodium content of processed foods frequently consumed by children in early childhood development centres in the North-West Province	Mast	(Korff, 2018)	Not applicable	0	0	0	0	0	0					
2018	CRP genotypes predict increased risk to co-present with low vitamin D and elevated CRP in a group of healthy black South African women	Art	(Myburgh *et al.*, 2018)	Environmental Sciences	Int	Int	4	4	4	4	1.381	1.381			
2018	Infant Development at the Age of 6 Months in Relation to Feeding Practices, Iron Status, and Growth in a Peri-Urban Community of South Africa	Art	(Rothman *et al.*, 2018)	Nutrition Dietetics	Int	Int	1	2	1	2	0.382	0.764			
2018	Effects of pre-and postnatal iron and n-3 fatty acid depletion, alone and in combination, on bone development in rats	Mast	(Strydom, 2018)	Not applicable	0	0	0	0	0	0					

Table 0-16: (18) Vitamins and minerals - impact and reach of student publications on the scientific and public health communities
(Continued)

(18) Vitamins and minerals				Scientific community										Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact			
							3 years post-publication		All-time					
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc		
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,															
2018	Monitoring the South African population's salt intake: spot urine v. 24 h urine	Art	(Swanepoel *et al.*, 2018)	Nutrition Dietetics	Int	Int	8	8	8	8	3.056	3.056			
2018	Consumers' attitudes regarding the use of the salt information on food labels	Mast	(Van Staden, 2018)	Not applicable	0	0	0	0	0	0					
2018	Fatty acid and micronutrient intake and status in association with allergy among pregnant urban women in South Africa	Mast	(Van Zyl, 2018)	Not applicable	0	0	0	0	0	0					
2019	Effect of small-quantity lipid-based nutrient supplements on growth, psychomotor development, iron status, and morbidity among 6-to 12-mo-old infants in South Africa: a randomized controlled trial.	Art	(Smuts *et al.*, 2019)	Nutrition Dietetics	Int	Int	2	3	2	3	3.449	5.173			
2019	Contribution of commercial infant products and fortified staple foods to nutrient intake at ages 6, 12, and 18 months in a cohort of children from a low socio-economic community in South Africa	Art	(Swanepoel *et al.*, 2019)	Nutrition Dietetics	0	0	0	0	0	0	0.000	0.000			
Number of articles equal to or exceeding the average expected citation counts for this theme:											n=9	n=13			

Annexure | Table 0-2 | Table 0-3 | Table 0-4 | Table 0-5 | Table 0-6 | Table 0-7 | Table 0-8 | Table 0-9 | Table 0-10 | Table 0-11 | Table 0-12 | Table 0-13 | Table 0-14 | Table 0-15 | Table 0-16 | Table 0-17

Table 0-17: (20) Other - impact and reach of student publications on the scientific and public health communities

(20) Other				Scientific community										Government documents Citation count	
				Normalisation category	Publication reach		Citation counts				Impact			
							3 years post-publication		All-time					
Year	Title	Document type	Reference		3 years	All-time	w/sc	wsc	w/sc	wsc	w/sc	wsc	3 years	All-time
Document type: Art = Article, Doc = Doctorate, Mast = Masters; Publication reach either 3 years post-publication or of all-time: Nat = National, or Int = International. w/sc = Without self-citation, wsc = with self-citation,														
1998	Purchasing efficiency in the mining foodservice industry	Mast	(Oldewage-Theron, 1998)	Not applicable	0	0	0	0	0	0				
1999	Purchasing efficiency in a mining food service organisation	Art	(Oldewage-Theron *et al.*, 1999)	Nutrition Dietetics	0	Int	0	0	1	1	0.032	0.032		
2000	Intra-and inter-individual variations in the glucose response to different standards and test foods	Mast	(Botes, 2000)	Not applicable	0	0	0	0	0	0				
2002	Markers of skeletal muscle damage as predictors of delayed onset muscle soreness	Mast	(Opperman, 2002)	Not applicable	0	0	0	0	0	0				
2002	The sensory, lipid and haemostatic profile evaluation of a potential functional food using red palm olein	Doc	(Scholtz, 2002)	Not applicable	0	0	0	0	0	0				
2002	Effect of freeze-drying, freezing and frozen storage of blood plasma on fibrin network characteristics	Art	(Pieters *et al.*, 2002)	Biochemistry Molecular Biology	Int	Int	1	1	22	23	0.441	0.461		
2003	Consumers' attitudes regarding the link between frozen and fresh vegetables and health	Mast	(Van der Walt, 2003)	Not applicable	0	Nat	0	0	1	1				
2003	Evaluation of the methodology for determining the glycaemic index of foods with special reference to blood sampling	Mast	(Van Heerden, 2003)	Not applicable	0	0	0	0	0	0				
2003	Intra- and inter-individual variation in glucose response to white bread and oral glucose in healthy women.	Art	(Nell *et al.*, 2003)	Nutrition Dietetics	Int	Int	2	2	6	6	0.160	0.160		
2004	Meta-analysis and systematic review of the benefits expected when the glycaemic index is used in planning diets	Doc	(Opperman, 2004)	Not applicable	0	0	0	0	0	0				
2004	Meta-analysis of the health effects of using the glycaemic index in meal-planning	Art	(Opperman *et al.*, 2004)	Nutrition Dietetics	Int	Int	35	37	252	254	7.775	7.837		
2005	Development of a functional beverage from the Kei apple fruit Dovyalis caffra	Mast	(Gore, 2005)	Not applicable	0	Int	0	0	3	3				
2005	The effect of extrusion processing on the glycaemic index of dry bean products.	Art	(Oosthuizen *et al.*, 2005)	Nutrition Dietetics	0	Int	0	0	2	2	0.064	0.064		
2005	Some health benefits of low glycaemic diets: a systematic review.	Art	(Opperman *et al.*, 2005)	Nutrition Dietetics	Nat	Int	2	2	3	3	0.095	0.095		
2005	Measuring the glycaemic index: Consensus and issues of debate.	Art	(Pieters & Jerling, 2005)	Nutrition Dietetics	Nat	Int	2	2	6	6	0.191	0.191		
2005	The impact of training on productivity in mass food production	Mast	(Van Zyl, 2005)	Not applicable	0	0	0	0	0	0				
2005	More evidence for capillary sampling in the determination of the glycaemic index.	Art	(Venter *et al.*, 2005)	Nutrition Dietetics	Nat	Int	1	2	3	4	0.095	0.127		
2006	The processes of planning and nutrient analysis of diets for controlled feeding trials in free-living subjects	Mast	(Van der Watt, 2006)	Not applicable	0	0	0	0	0	0				
2008	The effect of a fatty acid-based carrier on the bioavailability of epigallocatechin gallate	Mast	(Moruisi, 2008)	Not applicable	0	0	0	0	0	0				
2008	The process of nutrient analysis for controlled feeding trials: A comparative study of two South African nutrient databases with chemical analysis	Art	(Van der Watt *et al.*, 2008)	Medicine Research Experimental	0	Int	0	0	2	2	0.098	0.098		
2009	South African consumers' opinions and consumption of soy and soy products.	Art	(Bosman *et al.*, 2009)	Business	Nat	Int	1	2	7	9	0.589	0.757		
2010	Alcohol metabolism and health hazards associated with alcohol abuse in a South African context: a review	Art	(Pisa *et al.*, 2010)	Nutrition Dietetics	Int	Int	3	3	4	4	0.179	0.179		
2011	South African consumers' opinions and beliefs regarding the health benefits of soy and soy products.	Art	(Bosman *et al.*, 2011)	Business	0	Int	0	0	1	2	0.109	0.217		
2012	The validation of a suitable nutrient profiling model for South Africa	Mast	(Wicks, 2012)	Not applicable	0	Nat	0	0	3	3				
2013	Using existing dietary data for evaluating the construct validity of a nutrient profiling model	Mast	(Lee, 2013)	Not applicable	0	0	0	0	0	0				
2013	Pathogenic weight control measures and disordered eating behaviour of female student dancers	Mast	(Robbeson, 2013)	Not applicable	0	0	0	0	0	0				
2014	A desire for weight loss in season increases disordered eating behaviour risk and energy deficiency in athletes	Art	(Wright *et al.*, 2014)	Nutrition Dietetics	Int	Int	3	3	3	3	0.191	0.191		
2015	Disordered eating behavior, body image, and energy status of female student dancers	Art	(Robbeson *et al.*, 2015)	Nutrition Dietetics	Int	Int	12	13	24	24	2.179	2.179		
2017	Fibrinogen and clot-related phenotypes determined by fibrinogen polymorphisms: Independent and IL-6-interactive associations	Art	(Cronje *et al.*, 2017)	Multidisciplinary sciences	Int	Int	2	2	2	2	0.605	0.605		
2017	Candidate gene analysis of the fibrinogen phenotype reveals the importance of polygenic co-regulation	Art	(Cronjé *et al.*, 2017)	Biochemistry Molecular Biology	Int	Int	1	1	1	1	0.163	0.163		
2019	Plasma phospholipid fatty acids are associated with altered fibrin clot properties in a population-based setting	Art	(De Lange *et al.*, 2019)	Biochemistry Molecular Biology	0	0	0	0	0	0	0.000	0.000		
Number of articles equal to or exceeding the average expected citation counts for this theme:											n=2	n=2		

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