Development and testing of a standardized training manual:

Diet and the Nutritional Management of Diabetes Mellitus: A Comprehensive Guide for Health Practitioners

by
Ursula Rausch

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Supervisor: Dr Martani J Lombard
Co-supervisor: Mrs Irene Labuschagne

Faculty of Health Sciences
Department of Interdisciplinary Health Sciences
Division of Human Nutrition

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DECLARATION OF ORIGINAL WORK

By submitting this thesis electronically, I declare that the entirety of the work contained therein is my own original work, that I am the authorship owner thereof (unless to the extent explicitly otherwise stated) and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

Signature: Ursula Rausch Date: 28 November 2013

ABSTRACT

Objective

To develop and test a marketable, Continuing Professional Development (CPD) accredited training manual focused on the role of medical nutrition therapy (MNT) for healthcare professionals (HCP) of the multidisciplinary Type 1 and Type 2 Diabetes Mellitus (DM) management team.

Methods

The study consisted of two components: (a) development of the MNT manual and (b) testing of the MNT manual.

The development of the MNT manual consisted of seven steps: (1) needs assessment and problem definition; (2) literature search; (3) draft one of the MNT manual; (4) peer review; (5) draft two of the MNT manual; (6) expert panel evaluation; and (7) the final MNT manual.

The testing of the MNT manual's impact on knowledge had a test-retest design which consisted of seven steps: (1) DM knowledge questionnaire development; (2) participant recruitment; (3) questionnaire pilot; (4) initial knowledge testing; (5) self-study of MNT manual; (6) retesting of knowledge; (7) statistical analysis.

Results

From the literature a total of 132 published documents were selected for inclusion in the MNT manual after grading of the information. The first draft was compiled and sent for peer review and language editing. Recommended changes were made and the second draft was developed and sent to an expert panel consisting of 79 registered dietitians (RDs), of whom the majority were satisfied with the content. This led to the final MNT manual.

The questionnaire was compiled using the content of the MNT manual and creating 10 questions per section of the manual. The pilot was conducted using 10% (n = 7) of the total sample. Minor changes were made.

For knowledge testing, participants included RDs between the ages of 23 and 60 years, registered with the Health Professions Council of South Africa. A test-retest design was used. Participants scored a mean of 57.5% on the initial knowledge questionnaire (KQ1), ranging between 33.6% and 79.8%. They lacked knowledge on: management of the hospitalised patient; diabetes and exercise; diabetes and religion; gestational diabetes; supplements commonly used by diabetics; diabetes in prisons; diabetes in children; the function, side-effects and contra-indications of metformin.

The mean score on the second knowledge questionnaire (KQ2) increased to 90.5%, with the lowest score 50.4% and the highest 99.2%.There were two questions where participants scored < 50% (mean of *n* = 79) which related to the type of insulin regime most suitable during Ramadan and risk factors for Type 2 DM in children.

Data were also analyzed according to various socio-demographic variables, but no significant differences were found between groups.

Conclusions and implications

There is adequate research available to develop a comprehensive guide for HCP on the nutritional management of DM. Such an MNT manual should be marketed for CPD purposes to encourage HCP to improve their DM management skills, as seen by the dramatic improvement in DM management knowledge of the RDs participating in this research. Future studies may include knowledge testing of other HCP, as well as testing to determine if the newly acquired information is put into practice to the benefit of DM patients.

OPSOMMING

Objektiewe

Die ontwikkeling en toets van 'n bemarkbare, Voortgesette Professionele Ontwikkeling (VPO) geakkrediteerde handleiding oor die rol van mediese voedings terapie (MVT) vir mediese personeel van die multi-dissiplinêre Tipe 1- en Tipe 2 Diabetes Mellitus (DM) behandelings span.

Metodes

Die studie het bestaan uit 2 komponente: (a) die ontwikkeling van die MVT handleiding en (b) die toets van die MVT handleiding.

Die ontwikkeling van die MVT handleiding het bestaan uit sewe stappe: (1) assesering van benodighede en probleem definisie, (2) literatuursoektog; (3) aanvanklike konsep van die MVT handleiding; (4) eweknie evaluasie; (5) volgende konsep weergawe van die MVT handleiding; (6) deskundige paneel evaluering; en (7) die finale MVT handleiding.

Die toets van die MVT handleiding se impak op die kennis het 'n toets-hertoets ontwerp gehad wat bestaan het uit sewe stappe: (1) DM kennis vraelys ontwikkeling; (2) deelnemer werwing; (3) toets van vraelys; (4) toets van aanvanklike kennis; (5) self-studie van die MVT handleiding; (6) hertoetsing van kennis; en (7) statistiese analise.

Resultate

Uit die literatuur is 132 gepubliseerde dokumente gekies vir insluiting in die MVT handleiding na gradering van die kwaliteit van die inligting. Die aanvanklike konsep is ontwikkel, taalversorg en eweknie geevalueer. Aanbevole veranderinge is gemaak en die tweede konsep is ontwikkel en gestuur aan 'n paneel van 79 dieetkundiges, van wie die meerderheid tevrede was met die inhoud, wat gelei het tot die finale MVT handleiding.

Die vraelys is opgestel met 10 vrae per afdeling van die MVT handleiding, en getoets deur 10% (n = 7) van die totale aantal deelnemers, waarna geringe veranderinge gemaak is.

Vir kennis toetsing, is dieetkundiges tussen die ouderdomme van 23 en 60 jaar, wat geregistreer is by die Raad vir Gesondheidsberoepe van Suid-Afrika, ingesluit. Deelnemers het 'n gemiddeld behaal van 57.5 % op die aanvanklike kennis vraelys, met kennis wat gewissel het tussen 33.6% en 79.8%. Hulle het aanvanklik gebrekkige kennis gehad oor: die behandeling van die hospitaal pasiënt; diabetes en oefening; diabetes en godsdiens; swangerskaps diabetes; aanvullings gebruik deur diabete; diabetes in gevangenisse; pediatriese diabetes; asook die funksie, newe-effekte en kontra-indikasies van metformien.

Die gemiddelde telling op die tweede kennis vraelys het toegeneem tot 90.5%, met ‘n laagste telling van 50.4% en hoogste van 99.2%. Daar was 2 vrae waar deelnemers < 50% (gemiddelde % van n = 79) behaal het. Hierdie vrae het verband gehou met die mees geskikte insulien behandeling tydens Ramadan en risikofaktore vir Tipe 2 DM in kinders.

Data is ontleed volgens verskeie sosio-demografiese veranderlikes, maar geen beduidende verskille is tussen groepe gevind nie.

Gevolgtrekkings en implikasies

Daar is voldoende navorsing beskikbaar om ‘n omvattende handleiding vir mediese personeel oor die rol van voeding in die behandeling van DM te ontwikkel. So 'n MVT handleiding moet bemark word vir VPO doeleindes om mediese personeel aan te moedig om hul DM bestuursvaardighede te verbeter, soos gesien deur die dramatiese verbetering in DM bestuur kennis van die huidige deelnemers. Toekomstige navorsing kan die bepaling van kennis verbetering van ander mediese professies insluit, en of die verbeterde kennis in die praktyk DM pasiënte bevoordeel.

PREFACE AND/OR ACKNOWLEDGEMENTS

The principal researcher, U Rausch, developed the research idea and the protocol, planned the study, undertook data collection (with the help of a research assistant), captured the data for analyses, analyzed the data with the assistance of a statistician (Prof DG Nel), interpreted the data and drafted the thesis. Dr MJ Lombard and Mrs I Labuschagne (Supervisors) provided input at all stages and revised the protocol and thesis.

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LIST OF ABBREVIATIONS

ADA	American Diabetes Association
ADSA	Association for Dietetics of South Africa
CEU	Continuing Education Unit
CPD	Continuing Professional Development
CPE	Continuing Professional Education
DM	Diabetes Mellitus
DSME	Diabetes Self-management Education
HbA1c	Haemoglobin A1c
HCP	Healthcare Professionals
IDF	International Diabetes Federation
KQ1	Knowledge questionnaire 1 for initial testing
KQ2	Knowledge questionnaire 2 for testing after manual self-study
MNT	Medical Nutrition Therapy
MVT	Mediese Voedings Terapie
RDs	Registered Dietitians

EXECUTIVE SUMMARY

There have been dramatic increases in Diabetes Mellitus (DM) prevalence in the last two decades, with the most dramatic increases occurring in the developing world. It has been estimated that the number of people living with DM in sub-Saharan Africa will increase from 10.8 million in 2006 to 187 million by the year 2025. This increase in DM cases is largely due to weight gain resulting from urbanization. Nutrition education may significantly lower Haemoglobin A_{1c} (HbA_{1c}) levels, thereby managing DM and the secondary complications associated with the disease and thus lowering the profound financial burden DM has on society. Significant improvements in body weight, waist-to-hip ratio, body mass index, fasting blood glucose levels, blood pressure and blood lipids may also result from nutrition education. Therefore, healthcare professionals (HCP) in the DM treatment team should be familiar with current nutrition knowledge on the management of DM.

Continuing professional development (CPD) activities have been shown to improve the knowledge and confidence of HCP as well as enhance evidence-based practice. Therefore HCP should be encouraged to update and/or expand their knowledge on the nutritional management of DM by attending CPD activities through which they will additionally benefit by obtaining compulsory continuing education units (CEUs).

The development process for CPD materials and educational tools should include a needs assessment, a literature review and a pilot, to reach the goal of improved patient care by evidence-based practice.

In the initial stages of the study a needs assessment was done by testing the DM management knowledge of a random sample of 100 nurses and registered dietitians (RDs) from all nine provinces of South Africa using a validated DM management questionnaire (thesis in Masters of Nutrition, Stellenbosch University, presented by R. Catsicas, 2013). It was concluded that there was substantial confusion regarding DM and nutrition, especially with the research that has been published in the last decade. The need for an educational tool on nutrition and DM (hereafter called MNT manual) was substantiated to support HCP by providing them with recent, scientifically-based

information and thereby improve the standard of care of the culturally diverse DM patients in South Africa.

This study commenced after the needs assessment and an in-depth literature search was initiated to identify topics and published work to include in the MNT manual. From the results of the search, topics for inclusion in the MNT manual were further defined and a rough draft MNT manual was compiled. This was further refined with the ongoing addition of published work. The MNT manual was eventually sent for peer review with individuals specialising in DM care or educational tool development and some final changes were made.

Once the MNT manual was finalised, a knowledge questionnaire was compiled with approximately 10 questions per chapter. Where applicable, shorter chapters were combined to complete the question requirements. Thereafter, participants were invited to partake in the study. Interested individuals received consent forms, socio-demographic questionnaires and a copy of the knowledge questionnaire to test their initial DM knowledge. After return of the above, they were sent a copy of the MNT manual for self-study. Participants received approximately 30 days to familiarise themselves with the content, after which the knowledge questionnaire was reapplied.

Once all the data were received and entered into a spread sheet, analysis was done to determine if there was a significant improvement in knowledge and to compare knowledge according to various socio-demographic variables. The mean knowledge was 57.5% (n = 109) initially, which improved to 90.5% (n = 79) after self-study of the MNT manual. No significant differences in either before or after knowledge were found between groups (i.e. highest qualification, area of practice, self-perceived DM knowledge and frequency of DM patient consultation), when the data were analyzed using repeated measures of ANOVA. Sections of the MNT manual where participants scored especially poorly on the first knowledge assessment were related to clinical diagnosis, pharmacological treatment, special circumstances and religion, and the management of the hospitalised diabetic patient. Participants fared very well in all sections with the second knowledge testing, with the mean score for the group ≥ 85% for each section, with the exception of DM and children. The biggest improvements were

seen in the sections on clinical diagnostics, pharmacological treatment, diabetes and special circumstances, diabetes and religion, sweeteners, supplements and diabetes, and the management of the hospitalized diabetic patient.

From the results it is clear that HCP of a specific discipline (in this case RDs) have similar baseline DM knowledge and that knowledge significantly improves after self-study of the MNT manual. This compares well with other similar studies.

It can be concluded that the MNT manual can contribute to improving the nutrition and DM management knowledge of HCP and that this manual could be used for future CPD of HCP in South Africa. Further research into the improvements in practice and improved patient outcomes may be warranted, as may be the testing of knowledge improvement in non-dietitian HCP.

CHAPTER 1
INTRODUCTION

1.1 Background and problem statement

Nutrition is a relatively new field and ongoing research and new discoveries occur on a regular basis. Therefore it is crucial for healthcare professionals (HCP) to stay up to date with the newest nutritional research.[1] Outdated knowledge may lead to problems with the consistency of the DM care messages communicated to patients by the various HCP, especially in terms of the nutritional management of Diabetes Mellitus (DM). It is therefore anticipated that if a tool were available for HCP to educate themselves and have up-to-date knowledge on the nutritional care of the diabetic person, HCP would be able to convey the same or at least similar messages to their patients, decreasing patient confusion and ultimately improving patient care and compliance.

The purpose of this study was to develop such a tool in the form of a manual for DM management (to be updated every five years), focusing on the nutritional care of the diabetic patient. Various guidelines for DM have been published in other countries around the world, but none of them provide detailed information on the nutritional care of the diabetic patient. Considering the effect diet and lifestyle have on glycaemic control, the nutritional management of DM should be considered of high importance.

A well-developed educational tool can promote consistency in care by improving diagnostic accuracy, ensuring appropriate medical treatment and by eliminating the use of ineffective interventions.[2] As with the development of any educational tool, testing its impact is an essential part of the development process.[3, 4] With this in mind, the evidence-based medical nutrition therapy (MNT) manual for DM was developed.

1.2 Aims and objectives

1.2.1 Aim of the study

To develop and test a marketable, continuing professional development (CPD) accredited training manual focused on the role of MNT for HCP of the multidisciplinary DM (Type 1 and Type 2) management team.

1.2.2 Objectives of the study

The following objectives were pursued to achieve the abovementioned aim:

- To develop a standardized evidence-based DM education manual for all HCP in South Africa, based on the most recent and relevant internationally-published information on diet, nutrition and DM care.
- To test this MNT manual to determine whether it improves the DM knowledge of HCP.

1.3 Outline of the study

The research project consisted of two components that included several steps each: (1) the development of the MNT manual and (2) the testing of the MNT manual. This research will be presented in eight chapters. Chapter 2 will provide a detailed literature review on DM and more specifically the role of MNT in the management of DM. This chapter will further elaborate on the importance of continuing education and DM knowledge of HCP. Chapter 3 will describe the methodology used to plan and design the MNT manual, with results for each of the following steps taken: needs assessment, information collection, manual development, manual review and manual finalization. In Chapter 4 the testing of the MNT manual will be discussed in detail, which includes the development and testing of the knowledge questionnaire, participant recruitment and the testing and retesting of their knowledge. Chapter 5 will contain a discussion on the results of both components of the research. Chapter 6 will conclude the research and Chapter 7 will summarize the research study and provide future recommendations.

Chapter 8 will elaborate on any limitations that the research may have had. For an outline of the study procedures see Figure 1.

1.4 Ethical considerations

The study was approved by the Health Research Ethics Committee of Stellenbosch University (N11/01/016) and was conducted according to the principles of the Declaration of Helsinki.[5] Written information and consent was obtained from participants before inclusion in the study (Addendum 3). The study was not considered invasive as only knowledge was tested and no biochemical samples were collected. It was still time consuming for the participants, who were however awarded 33 continuing education unit (CEU) points on Level 2 for the successful completion (score of ≥ 70%) of the second knowledge questionnaire. The questionnaire was CEU accredited by the Association for Dietetics of South Africa.

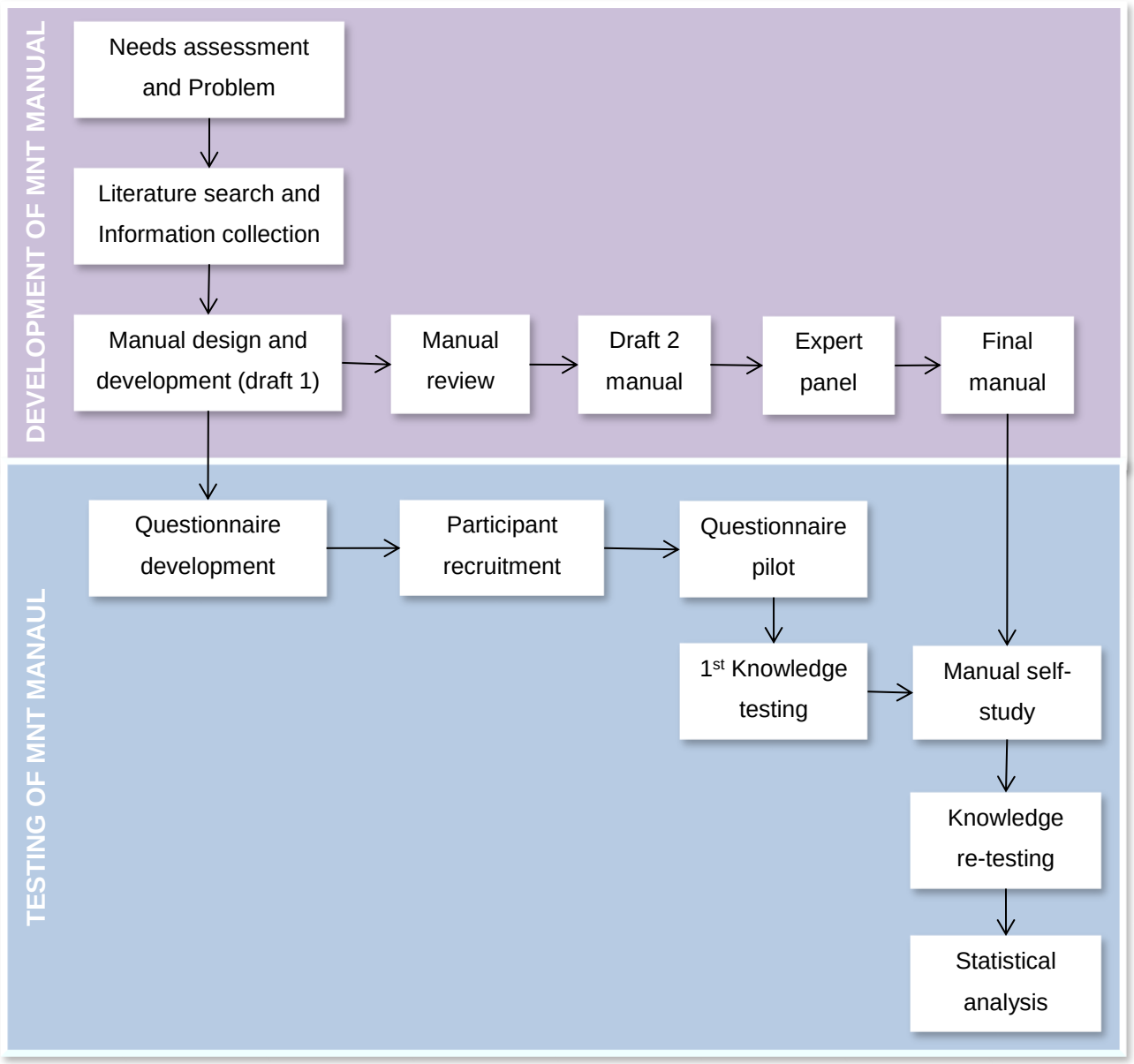

Figure 1.1 Flow chart of study outline

1.5 Definitions

Atherosclerosis	Thickening of arterial walls due to the accumulation of cholesterol and triglycerides.
Dyslipidaemia	Abnormality in, or abnormal amounts of, lipids and lipoproteins in the blood.
Gangrene	Tissue death (necrosis) of certain body parts. Often seen in diabetes.
Gastroparesis	Failure of the stomach to empty caused by decreased gastric motility.
Glycaemic index	A measure of how blood glucose will rise after eating a specific food.
Intangible	That which cannot be measured.
Ischaemia	Restriction of blood supply to tissues causing lack of oxygen and glucose required to keep tissues alive.
Macrovascular	Pertaining to the large blood vessels.
Microvascular	Pertaining to the small blood vessels and capillaries.
Multidisciplinary	Involving different areas of study, i.e. different health professionals.
Myocardial infarction	Heart attack.
Neuropathy	Damage to the nervous system.
Peripheral vascular disease	Obstruction of large arteries in the extremities.
Pharmacokinetics	Study of how pharmaceuticals function in the body from when they enter up to excretion.
Post-prandial	After meals.
Prevalence	The proportion of a population found to have a condition.

Retinopathy	Damage to the retina of the eye.
Urbanization	The physical growth of urban areas due to migration from rural areas.

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CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

The American Diabetes Association (ADA) describes DM as a group of metabolic diseases that are distinguished by hyperglycaemia that results from defects in insulin secretion, insulin action, or both. The chronic hyperglycaemia associated with DM leads to long-term damage and dysfunction of various bodily systems.[1] According to the World Health Organization, 38-88% of all cases of DM can be attributed to weight gain,[2] with urbanization being one of the causes of this rise in obesity.[3] These days, DM is a worldwide epidemic with millions of people affected in both developed and developing countries. It is estimated that in the year 2000, approximately 2.9 million people died worldwide due to DM or complications thereof. This is 5.2% of the global deaths in that year, ranking DM as the fifth leading cause of death internationally.[4] Diabetes Mellitus further exerts a profound financial burden on society, which is not only associated with the expense of managing the disease but also by indirect expenses that result from decreased productivity because of patient disability and premature death, time relatives spend to accompany loved ones to medical facilities as well as intangible costs which cannot be measured in monetary terms.[5]

The Diabetes Control and Complications Trial of 1993 proved a definite link between diabetic control and the development of secondary complications in Type 1 DM,[6] which typically include microvascular diseases such as retinopathy, nephropathy, and macrovascular diseases such as coronary heart disease, stroke, peripheral vascular disease,[3] hypertension, as well as dyslipidaemia and neuropathy.[6] The risk of these complications can be reduced through nutrition education as this may result in a reduction in Haemoglobin A_{1c} (HbA_{1c}) of 1% in newly diagnosed cases of Type 1 DM and 2% in newly diagnosed Type 2 DM cases.[7]

Because of the complexity of DM, a multidisciplinary team of HCP is required for optimal and effective treatment and management to prevent the development of secondary

complications. As DM treatment and management is so closely associated with dietary intervention, it is vital for all HCP in the treatment team to be equipped with accurate and up-to-date basic knowledge of the role of nutrition in the treatment and control of DM. It is known that healthcare systems in Africa have in the past focused more on acute illnesses and infections than on chronic illnesses, which means that many HCP have possibly not been adequately exposed to, and educated on, the treatment of DM,[8] making the continuing professional education (CPE) on this topic even more crucial.

Influencing healthcare is often very difficult, but there is a chance to do so by targeting HCP through means of CPE,[9] which is defined as all "educational activities that serve to maintain, develop, or increase the knowledge, skills, and professional performance and relationships a physician uses to provide services to patients, the public, or the profession". An increase in knowledge and improvement in patient care are the desired outcomes of such education activities.[10]

The presidents of the International Diabetes Federation (IDF) admit that there is lack in consistency in DM care around the world, both within countries and between countries, and that the development of consistent guidelines is important to ensure that diabetic patients receive the same standards of care everywhere.[9] With an evidence-based standardized educational tool, HCP will be able to provide patients with a standardized message regarding the management of blood glucose, not only in terms of medical treatment, but also in terms of nutritional treatment or MNT. To achieve this goal, CPE of HCP is required. The ideal CPE should be self-directed and contain learning methods and resources, specifically aimed at improving the knowledge, skills and attitudes of HCP.[11]

2.2 The national and international diabetes epidemic

In 1998, it was estimated that global DM incidence would increase by 35% between 1995 and 2025[12] and that DM prevalence would increase from 4.0 to 5.4% in the developed world, and from 3.3 to 4.9% in the developing world. This means that in 1995 there were approximately 135 million people worldwide affected by DM, which would

increase to about 300 million by the year 2025. When separating this total into developed and developing countries, the number of people with DM in developed countries will increase from 51 to 72 million and there will be a 170% increase in developing countries with a rise in DM prevalence from 84 to 228 million people. Therefore, by the year 2025, 75% of the worldwide DM patients will be in developing countries.[12] In sub-Saharan Africa specifically, it was estimated that in 2006 there were 10.8 million people with DM and that it would increase to 187 million by 2025.[13]

2.3 Overview of diabetes

Diabetes mellitus is a chronic illness, with patients needing continuous medical care and constant self-management education and support to prevent or delay the acute and chronic complications associated with the disease. The care of the diabetic patient is multifaceted and many issues other than glycaemic control need to be addressed.[14]

The body of a person with DM does not produce or respond to the hormone insulin which is produced by the β-cells of the pancreas and required for the storage of energy derived from foods. Without functioning insulin, blood glucose levels increase to abnormal levels, which can lead to short-term and long-term complications. Disturbances in carbohydrate, fat and protein metabolism are also present.[6]

2.3.1 Chronic complications

Increased blood glucose levels over longer periods leads to abnormal functioning and structural changes of the blood vessels of various tissues throughout the body. This may result in insufficient blood supply to these tissues leading to increased risk of stroke, myocardial infarction, renal injury and failure, neuropathy, retinopathy, blindness, ischaemia and gangrene of the extremities. Peripheral neuropathy and autonomic nervous system dysfunction may lead to other complication such as impaired cardiovascular reflexes, impaired bladder control, decreased sensation of the extremities,[15] and gastroparesis.[6] Hypertension may result secondary to renal injury and atherosclerosis due to abnormal lipid metabolism.[15]

2.3.2 Treatment team

Due to the rising prevalence of DM, the Diabetes Round Table (a multidisciplinary panel of experts) convened in 2006 and concluded that all physicians, as well as endocrinologists should work in conjunction with a multidisciplinary team of HCP to form a “diabetes team”. The team is the key to successful DM self-management, especially when the actual patient is part of the team. The ideal multidisciplinary team should consist of an endocrinologist, primary care physician, DM educator (nurse, RD and / or pharmacist), podiatrist, ophthalmologist and behavioural scientist. Depending on the needs of the patient and the resources available, other HCP may be added to this team or some removed.[16] Additional members may include an optometrist, occupational therapist, paediatrician, physiotherapist, psychologist, social worker, surgeon, obstetrician and exercise physiologist.[17]

2.4 Medical nutrition therapy and management of the diabetic patient

Medical Nutrition Therapy can be defined as the use of specific nutritional interventions to treat an injury, a disease or a condition, and usually comprises the identification of nutrition-related problems, a nutritional diagnosis, planning of an intervention to meet nutritional requirements and evaluation of the outcomes to see if requirements were met.[18] According to the ADA, MNT plays a vital role in preventing DM, but also in managing existing DM and preventing or slowing the progression rate of diabetic complications.[19] The ADA explains that deficient insulin action on target tissues results in abnormalities in carbohydrate, protein and fat metabolism.[1] Medical Nutrition Therapy therefore plays a vital role in DM care and management as optimal diabetic control requires the restoration of normal carbohydrate, protein and fat metabolism.[6] In the past it was believed that diabetics should follow a low fat, high carbohydrate diet. Nowadays, there is much evidence to promote lower carbohydrate, moderate fat and moderate protein diets for improved metabolic control. But there are other factors to also consider such as fibre content of the carbohydrates, glycaemic index, types of fatty acids, etc.[20]

Providing Type 2 DM patients with MNT has been shown to be beneficial and resulted in significant improvements in fasting postprandial blood glucose, HbA_{1c}, serum cholesterol levels and weight.[21] Medical Nutrition Therapy should therefore aim to achieve and maintain optimal metabolic outcomes, including normal blood glucose levels, lipid levels to decrease the risk of macrovascular complications and blood pressure to help reduce the risk of vascular disease. It should further aim to help reduce complications associated with DM, to improve health through better food choices and exercise. It is important that individual nutritional needs are met, taking into account personal and cultural preferences, whilst respecting the patients' willingness to make certain changes.[22]

Lim *et al.* (2009) found that when DM patients participate in a nutrition program, there are significant improvements in their body weight, waist-to-hip ratio, body mass index, fasting blood glucose, HbA_{1c}, blood pressure, and total cholesterol and triglyceride levels after three months.[23] According to the Centres for Medicare and Medicaid Services, combining Diabetes Self-Management Education (DSME) and MNT may be more effective medically than each on their own[24] and by integrating MNT into DSME, the burden on physicians to provide nutritional counselling is lessened and blood glucose control of DM patients may improve.[25]

2.5 Diabetes self-management

Successful DM self-management requires patient education on diet, exercise, medications and other lifestyle factors.[26] In order to help educate patients on all the above and encourage self-management, a team of knowledgeable HCP is required. The DM patient and their immediate family should be at the heart of the DM management team and work together with their multidisciplinary HCP team.[27] It is recommended that an RD be the team member to provide MNT due to the complexity of nutrition and nutrition-related issues. It is however, important that all members on the DM team are knowledgeable on MNT for DM.[28]

2.6 Continuing education and diabetes knowledge of health care professionals

Healthcare professionals are obligated to keep their professional knowledge and skills current to the benefit of their patients or clients, therefore a CPD programme has been implemented in South Africa where HCP are required to accumulate a number of CEUs per year.[29]

Continuing professional development is training and education which occurs after the completion of a medical degree.[30] Continuing professional education activities should be developed with the goal of maintaining, developing, or improving the “knowledge, skills, and professional performance and relationships a physician uses to provide services to patients, the public, or the profession” and the content is “that body of knowledge and skills generally recognized and accepted by the profession as within the basic medical sciences, the discipline of clinical medicine, and the provision of healthcare to the public”.[31] These activities may involve teaching HCP something completely new, thereby ensuring their knowledge is current, reminding HCP of things they have learned before but have since forgotten about or by showing them how to look at things from a different perspective.[31] Needs of patients are better met when HCP participate in CPD activities as these help to develop and maintain their knowledge and skills.[30]

Various types of CPD activities have become available in recent years, ranging from self-study to journal clubs and organized CPD events. These days, with most HCP having internet access, online CPD activities have also become quite popular. The type of CPD most effective however, depends on the individual HCP.[10]

To optimally care for DM patients, HCP need to have adequate knowledge of various diagnostic and treatment standards. By measuring the DM knowledge of HCP, areas can be identified where knowledge is lacking and education can be provided.[32] It has been found that HCP lack basic DM knowledge, such as how to use fasting plasma glucose for diagnosis, insulin pharmacokinetics, how to treat severe hypoglycaemia, blood pressure goals of diabetics, as well as the management of the Type 1 and Type 2 DM surgical patient.[32]

Research on the nutritional knowledge of nurses has indicated that nurses, especially those with less than 10 years' experience, lack knowledge in this field, with average test scores of 60.2%. Out of this subject group, 86% had not attended an education activity related to nutrition in the past 24 months.[33] The importance of CPD is clear, as was shown when nurses who received additional education in the field of DM scored significantly higher than those who did not (82% versus 61%).[32] Not only was improvement in knowledge seen but also increased confidence and self-awareness. Nurses were more aware of issues within their profession and CPE helped them improve their patient communications skills and they were better enabled to care for individual patients, all within a research-centred approach.[34]

Better baseline DM knowledge is apparent in HCP with additional DM training and experience.[32] Since DM is a rapidly changing clinical field,[35] it is essential that HCP update their knowledge regularly.

The development of CPE materials should begin with a needs assessment, which may include expert opinion and experience, knowledge questionnaires and needs assessments amongst the target population to identify topics of concern.[36] With the development of CPD education material, developers are required to use evidence-based information.[37] A literature review is a crucial part of the educational tool development process as this decreases current practice bias and reinforces evidence-based practice.[38] An educational tool based on scientific evidence, containing practical and reliable information which will eventually lead to improved patient care[39] will be a valuable tool for HCP. It is advised that educational tools are piloted before they are published,[39] which is why the testing process was such an important part of the development of the MNT manual.

2.7 Conclusion

In order to improve DSME in Africa, as well as to standardize health care messages with regard to DM, a comprehensive manual on MNT in DM for HCP is required. This MNT manual should include most aspects of DM care, including pharmaceutical treatment,

nutritional treatment, exercise, acute complications, supplementation, etc. To encourage HCP to purchase and complete the MNT manual, they will receive CEUs for the completion of a knowledge questionnaire after self-study of the MNT manual.

Van Meijel *et al*. (2004) created a model for the development and validation of evidence-based interventions. Their model consists of four stages: (1) description and defining of the problem; (2) gathering information about a proposed intervention based on the problem; (3) designing of an intervention; and (4) validation of the intervention. [40]

The MNT manual was developed on these principles. Information about DM and nutrition, as well as other aspects of DM care, were gathered and an MNT manual was compiled. After completion of the MNT manual, it was tested for face and content validity to ensure that the content was appropriate and up to date and that health professionals felt it contributed to their knowledge of DM care. The MNT manual was evaluated by testing the knowledge of the participants before and after self-study of the manual, as well as by additional questions on the manual itself that were part of the second questionnaire.[35]

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CHAPTER 3
ARTICLE: DEVELOPMENT OF THE SOUTH AFRICAN DIABETES MANUAL FOR HEALTH PROFESSIONALS

3.1 Abstract

Purpose: The purpose of the study was to develop a standardized education manual for healthcare professionals in South Africa regarding the nutritional management of Diabetes Mellitus.

Methods: The manual was developed in seven steps: 1) needs assessment and problem definition; 2) literature search; 3) draft one of the manual; 4) peer review; 5) draft two of the manual; 6) expert panel evaluation; and 7) the final manual.

Results: Following the literature search, the first draft of the manual was developed and sent for peer review and language editing. Recommended changes were made and the second draft was developed and sent to 79 dietitians, of whom the majority were satisfied with the content, which led to the final manual.

Conclusions and implications: A Diabetes Mellitus nutritional management manual for healthcare professionals in South Africa was developed using a systematic approach with peer reviews and expert panels. The next step will be to evaluate its impact on the knowledge of healthcare professionals.

Key words: Diabetes Mellitus, medical nutrition therapy, manual, professional development, South Africa

3.2 Introduction

Diabetes Mellitus (DM) is a worldwide epidemic affecting both developed and developing countries. It has been estimated that by the year 2025, 228 million people around the globe will be affected, of whom 75% will be from developing countries.[1] In sub-Saharan Africa specifically, DM prevalence will increase to 187 million by 2025.[2] With 38-88% of all DM cases being attributed to weight gain,[3] and urbanization being one of the causes of a rise in obesity,[4] it is no wonder that developing countries are so dramatically affected by DM.

Diabetes Mellitus is a chronic illness, with patients requiring continuous medical care, support and constant self-management education to help prevent the acute and chronic complications associated with the disease. The care of the diabetic patient is multifaceted, and many issues, other than glycaemic control, need to be addressed.[5] Due to the complexity of DM, a multi-disciplinary team of healthcare professionals (HCP)[6] is required for optimal and effective treatment and management of DM, to prevent the development of secondary complications. Members of the team should agree on the treatment goals of the patient and provide continuous, consistent and accessible care whilst educating, supporting, and involving the patient and his/her family in the decision-making process.[7]

Medical Nutrition Therapy (MNT) is the use of nutritional interventions to treat an injury, a disease or a condition.[8] The abnormalities in carbohydrate, protein and fat metabolism associated with DM are caused by deficient insulin action on target tissues.[9] Optimal diabetic control requires the restoration of normal carbohydrate, protein and fat metabolism by means of MNT.[10] Treatment and management of DM is therefore closely associated with MNT, making it vital for all HCP in the treatment team to have accurate and up-to-date knowledge of nutrition in the treatment and control of DM.[11]

Across the globe, there is inconsistency in DM care, both within countries and between countries, demonstrating the importance of the development of consistent educational tools for HCP.[12] A good quality tool, tested to ensure validity, can promote consistency in care by improving diagnostic accuracy and ensuring appropriate medical treatment by

eliminating the use of ineffective interventions.[13] The International Diabetes Federation strongly advises that developers of new diabetes manuals use published guidelines as a foundation for developing so-called “derived guidelines”. This method is more efficient and cost-effective than developing full-process guidelines, which are developed using primary sources.[12] Various DM guidelines have been published in countries around the world, but none of them give detailed information on the nutritional care of the DM patient. To ensure that DM patients receive the same standards of care everywhere,[12] Continuing Professional Development (CPD) of HCP on DM care guidelines is required.[14]

South Africa is a developing country, comprising different socio-economic groups and a variety of different cultures and religions. Therefore, the aim of the study was to develop a marketable, CPD accredited training manual, focused on the role of MNT within the Diabetes Self-Management Education framework, for HCP of the multi-disciplinary team, suitable within the South African context.

3.3 Methods

The manual was developed based on a model designed by the Nursing Science Department of the University of Utrecht[15] and comprised the following steps: Step 1) Needs assessment and problem definition; Step 2) Information collection; Step 3) Draft one of the manual; Step 4) Evaluation by three expert dietitians; Step 5) Second draft of the manual; Step 6) Evaluation by an expert panel; and Step 7) The final manual (Figure 3.1)

Figure 3.1 Outline of study procedures

The study was approved by the Health Research Ethics Committee of Stellenbosch University (ethics approval number: N11/01/016) and written information and consent was obtained from participants before inclusion in the study.

Step 1

During this step a definition of the problem at hand and the focus of the educational tool were developed. A random sample of 100 dietitians and nurses in all provinces of South Africa was selected, and their knowledge regarding nutrition and DM management was tested using a validated nutrition and diabetes management questionnaire. With this information the problem at hand was defined and the focus of the educational tool was developed (unpublished data).

Step 2

With the problem defined, the search and collection of relevant information was initiated. The latest internationally-published data on diet, nutrition and DM management, as well as position and consensus statements from various leading bodies and diabetes manuals from various countries, were collected and graded to determine the strength of evidence, before consideration for inclusion in the manual.

Step 3

The information collected was used to compile comprehensive guidelines on the nutritional management of DM, starting with basic information and progressing to more detailed information concerning diet and nutrition in various situations.

Step 4

The first draft of the manual was sent for peer review to three expert dietitians specialising in diabetes care and manual development.

Step 5

A second draft of the manual was developed, based on comments made by the reviewers.

Step 6

An expert panel (n = 79) consisting of registered dietitians in South Africa, working either in the private or public healthcare sector, were invited to read the manual and provide feedback regarding perceived knowledge improvement, expected service delivery improvement, most interesting chapters and missing information.

Step 7

Based on the expert panel's comments, the necessary changes were made and the final manual was compiled.

3.4 Results

The needs assessment determined that HCP in South Africa lack adequate knowledge regarding basic DM management, including the role of MNT.

During the information collection step, position and consensus statements of leading bodies were collected, which included the American and Canadian diabetes associations, the International Diabetes Federation and the World Health Organization, as well as published diabetes manuals from Australia, Canada and Scotland. In addition to this, the Cochrane Library, Pubmed, Medline, Science Direct, Google Scholar and EBSCOhost (under the sections Academic Search Premier and Health Source: Nursing / Academic Edition) were extensively searched for relevant published papers on the topics of diet, nutrition and diabetes treatment and management. A total of 132 published documents including journal articles (n = 65), books or book chapters (n = 14), diabetes manuals and care guidelines (n = 7), as well as consensus and position statements (n = 17) from five Diabetic or Dietetic Associations, were identified for inclusion in the manual after grading of evidence (Table 1).

The first draft of the manual was developed, based on the published papers identified during the literature search. Practical components in the form of case studies were added to help explain certain topics that were otherwise difficult to understand.

Some of the comments from the reviewers were that the manual was too long, that the chronological order of some topics should be altered and that certain sections were difficult to understand. These comments were considered and changes were made.

The manual was divided into 12 sections comprising 17 chapters. Shorter chapters or those with similar topics were combined to create a section. A summary of each section was compiled and inserted at the beginning of the section.

Each section was allocated a specific colour, which was used to colour the top right-hand margin to ease perusal of the document. Thereafter, the manual was sent for language editing.

All of the dietitians from the expert panel commented that the manual improved their DM knowledge and that they would therefore be able to provide an improved service to their DM patients. Every chapter was found useful, especially those regarding pharmacological treatment, carbohydrate counting, exercise, children, and religion. In general, the comments were positive, with 61.8% of the reviewers remarking that no changes were necessary and 72.4% stating that all relevant topics were incorporated and therefore no additional information was required. Some reviewers (n = 4) felt that the manual was too long and pointed out some inconsistencies due to different sources.

These were identified and corrected. Some additional topics mentioned for inclusion were: use of sliding scale insulin for the critically ill; long-term complications of DM; DM and HIV/AIDS; as well as a recent food exchange list. Final changes were made according to the above comments and the manual was completed.

Table 3.1 Breakdown of sections and chapters with graded main sources[16]

Section	Chapter	Main sources	Evidence strength
1.	1. Physiology of DM	Guyton and Hall[17]	I
	2. Classification of the different types of DM	ADA[9]	I
2.	3. Clinical diagnostics	ADA,[9] CDA,[18] IDF and WHO[19]	I
3.	4. Targets for control	ADA,[20] CDA,[18]	I
4.	5. Pharmacological treatment	ADA,[20]	I
5.	6. Acute complications associated with DM	ADA,[20]	I
6.	7. Dietary approaches	ADA,[10] FAO/WHO[21]	I
7.	8. DM and exercise	ADA,[22] American college of sports medicine,[23] Diabetes outreach diabetes manual,[24] Lumb and Gallen,[25] ISPAD.[26]	I
8.	9. Children and DM	ADA,[27] ISPAD[26]	I
9.	10. DM and special circumstances	ADA,[28] CDA[18]	I
		Expert opinion and experience	IV

	11. Religion and DM	Quresh[29]	IV
10.	12. Sweeteners	CDA[18]	I
		Wolever *et al*.[30]	III
	13. Supplements and DM	Campbell,[31] Ruhe and McDonald[32]	III
		Reljanovic *et al*.[33]	I
11.	14. Management of the hospitalized diabetic	ADA[5]	I
	15. DM in correctional institutions	ADA[34]	I
	16. DM in the workplace	ADA[35]	I
12.	17. When to refer to a dietitian	Diabetes outreach diabetes manual[24]	I

I. Evidence from one or more randomized controlled trial.
II. Evidence from one or more controlled not randomized trial.
III. Evidence from non-experimental descriptive studies (case-control, comparative or correlation studies).
IV. Evidence from expert committee reports or opinions or clinical experience of respected authorities.

3.5 Discussion

Despite possessing inadequate nutrition knowledge, and not being knowledgeable about advances in the field of nutrition, nurses rarely attend CPD activities regarding nutrition. This is a cause for concern, as nearly 90% of nurses have reported being regularly approached by patients for nutrition advice.[36]

CPD activities have been shown to improve knowledge and confidence as well as enhance evidence-based practice.[37] With the purpose of creating an evidence-based educational manual for CPD purposes, a comprehensive literature review of various topics related to DM and nutrition was compiled.[38] Care was taken to include a variety of topics to provide new information as well as refresh old knowledge, ensuring up-to-date knowledge of HCP.[39] The chapters that HCP were less familiar with, such as religion, and exercise, were found most interesting by the expert panel.

Evidence used for full-process guideline recommendations should always be graded,[12] to give the user an indication of the confidence the guideline development group has in the recommendation.[16] This manual was compiled mostly from position and consensus statements and care guidelines of diabetic associations (called a derived guideline),[12] with any additional information gathered from clinical trials and systematic reviews where available. The information in position and consensus statements and care guidelines, as well as data from systematic reviews or meta-analyses, was considered to be graded and therefore unbiased good evidence (level I).[16] However, where such information was lacking and the information from clinical trials as well as websites of diabetic and dietetic associations was used, the grading of evidence was more complicated. In these cases, opinion was used to grade (level II, III or IV) the available information and consider it for inclusion.[16]

There are no recommendations to indicate what size the development group of an MNT manual should be. Considering the recommendations for diabetes guideline development groups, a possible limitation of the study was that the development group for this manual comprised only four people instead of the recommended 12 – 15, which

may have limited the content and led to bias.[16] However, considering that the manual was focusing only on the nutritional management of DM and was developed as a derived guideline, bias was again reduced.[12]

3.6 Conclusion

The South African population is diverse, consisting of a multitude of cultures, with people from varying socio-economic backgrounds practising numerous religions. For this reason, using DM manuals developed in other counties, for their populations, may not be appropriate and a manual for the South African population was developed.

It can be concluded that there is adequate information available on various aspects of DM and nutrition in order to compile a comprehensive manual for HCP on the nutritional management of the DM patient. It is important that developers of CPD education materials do a needs assessment before starting their development process and use good quality information to ensure the development of evidence-based educational materials.

3.7 Implications for research and practice

The steps used to develop the manual can be used for the development of other evidence-based recommendations, CPD educational materials and healthcare manuals. The final step in completing the development process will be the validation[15, 38] of the newly developed manual to ensure that it will improve the knowledge of HCP. Plans for the future updating of the manual also need to be made, to ensure that the information stays current.[12]

This manual may provide a starting point for the development of a South African diabetes medical management guideline, covering all areas of DM management from all relevant multidisciplinary groups.

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CHAPTER 4
ARTICLE: ASSESSMENT OF THE SOUTH AFRICAN MNT DIABETES MANUAL FOR HEALTH PROFESSIONALS TO IMPROVE KNOWLEDGE AND STANDARDIZE NUTRITIONAL RECOMMENDATIONS AND CARE WITHIN A MULTIDISCIPLINARY TEAM

4.1 Abstract

Purpose: The purpose of the study is to develop a diabetes knowledge questionnaire and test the relative validity of a continuous professional development (CPD) standardised education manual for healthcare professionals (HCP) in South Africa regarding diet, nutrition and Diabetes Mellitus (DM) management.

Methods: A recently developed diabetes manual[1] was used to compile a knowledge questionnaire designed to test the baseline diabetes knowledge of registered dietitians in South Africa. The questionnaire was piloted using 10% of the sample size (n = 79). A test-retest study design was used, with participants completing the knowledge questionnaire once before self-study of the DM manual, and again afterwards.

Results: Mean knowledge improved from 57.5% to 90.5%. Data were analyzed according to various socio-demographic variables, but no significant differences were found between groups. Sections where participants showed the greatest improvements in knowledge were: clinical diagnostics; pharmacological treatment; children and diabetes; diabetes and special circumstances and diabetes and religion; sweeteners, supplements and diabetes; and management of the hospitalized diabetic patient.

Conclusions and implications: The diabetes manual dramatically improved poor DM management knowledge and should definitely be marketed for CPD of HCP of the multidisciplinary DM treatment team.

Key words: diabetes mellitus, medical nutrition therapy, continuing education, South Africa

4.2 Introduction

Influencing healthcare is often very difficult, but there is a chance to do so by targeting healthcare professionals (HCP) by means of continuous professional education (CPE)[2] or continuous medical education (CME), which have the goal of increasing knowledge and improving patient care.[3] The content of CME is developed to teach HCP something completely new (ensuring their knowledge is current), reminding HCP of things they have forgotten or showing them how to look at things from a different perspective. Various types of CPD activities have become available in recent years, ranging from self-study to journal clubs and organized CPD events. These days, with most HCP having internet access, online CPD activities have also become quite popular. The type of CPD most effective however, depends on the individual HCP.[3]

Healthcare professionals are obligated to keep their professional knowledge and skills current to the benefit of their patients or clients,[3] but may find the increased knowledge, confidence and self-awareness that result from attending CPD activities, benefit themselves. It also helps improve patient communications skills and patient care, all within a research-centred approach.[5] In South Africa (as well as many other countries) a CPD programme has been implemented where HCP are required to accumulate a number of Continuing Education Units (CEUs) per year.[3]

To optimally care for DM patients, HCP need to have adequate knowledge of various diagnostic and treatment standards. By measuring the DM knowledge of HCP, areas can be identified where knowledge is lacking and education can be provided.[6] Healthcare professionals lack basic DM knowledge, such as using fasting plasma glucose for DM diagnosis, insulin pharmacokinetics, treatment of severe hypoglycaemia, blood pressure goals of diabetics, as well as the management of the Type 1 and Type 2 DM surgical patient. Additional education in the field of DM improved DM knowledge of nurses significantly compared to those who did not receive the training (82% versus 61%).[6]

To address the above issues, a manual[1] on the nutritional management of the DM patient was developed. This study concluded that it was possible to develop a manual

on the medical nutrition therapy (MNT) of DM and various aspects associated with the disease, based on available position papers and consensus statements as well as clinical research studies.[7] The current study aimed to test this MNT manual, with the intent of it being used in future for CPE, to ensure that HCP showed improvement in DM knowledge on the hypothesis that their initial knowledge was inadequate.

To test the MNT manual, a knowledge questionnaire was developed on the content, and knowledge of participants was tested using a test-retest methodology.

The study was approved by the Human Research Ethics Committee of the University of Stellenbosch (N11/01.016) and was not considered to have ethical implications, but it was expected to benefit HCP in terms of their knowledge regarding the nutritional management of DM, which would in turn benefit diabetic patients.

4.3 Methods

The following steps were taken to test the impact of the MNT manual on participants' knowledge: (Step 1) Development of the knowledge questionnaire; (Step 2) Validation of the knowledge questionnaire; (Step 3) Testing of knowledge; (Step 4) MNT manual self-study; (Step 5) Retesting of knowledge (Figure 1).

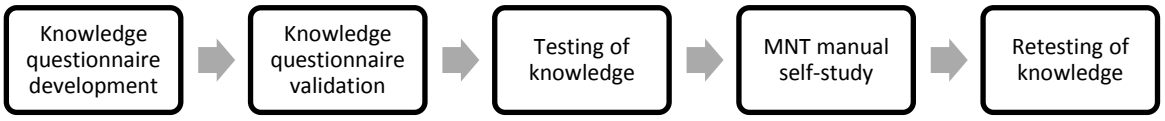

Figure 4.1 Outline of study procedures

Step 1: Questionnaire development

Using the previously developed MNT manual,[1] a knowledge questionnaire, comprising 119 multiple-choice, complete-the-sentence and true / false questions, was compiled

with approximately 10 questions per chapter. Some of the shorter chapters were combined to compile the required amount of questions.

Step 2: Questionnaire validation

The questionnaire was validated for content by two registered dietitians (RDs), who reviewed the questions to ensure their applicability, and piloted using a sample of approximately 10% (n = 7) of total participants (n = 79). The pilot participants were invited to participate and given the opportunity to comment on the questionnaire to ensure that all questions were well understood.

Step 3: Knowledge testing

Registered dietitians were invited to partake in the study through an advertisement sent out via e-mail to members of the Association of Dietetics of South Africa.

Interested participants were contacted via e-mail or post (depending on their preference), and provided with consent forms, a standard socio-demographic questionnaire and the first knowledge questionnaire (KQ1). Results from KQ1 would provide baseline information on the current knowledge of the participants.

Step 4: MNT manual self-study

Within four weeks after the return or submission of the above, participants were sent a copy of the MNT manual for self-study. They received approximately four weeks to familiarize themselves with the content.

Step 5: Knowledge retesting

Participants were encouraged to participate in the study, as they could earn 33 CEUs if they scored ≥ 70% on the second questionnaire, which they had to complete after reading the MNT manual, which was accredited for CPD purposes by the Association of Dietetics of South Africa. After self-study of the MNT manual, participants were asked to complete the second knowledge questionnaire (KQ2), which was identical to KQ1. Since

the manual was designed to be a quick reference on various topics of DM, participants were allowed and encouraged to use the manual during the completion of KQ2.

4.4 Statistical analysis

For both KQ1 and KQ2, participants were awarded 1 point for every correctly answered question. The total points were then divided by 119 (the number of questions) and multiplied by 100 to get each participant's mean score. To determine the mean for the group, all the mean scores were summed and divided by the total number of participants. To determine the improvement in knowledge the % improvement was calculated [(KQ2 mean – KQ1 mean) / KQ1 mean].

To determine baseline knowledge, as well as improvement in baseline knowledge of the different sections in the manual, the points for the various questions for each section were summed and the means (total /number of questions in a section x 100) calculated. The means per section for KQ1 and KQ2 were compared and % improvement calculated [(KQ2 section mean – KQ1 section mean) / KQ1 section mean].

The total knowledge of KQ1 and KQ2 were computed and analyzed in detail, with repeated measures of ANOVA, versus several categorical socio-demographic variables such as workplace (public or private sector), initial self-assessment of DM knowledge adequacy, highest qualification and frequency of treating DM patients. The Bonferroni multiple comparisons procedure was used to interpret the interactions of the variables, with a p-value of < 0.05 indicating statistical significance. Distributions of the variables were presented with histograms and frequency tables.

4.5 Results

Step 1

The questionnaire was compiled with varying question difficulty so that some of the questions could be answered using existing knowledge, but most would have to be answered using knowledge gained from reading the MNT manual. The answers to all

the questions could be found in the MNT manual. The questionnaire was randomized however, to make it more difficult for participants to find the answers.

Step 2

The questionnaire was well understood in general, with only minimal suggestions from the pilot participants, after which acronyms were removed and certain sentences were reworded to make them more easily understandable.

Step 3

A total of 109 participants volunteered to partake in the study. Participants were RDs between the ages of 23 and 60 years, registered with the Health Professions Council of South Africa. Eighty-eight per cent of the participants' highest qualification was a B.Sc. in dietetics and 12% had completed a postgraduate degree (M.Sc. or Ph.D.). Forty-one per cent of the participants were working in the public sector and 74% in the private sector. The majority (77%) were working with DM patients on a regular basis. Most of the participants (59%) believed that their knowledge of DM and nutrition was adequate at the beginning of the study, but all wanted to learn more about the topic. The participants scored an average of 57.5% on the completion of KQ1, with a lowest score of 33.6% and a highest score of 79.8% (Table 4.1).

Participants initially fared best (Table 4.2) in section 1 on diabetes basics, with only 6 participants scoring < 50% and worst in section 10 (sweeteners and supplements) with 98 participants scoring < 50%. They also lacked knowledge of the following (average < 60%): section 2 (clinical diagnostics); section 4 (pharmacological treatment); section 9 (special circumstances and religion and diabetes); and section 11 (management of the hospitalized diabetic patient).

Out of the initial 109 participants, 79 (72.5%) completed both KQ1 and KQ2. The mean score on the completion of KQ2 (after self-study of the MNT manual) increased to 90.5%, with the lowest score 50.4% and the highest 99.2% (Table 4.3). Participants

Table 4.1 Total and mean difference in scoring between the two questionnaires

	KQ1 (n = 109)	KQ2 (n = 79)	% Improvement
Mean	57.5	90.5	57.4*
Median	57.1	91.6	60.4*
Minimum score	33.6	50.4	50.0
Maximum score	79.8	99.2	24.3

KQ1 = Knowledge questionnaire 1

KQ2 = Knowledge questionnaire 2

n = sample size

* = significance P ≤ 0.05

Step 5

fared very well in all sections. The worst score (<85% mean) was for the section on children and diabetes. In all other sections the mean score was > 85% for the group. When looking at the individual questions, there were only 2 on KQ2 where participants scored < 50% (mean of n = 79). These questions related to the type of insulin regime most suitable during Ramadan and risk factors for Type 2 DM in children.

When comparing the before and after knowledge per section (Table 4.3), there were dramatic improvements in knowledge in all the sections. The largest improvements were seen were in: section 2 (clinical diagnostics); section 4 (pharmacological treatment); section 8 (children and diabetes); section 9 (diabetes and special circumstances and diabetes and religion); section 10 (sweeteners, supplements and diabetes); and section 11 (management of the hospitalized diabetic patient).

Table 4.2 Scoring of registered dietitians after completing Knowledge Questionnaire 1 for the different sections and chapters in the manual

Section	Chapters	Participant number according to score (n%)				Mean
		0 – 25%	26 – 50%	51 – 75%	76 – 100%	KQ1 (%)
1.	1. Physiology of diabetes	0 (0)	6 (5.5)	45 (41.3)	58 (53.2)	75.4
	2. Classification of the different types of diabetes					
2.	3. Clinical diagnostics	11 (10.1)	56 (51.4)	37 (33.9)	5 (4.9)	48.9
3.	4. Targets for control	1 (0.9)	24 (22.0)	55 (50.5)	29 (26.6)	65.9
4.	5. Pharmacological treatment	15 (13.8)	48 (44.0)	42 (38.5)	4 (3.7)	47.1
5.	6. Acute complications associated with diabetes	1 (0.9)	32 (29.4)	51 (46.8)	25 (22.9)	63.5
6.	7. Dietary approaches	2 (1.8)	24 (22.)	51 (46.8)	32 (29.4)	66.7
7.	8. Diabetes and exercise	2 (1.8)	23 (21.1)	45 (41.3)	39 (35.8)	66.9
8.	9. Children and diabetes	7 (6.4)	28 (25.9)	60 (75.9)	14 (12.8)	54.6
9.	10. Diabetes and special circumstances	4 (3.7)	54 (49.5)	29 (26.6)	22 (20.2)	56.2
	11. Religion and diabetes					
10.	12. Sweeteners	56 (51.4)	42 (38.5)	10 (9.2)	1 (0.9)	27.7

	13. Supplements and diabetes					
11.	14. Management of the hospitalized diabetic	4 (3.7)	52 (47.7)	30 (27.5)	13 (11.9)	53.8
12.	15. Diabetes in correctional institutions	0 (0)	32 (29.4)	50 (45.9)	27 (24.8)	63.5
	16. Diabetes in the work environment					
	17. When to refer to a dietitian					

KQ1 = Knowledge questionnaire 1

KQ2 = Knowledge questionnaire 2

n = sample size

Table 4.3 Scoring of registered dietitians after completing Knowledge Questionnaire 2 for the different sections and chapters in the manual

Section	Chapters	Participant number according to score (n%)				Mean	
		0 – 25%	26 – 50 %	51 – 75 %	76 – 100%	KQ2 (%)	% Improvement
1.	1. Physiology of diabetes 2. Classification of the different types of diabetes	0 (0)	0 (0)	5 (6.3)	74 (98.7)	92.3	22.4
2.	3. Clinical diagnostics	0 (0)	2 (2.5)	9 (11.4)	68 (86.1)	89.4	82.8
3.	4. Targets for control	0 (0)	0 (0)	3 (3.8)	76 (96.2)	93.0	41.1
4.	5. Pharmacological treatment	0 (0)	1 (1.3)	7 (8.9)	71 (89.9)	90.1	91.3
5.	6. Acute complications associated with diabetes	0 (0)	0 (0)	4 (5.1)	75 (94.9)	95.2	49.9
6.	7. Dietary approaches	0 (0)	2 (2.5)	2 (2.5)	75 (94.9)	92.5	38.7
7.	8. Diabetes and exercise	0 (0)	1 (1.3)	5 (6.3)	73 (92.4)	92.0	37.5
8.	9. Children and diabetes	0 (0)	1 (1.3)	8 (10.1)	70 (88.6)	84.1	54.0

9.	10. Diabetes and special circumstances	0 (0)	1 (1.3)	6 (7.6)	72 (91.1)	87.2	55.2
	11. Religion and diabetes						
10.	12. Sweeteners	0 (0)	3 (3.8)	4 (5.1)	72 (91.1)	90.5	226.7
	13. Supplements and diabetes						
11.	14. Management of the hospitalized diabetic	0 (0)	1 (1.3)	8 (10.1)	70 (88.6)	89.1	65.6
12.	15. Diabetes in correctional institutions	0 (0)	0 (0)	6 (7.6)	73 (92.4)	89.7	41.3
	16. Diabetes in the work environment						
	17. When to refer to a dietitian						

KQ1 = Knowledge questionnaire 1

KQ2 = Knowledge questionnaire 2

n = sample size

There were no significant differences when the data were analyzed according to a variety of socio-demographic variables (Table 4.4) for either KQ1 or KQ2. The only statistically significant differences found were when results for KQ1 and KQ2 were compared.

Both public- and private-practising RDs had similar scores for KQ1 as well as for KQ2. A significant improvement in knowledge was found when results for KQ1 and KQ2 were compared.

When asked if they thought their diabetes knowledge was adequate, most of the participants (n = 46), felt that it was, yet they still achieved a mean of 58.7% on KQ1, compared to 56.7% for those (n = 33) who said they believed their knowledge to be inadequate. There was no difference in mean knowledge on KQ2 (90.5%) when these 2 groups were compared. A significant improvement was found between KQ1 and KQ2 for both these groups.

When KQ1 was analyzed, it was found that RDs who treated DM patients once a week or less (n = 32) had the lowest initial score (54.3%), with those seeing DM patients 2 - 3 times per week (n = 26) scoring higher (59.7%) and those seeing DM patients on a daily or near daily (n = 21) basis scoring the highest (60.9%). None of these differences were statistically significant however. All of these groups scored similarly on KQ2 (90.3 – 90.9%) with significant improvements from the initial score of KQ1.

Comparisons of the data according to highest qualifications showed participants with a Ph.D. started with the worst knowledge (43.7%) but had greatest improvement in knowledge (98.3%), whereas those with a B.Sc. had the best initial knowledge (58.3%) and the smallest knowledge improvement (90.0%). Participants with an M.Sc. degree had results between the aforementioned two groups (55.8 and 93.3% respectively). Again, statistical significance could only be seen when these results were compared for KQ1 and KQ2.

4.6 Discussion

In comparison with other DM knowledge questionnaires which used “complete the sentence” type questions,[6] this questionnaire with its true / false and multiple choice questions, may have been considered easy and less accurate since a participant could guess the correct answer. For this reason, an additional answer was added to each question: “I don’t know the answer or am unsure”. This answer option was often used by the participants with the completion of KQ1 (2 537 times in total) and to a lesser extent with KQ2 (59 times in total).

Participants had inadequate knowledge at the beginning of the study, but it improved significantly after the participants had received and read the manual. This compares well with a 2000 study performed in the United States of America where pre-test mean DM knowledge of RDs was 69% and post-test mean was 86%.[8] No statistically significant differences were found between various socio-demographic variables, which is similar to other studies[9] thus indicating that most HCP from a specific discipline have similar DM knowledge. Even though the knowledge differences between public and private sector RDs were non-significant, it is still interesting to note that the private sector RDs started with a higher initial knowledge, but the public sector RDs had a great knowledge improvement and their final knowledge surpassed that of the other group. When comparing the results according to participants’ highest qualifications, the Bachelor group had the best initial knowledge and the Doctorate group the worst, but the Doctorate group showed the best improvement and the highest score on KQ2. However, the sample size for those in the Doctorate group was very small and data should be interpreted with caution.

Table 4.4 Mean knowledge comparison according to variables

Variable	n	Mean score (%)	
		KQ1	KQ2
Workplace			
Public	25	55.5	91.3
Private	54	58.9	90.1
Highest Qualification			
Bachelor's	70	58.3	90.0
Master's	8	55.8	93.3
Doctorate	1	43.7	98.3
Self-perceived DM knowledge			
Adequate	46	58.7	90.5
Inadequate	33	56.7	90.5
How often DM patients are seen			
< Once per week	32	54.3	90.3
2- 3 times per week	26	59.7	90.9
Daily or nearly daily	21	60.9	90.4

KQ1 = Knowledge questionnaire 1

KQ2 = Knowledge questionnaire 2

n = sample size on KQ2

The sections on KQ1 where participants scored poorly (clinical diagnostics, pharmacological treatment, special circumstances and religion and diabetes, management of the hospitalized diabetic patient) could be explained by the fact that certain topics, such as diagnostic recommendations and medications continually evolve and that HCP need to stay continually updated on the latest developments, whereas other topics such as religion and diabetes were most likely not covered at all or very briefly at university. Participants did not score very well initially in the section on the management of the hospitalized DM patient, which could be explained by the fact that most of the participants (68.4%) were private practising and possibly not seeing such patients on a regular basis.

The data for this study is in line with other studies testing the DM management knowledge of HCP,[7] and it is clear from the results of KQ1, that RDs lack knowledge concerning DM management and even the nutritional management of DM patients. This is alarming and demonstrates the importance of CPD on the topic of DM. The mean calculated from KQ2, demonstrates a significant increase in knowledge and that the participants were able to use the diabetes manual to find the answers to various questions, indicating the ease of use of the manual. By incorporating the MNT manual in CPD events for HCP, their knowledge of DM management, self-confidence and different attitude towards the disease,[5] may improve the care of their DM patients.

One limitation of the study is that the manual was only read by RDs. It would have been beneficial to include other HCP in the study, as they may have possibly shown an even greater increase in knowledge, but it is also possible that they may not understand the information quite as well as the dietitians since they lack a nutritional background. Because the participants were able to earn CEU’s with the successful completion of KQ2, it is also possible that this motivation led to higher scores on KQ2 than if they had not been encouraged in this way.

4.7 Conclusion

Despite working with DM patients regularly, the knowledge of South African RDs and possibly all HCP on the nutritional management of DM is not adequate, but by encouraging them to read through the diabetes manual for CEUs[2] this inadequate knowledge can be improved. The diabetes manual can and should be used to encourage professional development on the topic of nutrition and DM, as its use in practice may benefit South African diabetic patients.

4.8 Implications for research and practice

It may be warranted to do a future study on the knowledge improvement of HCP that are not RDs and to test if their behaviour (i.e. treatment of patients) was changed by the gain in DM knowledge to the benefit of their patients. A study to determine if gained knowledge is sustained over longer periods, by repeating the knowledge questionnaire on the same group of participants in 6 to 12 months, may also provide interesting results.

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CHAPTER 5
DISCUSSION

The ever-worsening DM epidemic[1] puts increasing pressure on the healthcare system and HCP in South Africa to provide DM patients with better care. This research focused on the development of a South African CPD accredited manual on the nutritional management of DM and the testing of the newly developed manual's ability to improve the knowledge of HCP using a test-retest methodology. The development of the MNT manual consisted of four main stages as suggested by Van Meijel *et al.* (2004): (1) problem definition; (2) information collection; (3) manual design; and (4) manual testing. Various steps as discussed in chapter 3 and 4 were added to these main stages to complete them. To enable an efficient and sensible development process,[2] it is important that structured steps are used when developing educational materials or intervention.

With the purpose of improving DM care and DSME messages by improving the knowledge of HCP, the MNT manual was developed. Information was sourced from all over the world and included position and consensus statements from various DM associations, clinical trials and systematic reviews and where necessary practical information from websites of reputable diabetic or dietetic associations. Several DM care guidelines from other countries were also used as seed for the development of the MNT manual. Most of these were however not focused specifically on nutrition and contained only very basic and limited information on the aforementioned. This discovery is rather concerning, as DM management is so closely associated with diet and nutrition[3, 4] and emphasized once again the importance of developing a manual on this topic and promoting its use by means of CPD. Since CPD is compulsory in South Africa, this is a great motivator for HCP.

With the needs assessment, it was discovered that HCP (nurses and RDs) lack knowledge on the topic of DM (data not included). This lack of knowledge may be because healthcare systems in Africa have in the past focused less on chronic diseases, such as DM, and more on the treatment and management of infectious diseases.[5]

Despite possessing inadequate nutrition knowledge, and not being knowledgeable about advances in the field of nutrition, nurses rarely attend educational activities on the topic of nutrition.[6] This may be because not many CPD activities on nutrition are available or because they are only advertised to attract RDs. This is very concerning, as nearly 90% of nurses have reported being regularly approached by patients for nutrition advice[6] and their outdated nutrition knowledge may lead them to advise their patients incorrectly. If this is true for nurses, it would probably also be true for other HCP.

When the initial DM knowledge of RDs was tested, their mean score was only 57.5%, which compares well with the results of Rubin, Moshang and Jabbour (2007), who found the DM knowledge of nurses who had not received additional DM education to be 61%. After our participants were encouraged to improve or refresh their current knowledge, their mean score improved dramatically to 90.5%, which is consistent with other studies on knowledge improvement after CPD activities.[7, 8] This research study only tested the knowledge improvement of RDs, but it is expected that the knowledge improvement of other HCP, such as nurses, will be just as significant or even more, and that the insight they will obtain from the MNT manual will help improve their attitudes[9] towards the nutritional management of DM.

After participants had studied the MNT manual and completed KQ2, there were only 2 questions where they scored < 45%. These were related to the type of insulin regimen most suitable during Ramadan and risk factors for children to develop Type 2 DM. The improvement in knowledge after participants had received the MNT manual was significant, with the mean score increasing to 90.5%.

When the data were analyzed with repeated measures of ANOVA, no statistically significant differences ($p < 0.05$) were found between groups, such as when the before or after knowledge of public and private practising RDs was compared or when the knowledge of RDs with varying post-graduate status was compared. This is consistent with the findings of Schaller and James (2005), who only found significant knowledge differences between nurses with a diploma and those with a degree but not with any other comparison of qualifications. They discovered that knowledge was worse in participants who had a postgraduate diploma,[6] which is comparable to this research

where the RDs with the lowest qualifications (B.Sc.) had the best initial scores compared to the scores of RDs with an M.Sc. or Ph.D. as highest qualification, even though these differences were not statistically significant. It is expected for HCP who work with DM patients frequently to have better knowledge of the disease than those who do not, as was seen in this research study, with RDs who treated DM patients < once per week having a mean score of 54.3% and those who treated DM patients more frequently scoring between 59.7 and 60.9%. These differences were once again not statistically significant.

Contrary to a study on nurses, which found perceived DM knowledge correlates to actual DM knowledge,[10] this study's results show that RDs are not aware that their DM knowledge is inadequate, as the majority of study participants felt that their DM knowledge was adequate, yet only scored 58.7% (mean of n = 46).

The chapters on pharmacological treatment; DM and exercise; children and DM; and religion and DM were found most interesting by the expert panel. These were also the chapters where participants lacked the most knowledge initially. Chapters that they were less enthusiastic about included clinical diagnostics; targets for control (blood glucose, lipids, and blood pressure); sweeteners; management of the hospitalized DM patient; and DM in the workplace. Participants did reasonably well (mean score > 50%) in the initial assessment of their knowledge of the above chapters, except for clinical diagnostics and sweeteners. One can assume that RDs are not as interested in the diagnosis of the different types of DM as they expect this to be done by medical doctors. For many years, RDs have been aware that DM patients may use sugar as part of a balanced diet, and perhaps due to this knowledge, the chapter on sweeteners did not interest them as much as the other chapters.

The overall response to the MNT manual was excellent, with only five members of the expert panel commenting that they would probably not purchase the MNT manual for CPD purposes, but that this decision also depended on the cost. The remaining participants were very satisfied with the evidence-based content and felt it to be a very useful comprehensive guide for HCP on the topic of DM.

The MNT manual provides HCP in South Africa with a practical, up-to-date and evidence-based guide on nutrition in the care and management of their DM patients.

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CHAPTER 6
CONCLUSION

The assessment of the MNT manual indicates that it will be a useful tool for HCP and its use can be encouraged by incorporating it into a continuing education program.

Evidently RDs lack knowledge about DM, especially regarding the clinical diagnosis, pharmacological treatment, special circumstances, religion and DM, as well as the management of the hospitalized diabetic. This lack of knowledge significantly decreases when RDs are given the chance to learn more about these topics using a self-study method with CEUs as a principal motivator.

CHAPTER 7
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The development of evidence-based educational materials, which may be applied for CPD purposes, may encompass the following steps: (1) a needs assessment to determine relevance of the topic at hand, as well as additional relevant topics for inclusion; (2) collection and grading of good quality scientific information; (3) development of draft educational material; (4) review by a few experts in the field; (5) knowledge questionnaire and second draft educational material development; (6) educational material and knowledge questionnaire evaluation by an expert panel; (7) finalising education and knowledge-testing material. These steps could also be used for the development of other evidence-based recommendations and healthcare manuals. It is crucial to the professional development of HCP that educational materials are evidence based and contain information from good quality research and / or reputable sources. It is recommended that the quality or grading of the research is indicated, as this may increase the confidence HCP have in the information. This information is not available in the current edition of the MNT manual. Plans for the future updating of the manual also need to be made, to ensure that the information stays current.[1] This manual may provide a starting point for the development of a South African DM medical management guideline, covering all areas of DM management from all relevant multidisciplinary groups.

A future study on the knowledge improvement of HCP other than RDs (i.e. medical practitioners and nurses) may be warranted not only to test how much nutritional knowledge they have initially, but also to determine the improvement, as it may be possible that they will not understand all of the information in the MNT manual as well as the RDs did.

Testing if changes in practice, to the benefit of DM patients, are a result of the knowledge gain, would also be insightful as would determining if the gain in knowledge is sustained after a period of 6 to 12 months. Assessment of the long-term use of the MNT manual as a reference guide would provide valuable insight as well.

Even though many CPD activities are available for HCP, few attend activities regarding nutrition and / or diet therapy,[2] possibly because these activities are only marketed to attract RDs. Since nutrition plays such an integral part in DM management,[3] the MNT manual should ideally be marketed as a CPD activity via the various professional associations of members of the DM treatment team. This would include endocrinologists, primary care physicians, DM educators, RDs, pharmacists, podiatrists, ophthalmologists and behavioural scientists.[4] In order to integrate MNT thoroughly into the standard care of DM patients, this interdisciplinary approach is essential.[3]

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CHAPTER 8
LIMITATIONS OF THE STUDY

The development group for the MNT manual was smaller than recommended, comprising only 3 people instead of the recommended 12 – 15. This may have led to some bias and limited the contents of the MNT manual.[1] However, because the MNT manual was developed as a “derived guideline” or educational tool, bias was again reduced.[2]

The knowledge improvement was only determined for RDs. It would have been beneficial to have included HCP from other disciplinary groups and tested their knowledge improvement, as well as to determine if the MNT manual was useful to them.

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1. Shekelle PG, Woolf SH, Eccles M, Grimshaw J. Clinical guidelines: developing guidelines. BMJ. 1999;318:593-6.

2. International Diabetes Federation. Clinical guidelines task force. Guide for guidelines: a guide for clinical guideline development. Brussels: International Diabetes Federation. 2003; [accessed 12 Jul 2012].
Available from: http://www.idf.org/.

APPENDICES

Appendix 1. Ethics approval letter

07 February 2011 **MAILED**

Ms MJ Lombard
Community Health
4th Floor, Teaching Block
Tygerberg Campus
7505

Dear Ms Lombard

"The development and validation of a standardized training manual: Medical nutrition therapy as part of diabetes self-management education for health care professionals in Africa."

ETHICS REFERENCE NO: N11/01/016

RE : APPROVAL

It is a pleasure to inform you that a review panel of the Health Research Ethics Committee has approved the above-mentioned project on 29 January 2011, including the ethical aspects involved, for a period of one year from this date.

This project is therefore now registered and you can proceed with the work. Please quote the above-mentioned project number in ALL future correspondence. You may start with the project. Notwithstanding this approval, the Committee can request that work on this project be halted temporarily in anticipation of more information that they might deem necessary.

Please note a template of the progress report is obtainable on www.sun.ac.za/rds and should be submitted to the Committee before the year has expired. The Committee will then consider the continuation of the project for a further year (if necessary). Annually a number of projects may be selected randomly and subjected to an external audit.

Translations of the consent document in the languages applicable to the study participants should be submitted.

Federal Wide Assurance Number: 00001372
Institutional Review Board (IRB) Number: IRB0005239

The Health Research Ethics Committee complies with the SA National Health Act No.61 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 Part 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health).

Please note that for research at primary or secondary healthcare facility permission must still be obtained from the relevant authorities (Western Cape Department of Health and/or City Health) to conduct the research as stated in the protocol. Contact persons are Ms Claudette Abrahams at Western Cape Department of Health (healthres@pgwc.gov.za Tel: +27 21 483 9907) and Dr Hélène Visser at City Health (Helene.Visser@capetown.gov.za Tel: +27 21 400 3981). Research that will be conducted at any tertiary academic institution requires approval from the relevant hospital manager. Ethics approval is required BEFORE approval can be obtained from these health authorities.

Appendix 2. Advertisement used to recruit participants

Diabetes research: CPD opportunity!

A Master's degree student, in collaboration with NICUS, developed a practical, hands-on, long distance training manual for health care professionals. The purpose of the manual is to improve the messages that healthcare professionals give to their diabetic patients and to ensure that there is consistency in those messages. We hope that this objective can be achieved with this manual and that it will help improve the quality of life of the countless diabetics in South Africa. It will in future be sold by NICUS and will include up to 33 CEU points. The manual focuses on Medical Nutrition Therapy as part of the diabetes self-management. However, the manual needs to be tested among different healthcare professionals to determine its applicability in terms of knowledge improvement.

The manual includes various aspects of diabetes management, including the basics such as different medicinal treatments, targets for control, how to diagnose diabetes, as well as more nutritionally focused topics such as exercise and the type 1 and type 2 diabetic, nutritional supplements for diabetes, diabetes and the hospitalised patient, as well as many more interesting topics!

If you are willing to participate and would love to update and improve your knowledge on diabetes management, please click here to complete a short form with your contact details and we will get in touch with you as soon as possible to send you your FREE version of the Manual for study participation together with other documents related to the study. Upon completion of the study, your knowledge on diabetes will be tested and those study participants scoring 80% or higher will receive 33 CEUs. Certificates will be issued by NICUS.

Your participation will be greatly appreciated!

Appendix 3. Participant information and consent

16 January 2013

Dear Dietitian,

You have responded to an advertisement from ADSA about participating in research related to Diabetes.

Thank you for your willingness to participate in this research! Below you will find more detailed information as well as some forms for you to complete.

Kind regards,
Ursula Rausch

Participant information and consent

TITLE OF THE RESEARCH PROJECT

The development and validation of a standardized training manual: Diet and the Nutritional Management of Diabetes Mellitus: a Comprehensive Guide for Health Practitioners.

REFERENCE NUMBER: N11/01/016

PRINCIPAL INVESTIGATOR: Ursula Rausch

ADDRESS:

Division Of Human Nutrition

Room 3085

Clinical Building

Faculty of Health Sciences

Stellenbosch University

Tygerberg Campus

CONTACT NUMBER: 021 938-9259

Dear Colleague

My name is Ursula Rausch and I am a master's student at the University of Stellenbosch. I would like to invite you to participate in a research project that aims to validate a training manual on diabetes and nutrition for health professionals intended for the earning of CEU's.

Please take some time to read the information presented here, which will explain the details of this project and contact me if you require further explanation or clarification of any aspect of the study.

Your participation is entirely voluntary and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you did initially agree to take part.

This study has been approved by the Health Research Ethics Committee (HREC) at Stellenbosch University and will be conducted according to the ethical guidelines and principles of the international

Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

What is this study all about?

As diabetes treatment and management is so closely associated with dietary intervention, it is vital for all health care professionals in the treatment team to be equipped with accurate and up-to-date knowledge of the role of nutrition in the treatment and control of diabetes. It is therefore important for all health care professionals to standardize health care messages and to avoid mixed messages that can confuse patients. It is anticipated that the general blood glucose control of Type 1 and Type 2 diabetics will improve if health professionals in the treatment team communicate standardized nutrition messages.

The study will therefore focus on the development of a long distance education tool (a training manual) that will equip health care professionals with standardized nutritional knowledge for the treatment of both Type 1 and Type 2 Diabetes. This study will also include the testing of the manual, to determine if nutrition knowledge does improve. Participants for the study must be registered health care professionals in South Africa. We have decided to include general practitioners, registered nurses and registered dieticians in the study.

Why have you been invited to participate?

You have been invited to participate in this study because a manual for health care professionals has been written for the nutritional management of diabetes in South Africa. In order to improve the knowledge of other healthcare professionals in South Africa (with this manual), we need to ensure that it does in fact improve knowledge! By participating in the study, you will be assisting us in testing this manual and the content thereof.

What will your responsibility be?

You will receive a knowledge questionnaire on diabetes and nutrition. This questionnaire will comprise of numerous diabetes management related questions and is anticipated to take approximately 60 minutes of your time. This will have to be completed and returned to the researcher. Upon receipt of your completed questionnaire, a training manual will be sent to you, either by post or by e-mail, depending on your preference. You will receive 1 month to read through the manual and then you will have to complete a knowledge questionnaire again. It is anticipated that the training (self-study of the manual) will take approximately 40 hours of your time while the completion of the second knowledge questionnaire will take another 60 minutes. You may feel free to use your manual when answering the second knowledge questionnaire. Your knowledge before and after reading the manual will be compared in order to determine if the manual improved your knowledge on the subject. Participants who score 80% or more on the second questionnaire will receive a Continuing Education Units (CEU) certificate for 33 points on level 2.

Will you benefit from the study?

Absolutely! You will improve your knowledge on the nutritional management of diabetes as well as earn CEU's.

Are there any risks involved if you participate?

No risks to the participants are anticipated with this study. Reading through the manual will be time-consuming however.

If you do not agree to participate, what alternatives do you have?

Should you wish not to participate in the study, you may contact the Nutrition Information Centre of the University of Stellenbosch for more information regarding diabetes and nutrition.

Who will have access to your personal records?

Only the principal researcher will have access to your information. Your test scores and other information will remain confidential. No one other than the principal researcher will have seen your personal information.

What will happen in the unlikely event of some form of injury occurring as a direct result of your participation?

No risk of injury to the participants is anticipated with this study.

Will you be paid to take part in this study and are there any costs involved?

No, you will not be paid to partake in the study, as you will be benefiting from the study otherwise. You should not incur any major expenses in order to partake in the study as you will be provided with the relevant documents either by post or by e-mail. You will receive paid for return envelopes for your questionnaires if you wish to use regular mail. The only expense would be taking the envelopes to the post office and for those preferring e-mail, internet costs.

Is there anything else you should know or do?

If you have any further questions of if you have any problems you can contact Ursula Rausch via e-mail at: diabetesmanual@gmail.com.

You can also phone the Health Research Ethics Committee at 021 938-9207 if you have any concerns or complaints that have not been adequately addressed by the researcher.

If you are willing to participate in this study please sign the attached Declaration of Consent and complete the socio-demographic questionnaire and the Diabetes Knowledge Questionnaire and *e-mail*

these back to U Rausch at diabetesmanual@gmail.com or alternatively you may use the self-addressed envelopes provided.

Yours sincerely,

Ursula Rausch

Principal Investigator

Declaration by participant

By signing below, I …….…… (full names) agree to take part in a research study entitled: The development and validation of a standardized training manual:

The development and validation of a standardized training manual: Diet and the Nutritional Management of Diabetes Mellitus, a Comprehensive Guide for Health Practitioners.

I declare that:

- I have read the attached information leaflet and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.
- I may be asked to leave the study before it has finished, if the researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.

Signed at (*place*) ..... On (*date*) ……..

.....

Signature of participant

Socio-demographic questionnaire

Please tick/complete the following:

1. **Gender**
   - ☐ Male
   - ☐ Female
2. **Age** _____
3. **Highest level of education**
   - ☐ Bachelor's degree/diploma
   - ☐ Master's degree
   - ☐ Doctorate/PhD
4. **Name of institute where highest education was received**

   _____
5. **Was nutrition part of your training?**
   - ☐ Yes
   - ☐ No
6. **If yes, how much time was spent of nutrition training?**
   - ☐ 0-6 months
   - ☐ 6-12 months
   - ☐ More than a year
7. **Have you had any other form of nutrition training?**
   - ☐ Yes
   - ☐ No
8. **Your employment status is:**
   - ☐ Full time employed
   - ☐ Part time employed
   - ☐ Self employed
   - ☐ Unemployed
   - ☐ Retired
   - ☐ Student

9. **If currently working, what sector are you working in?**
   - ☐ Public
   - ☐ Private
10. **Do you think nutrition plays a part in the treatment of diabetes?**
    - ☐ Yes
    - ☐ No
11. **Do you believe your knowledge on diabetes and nutrition related factors are adequate?**

- ☐ Yes
- ☐ No

12. **If not, why?**

_____

_____

_____

_____

_____

13. **Are you interested in learning more about nutrition and the treatment of diabetes?**
    - ☐ Yes
    - ☐ No
14. **Are you currently working with diabetic patients in your work place?**
    - ☐ Yes
    - ☐ No
15. **If yes, how much time, in your opinion, do you spend educating people on diabetes?**
    - ☐ Little (once a week or less)
    - ☐ Moderate (2 – 3 times per week)
    - ☐ A lot (daily or almost daily)
16. **How much time do you spend per patient teaching them about the importance of nutrition and blood glucose control?**
    - ☐ 10 minutes or less
    - ☐ 10-30 minutes
    - ☐ 30-60 minutes
    - ☐ More than 60 minutes

17. **What percentage of your time do you spend with type 1 diabetic patients?**
    - ☐ Little (once a week or less)
    - ☐ Moderate (2 – 3 times per week)
    - ☐ A lot (daily or almost daily)
18. **What percentage of your time do you spend with type 2 diabetic patients?**
    - ☐ Little (once a week or less)
    - ☐ Moderate (2 – 3 times per week)
    - ☐ A lot (daily or almost daily)

Appendix 4. Diabetes knowledge questionnaire

Knowledge questionnaire on the Nutritional Treatment of Diabetes

Dear participant,

Please read the questions thoroughly and choose the answer you feel is most correct.

Keep in mind that your answers are used for research purposes and that we rely on your honesty in completing the questionnaire. This questionnaire will be used to assess your diabetes knowledge after you have read the manual. This score will be used for CPD purposes. You may use the manual to look up any answers that you are not sure of.

By keeping to these instructions you will help us get more accurate results and therefore help us with the development of a guideline which we hope will benefit healthcare professionals and diabetics in South Africa!

Thank you for your participation!

Kind regards,

Ursula Rausch (RD)

Principle investigator

1. **How soon after hospitalization should a diabetic person have a follow-up visit with their healthcare provider?**
   a. 1 week
   b. 1 month
   c. 3 months
   d. I don't know the answer or I am unsure

2. **It has been shown, without a doubt, that chromium supplementation improves glycaemic control.**
   a. True
   b. False
   c. I don't know the answer or I am unsure

3. Which type of diabetes is more prevalent?

a. Type 1 diabetes mellitus
b. Type 2 diabetes mellitus
c. Gestational diabetes mellitus
d. I don't know the answer or I am unsure

4. Which of the following characteristic(s) increases a woman's risk of developing gestational diabetes?

a. Obesity
b. Strong family history of Type 1 diabetes
c. Diagnosis of polycystic ovarian syndrome
d. a and b
e. a and c
f. b and c
g. I don't know the answer or I am unsure

5. Metformin commonly leads to the following side-effects:

a. Transient gastrointestinal disturbances
b. Hypoglycaemia
c. Lactic acidosis
d. a and b
e. a and c
f. I don't know the answer or I am unsure

6. Which of the following is the best diagnostic test for diabetes?

a. Fasting plasma glucose
b. Oral glucose tolerance test
c. I don't know the answer or I am unsure

7. The DASH diet has been formulated to specifically target:

a. Blood glucose
b. Blood pressure
c. Blood lipids
d. I don't know the answer or I am unsure

The following symptoms are a sign of:

- **Extreme thirst**
- **Blurred vision**
- **Increased appetite**
- **Fatigue**

8.

a. Hypoglycaemia
b. Hyperglycaemia
c. None of the above
d. I don't know the answer or I am unsure

9. The specific pancreatic cells responsible for production of insulin are called the:

a. Alpha cells
b. Beta cells
c. I don't know the answer or I am unsure

10. Children are most at risk of Type 2 diabetes if:

a. They have a BMI of > 85th percentile for age and gender
b. They have a family history of Type 2 diabetes
c. They had an early onset of puberty
d. a and b
e. All of the above
f. I don't know the answer or I am unsure

11. Renal insufficiency, haemodynamic instability and imaging studies with a contrast dye are all contraindications for which common diabetic medication?

a. Metformin
b. Sulphonylureas
c. Short working insulin
d. I don't know the answer or I am unsure

12. During hospitalization, newly diagnosed diabetics should receive only "survival skills" to manage their diabetes.

a. True
b. False
c. I don't know the answer or I am unsure

13. Sugar alcohols are a type of:

a. Sugar found in alcohol
b. Reduced-energy sweetener
c. Non-nutritive sweetener
d. I don't know the answer or I am unsure

14. Carbohydrates definitely need to be consumed before exercise, if the pre-exercise blood glucose level is:

a. < 5.5 mmol/ℓ
b. 6 – 12 mmol/ℓ
c. > 15 mmol/ℓ
d. I don't know the answer or I am unsure

15. It is very important that diabetic prisoners receive special meals that are healthier than the regular meals.

a. True
b. False
c. I don't know the answer or I am unsure

16. **Asymptomatic individuals with a BMI of more than … kg/m^2 plus any additional risk factors should be tested for diabetes or prediabetes.**

a. 25
b. 30
c. 35
d. I don't know the answer or I am unsure

17. **The diagnosis of gestational diabetes can be made by HbA1c.**

a. True
b. False
c. I don't know the answer or I am unsure

18. **When blood glucose levels are > 13.3 mmol/ℓ, the diabetic person should:**

a. Test for ketones
b. Exercise to help reduce blood glucose levels
c. Inject glucagon
d. All of the above
e. I don't know the answer or I am unsure

19. **The LDL-cholesterol level for diabetics who are at risk of coronary heart disease should ideally be:**

a. < 5.2 mmol/ℓ
b. < 3 mmol/ℓ
c. < 1.8 mmol/ℓ
d. I don't know the answer or I am unsure

20. **Muslim diabetics are only allowed to use pork-based insulin as synthetic insulin is not permitted.**

a. True
b. False
c. I don't know the answer or I am unsure

21. Uncontrolled diabetes leads to an increased urinary loss of:

a. Magnesium
b. Calcium
c. I don't know the answer or I am unsure

22. Which type of insulin regime is most suitable during Ramadan?

a. Only short acting
b. Only long acting
c. Combination of long- and short acting
d. Premix insulin
e. I don't know the answer or I am unsure

23. The glycaemic targets for children should be:

a. Less strict than for adults since they are more prone to hypoglycaemia
b. More strict than for adults as they will have diabetes for many years to come
c. I don't know the answer or I am unsure

24. Snacks should be available for prisoners that are on medications that may cause hypoglycaemia.

a. True
b. False
c. I don't know the answer or I am unsure

25. Type 1 diabetes occurs only in children

a. True
b. False
c. I don't know the answer or I am unsure

26. If a person is admitted to hospital and hyperglycaemia occurs:

a. They probably developed diabetes whilst in hospital.
b. HbA1c should be done to determine if they have unrecognised diabetes.
c. They may have hyperglycaemia unrelated to diabetes.
d. a and b
e. b and c
f. I don't know the answer or I am unsure

27. DPP-4 inhibitors:

a. Stimulate the pancreas to produce insulin
b. Extend the action of naturally occurring GLP-1
c. Improve pancreatic islet cell function
d. a and b
e. b and c
f. I don't know the answer or I am unsure

28. The term "prediabetes" is synonymous with:

a. Impaired glucose tolerance
b. Impaired fasting glucose
c. All of the above
d. I don't know the answer or I am unsure

29. Prison staff need to be educated on:

a. Measuring blood glucose levels
b. Injecting insulin
c. Injecting glucagon
d. Recognizing hypo- and hyperglycaemia as well as DKA
e. Treating hypo- and hyperglycaemia as well as DKA
f. a and d
g. a, b, c and d
h. All of the above
i. I don't know the answer or I am unsure

30. When considering a diabetic person for employment, the employer needs to keep in mind that the diabetic person may develop secondary complications in the coming years, such as retinopathy en neuropathy which may affect their ability to do their jobs.

a. True
b. False
c. I don't know the answer or I am unsure

31. Type 2 diabetes is associated with:

a. Insulin resistance
b. Decreased insulin production
c. Physical activity
d. a and b
e. a, b and c
f. I don't know the answer or I am unsure

32. When exercising, it is best that a Type 1 diabetic…

a. dramatically increases their carbohydrate intake in order to prevent hypoglycaemia
b. decreases their rapid-acting insulin a bit in order to prevent hypoglycaemia
c. I don't know the answer or I am unsure

33. An appropriate blood glucose goal for critically ill hospitalized patients (i.e. patients in intensive care unit) is to aim for < 6.1 mmol/ℓ.

a. True
b. False
c. I don't know the answer or I am unsure

34. Weight loss is NOT considered to help someone with prediabetes revert back to normal glucose metabolism.

a. True
b. False

c. I don't know the answer or I am unsure

35. During illness, Type 1 diabetics should test their urine regularly for:

a. Blood
b. Ketones
c. Glucose
d. I don't know the answer or I am unsure

36. Sweet wine, port and creams are just as good alcohol choices as are whisky and red wine.

a. True
b. False
c. I don't know the answer or I am unsure

37. Why are Type 1 diabetics generally more thin than Type 2 diabetes, or even underweight, at diagnosis?

a. They eat healthier than type 2 diabetics
b. Due to ketosis
c. Due to insulin resistance
d. I don't know the answer or I am unsure

38. Lutein has been found useful for:

a. Retinopathy
b. Age-related macular degeneration
c. Night blindness
d. I don't know the answer or I am unsure

39. To diagnose metabolic syndrome, a waist circumference of ≥ 94 cm for men and ≥80 cm for women is used together with blood pressure measurements and lipid levels.

a. True
b. False
c. Waist circumference should vary for different ethnic groups

d. I don't know the answer or I am unsure

40. Which of the following is NOT a risk factor for Type 2 diabetes?

a. First degree relative with Type 2 diabetes
b. Caucasian population group
c. Acanthosis nigricans
d. History of gestational diabetes
e. I don't know the answer or I am unsure

41. When blood glucose levels are < 3.8 mmol/ℓ, a person should:

a. Have a peanut butter sandwich
b. Have some sugar containing cold drink or glucose sweets
c. Have some sugar containing cold drink or glucose sweets, followed by a low GI meal
d. Have a low glycaemic index cooked meal
e. I don't know the answer or I am unsure

42. When an employer wishes to assess a diabetic person before employing that person, they should request an HbA1c to get an idea of the overall blood glucose control of that person.

a. True
b. False
c. I don't know the answer or I am unsure

43. After aerobic exercise, a diabetic person should:

a. Have a carbohydrate containing snack or meal
b. Reduce their bolus insulin
c. All of the above
d. I don't know the answer or I am unsure

44. **Medications such as immunosuppressants, corticosteroids and parenteral nutrition may cause:**

a. Hypoglycaemia
b. Hyperglycaemia
c. I don't know the answer or I am unsure

45. **Should no risk factors for diabetes be present, screening should begin at the age of:**

a. 18 years
b. 45 years
c. 60 years
d. I don't know the answer or I am unsure

46. **A Jewish person is not allowed to have yoghurt as a mid-afternoon snack if they had meat at lunch.**

a. True
b. False
c. I don't know the answer or I am unsure

47. **If a pregnant woman is diagnosed with diabetes, at her first prenatal visit, it means she:**

a. had undiagnosed diabetes before she fell pregnant
b. has gestational diabetes
c. I don't know the answer or I am unsure

48. **Diabetics are advised to use fructose instead of sucrose.**

a. True
b. False
c. I don't know the answer or I am unsure

49. **There has been an increase in Type 2 diabetes amongst children in recent years. The primary criteria for screening children is:**

a. Sugar consumption
b. BMI > 85th percentile for age and gender
c. Lack of physical activity
d. All of the above
e. I don't know the answer or I am unsure

50. **Diabetic prisoners that are frequently ill are a security risk for prisons.**

a. True
b. False
c. I don't know the answer or I am unsure

51. **Which of the following factors does NOT help lower the glycaemic index of a food?**

a. High fat content
b. High carbohydrate content
c. Large quantities of lectins, phytates and tannins
d. I don't know the answer or I am unsure

52. **True or false: Cinnamon supplements are completely safe and may be used by all diabetic people.**

a. True
b. False
c. I don't know the answer or I am unsure

53. **Type 1 diabetes is caused by the autoimmune destruction of the pancreatic cells.**

a. True
b. False
c. I don't know the answer or I am unsure

54. HbA1c is a measure of glycated haemoglobin over the last …. Months.

a. 3
b. 6
c. 12
d. I don't know the answer or I am unsure

55. If a diabetes screening test is negative, the tests should be repeated every … years in individuals who are at risk or of a certain age.

a. 3
b. 5
c. 10
d. I don't know the answer or I am unsure

56. The following sentence most accurately describes the action of sulphonylureas:

a. Sulphonylureas decrease the absorption of glucose from the gastrointestinal tract
b. Sulphonylureas stimulate the pancreas to produce more insulin
c. Sulphonylureas are a type of insulin
d. I don't know the answer or I am unsure

57. When self-monitoring of blood glucose is performed, patients should wash their hands and clean the fingertip that is going to be pricked with alcohol.

a. True
b. False
c. I don't know the answer or I am unsure

58. Rapid insulin should be injected….. a meal.

a. 30 minutes before
b. immediately before
c. 30 minutes after
d. I don't know the answer or I am unsure

59. Very high triglyceride levels could lead to:

a. Heart failure
b. Diabetes
c. Pancreatitis
d. All of the above
e. I don't know the answer or I am unsure

60. If someone is unconscious due to hypoglycaemia, one should:

a. Inject insulin
b. Try to feed them some food
c. Rub jam or syrup on the inside of their cheek
d. I don't know the answer or I am unsure

61. Blood pressure is considered dangerous, and medical treatment is required, when it is:

a. > 120/80 mmHg
b. > 130/85 mmHg
c. > 140/90 mmHg
d. I don't know the answer or I am unsure

62. Women with a history of GDM should be screened for diabetes or prediabetes every … year(s).

a. 1
b. 3
c. 5
d. I don't know the answer or I am unsure

63. **Metformin (Glucophage) helps to decrease blood glucose levels by:**

a. Increasing the uptake of insulin into the cells
b. Decreasing the uptake of glucose from the gastrointestinal tract
c. Decreasing the liver's release of glucose into the blood stream
d. a and b
e. All of the above
f. I don't know the answer or I am unsure

64. **If a diabetic suffers from hypoglycaemia during the night, but their fasting blood glucose levels are normal, it means that:**

a. They are overmedicated
b. They are having a too large supper
c. Their late evening snack is too small and / or incorrect
d. I don't know the answer or I am unsure

65. **A natural treatment for dyslipidaemia (for those intolerant to statins) is:**

a. Vitamin C
b. Niacin
c. Folic acid
d. I don't know the answer or I am unsure

66. **Fasting blood glucose levels should ideally be:**

a. 2 – 3 mmol/ ℓ
b. 4 – 7 mmol/ℓ
c. 8 – 10 mmol/ℓ
d. I don't know the answer or I am unsure

67. Sucrose intake of diabetics should not exceed …. of total daily energy.

a. 5%
b. 10%
c. 15%
d. Diabetics aren't allowed to use sucrose at all!
e. I don't know the answer or I am unsure

68. Carbohydrate counting is especially helpful for individuals with:

a. Type 1 diabetes
b. Type 2 diabetes
c. I don't know the answer or I am unsure

69. Insulin should be stored in the:

a. Medicine cabinet
b. Back of the fridge
c. Door of the fridge or vegetable drawer
d. Freezer
e. I don't know the answer or I am unsure

70. Lantus is an example of a:

a. Fast acting insulin
b. Premix insulin
c. Long acting insulin
d. I don't know the answer or I am unsure

71. Sulphonylureas are typically prescribed to

a. Type 1 diabetics
b. Type 2 diabetics
c. I don't know the answer or I am unsure

72. **Fat…**

a. delays the absorption of glucose from a meal
b. speeds up the absorption of glucose from a meal
c. I don't know the answer or I am unsure

73. **Which of the following foods is NOT a fast acting sugar?**

a. Honey
b. Glucose sweets
c. Chocolate
d. I don't know the answer or I am unsure

74. **Diabetic ketoacidosis (DKA) is the result of:**

a. Hypoglycaemia
b. Hyperglycaemia
c. None of the above
d. I don't know the answer or I am unsure

75. **A DMMP is a:**

a. new type of treatment for Type 2 diabetes.
b. plan for the treatment of diabetes in children.
c. newly developed immunization for babies to prevent Type 1 diabetes.
d. I don't know the answer or I am unsure

The following symptoms indicate which problem:

- **Awaking with sweaty pajamas and sheets**
- **Awaking with a headache**
- **Nightmares**
- **Not feeling rested**

76.

a. Hyperglycaemia during the night
b. Hypoglycaemia during the night
c. These symptoms are not related to diabetes
d. I don't know the answer or I am unsure

77. Insulin should be injected into:

a. Fatty tissue
b. Muscle tissue
c. Directly into the blood stream
d. I don't know the answer or I am unsure

78. The recommended intake for the 3 macronutrients for diabetics is:

a. 20% fat, 20% protein and 60% carbohydrate
b. 30% fat, 15-20% protein and 45 – 65% carbohydrate
c. 30% fat, 20% protein and 50% carbohydrate
d. I don't know the answer or I am unsure

79. Protein stimulates the release of insulin.

a. True
b. False
c. I don't know the answer or I am unsure

80. Type 2 diabetics suffering from nocturnal hypoglycemia should be advised to:

a. Have a high carbohydrate snack such as a rusk before bed-time
b. Have a high protein snack such as cheese before bed-time
c. Have a snack containing both carbohydrates and protein before bed-time
d. I don't know the answer or I am unsure

81. During which of the following situations should a diabetic person increase their self-monitoring?

a. Acute illness
b. Pregnancy
c. When their therapy is being / was recently adjusted
d. All of the above
e. I don't know the answer or I am unsure

82. **Hyperosmolar hyperglycaemic state (HHS) is more common in:**

a. Type 1 diabetes
b. Type 2 diabetes
c. I don't know the answer or I am unsure

83. **Diabetics on insulin or insulin secretagogues should:**

a. Consume alcohol on its own since it is a rich source on carbohydrates
b. Always consume alcohol with a balanced meal
c. Strictly avoid alcohol
d. I don't know the answer or I am unsure

84. **If a diabetic person is going to partake in an endurance sporting event, they should:**

a. Avoid eating any food in the hours before the event
b. Have a balanced meal 3 – 4 hours before the event
c. Drink a carbohydrate containing sports drink during the event
d. a and c
e. b and c
f. I don't know the answer or I am unsure

85. **When counting the carbohydrates in a meal, the fibre (if > 5g) in the meal should be…. the total carbohydrates.**

a. added to
b. subtracted from
c. I don't know the answer or I am unsure

86. **If ketones are present, a diabetic person should:**

a. Try and exercise as soon as possible at a high intensity until the ketones have cleared
b. Avoid exercise until the ketones have cleared
c. I don't know the answer or I am unsure

87. Hyperglycaemic hyperosmolar state (HHS) occurs when:

a. Blood glucose levels are elevated and ketones accumulate
b. Blood pressure increases due to high blood glucose
c. Blood glucose is severely elevated for days or weeks
d. I don't know the answer or I am unsure

88. One can aim for a higher HbA1c in toddlers, children and adolescents as they are more at risk of hypoglycaemia than other age groups

a. True
b. False
c. I don't know the answer or I am unsure

89. With carbohydrate counting, one can initially assume that 1 unit of insulin will be able to decrease the blood response of … g of carbohydrate.

a. 5 g
b. 15 g
c. 30 g
d. I don't know the answer or I am unsure

90. Immediately before and during exercise, it is recommended that a diabetic person / child consumes:

a. Low glycaemic index carbohydrates
b. High glycaemic index carbohydrates
c. I don't know the answer or I am unsure

91. Children are less prone to hypoglycemia than adults.

a. True
b. False
c. I don't know the answer or I am unsure

92. Glucomannan is a type of:

a. Herbal supplement
b. Multivitamin supplement
c. Soluble fibre supplement
d. I don't know the answer or I am unsure

93. Medical nutrition therapy may be done by:

a. Registered dietitians
b. Registered nurses
c. Medical doctors
d. All of the above
e. I don't know the answer or I am unsure

94. How many additional carbohydrates are required before exercise that lasts < 20 minutes at an intensity of > 60% maximal heart rate with initial blood glucose within normal range?

a. 0 g
b. 15 g
c. 30 g
d. I don't know the answer or I am unsure

95. The dietary guidelines for children with diabetes and for children without diabetes vary considerably.

a. True
b. False
c. I don't know the answer or I am unsure

96. Olive oil, peanut butter and nuts contain a large amount of:

a. Saturated fatty acids
b. Monounsaturated fatty acids
c. Polyunsaturated fatty acids
d. I don't know the answer or I am unsure

97. Sports drinks, carbonated beverages and glucose sweets are examples of foods that should:

a. Be completely avoided by all diabetics, including diabetic children.

b. Be used in the presence of hyperglycaemia.

c. Be used immediately before and during exercise to prevent hypoglycaemia.

d. I don't know the answer or I am unsure

98. Diabetic children have completely different nutritional requirements than other children.

a. True

b. False

c. I don't know the answer or I am unsure

99. In diabetics, what is a common occurrence during illness?

a. Hypoglycaemia

b. Hyperglycaemia

c. I don't know the answer or I am unsure

100. Muslim diabetics on sulphonylureas are advised to take their medication … minutes before their evening meal during Ramadan.

a. 5

b. 15

c. 30

d. I don't know the answer or I am unsure

101. Half of the sugar alcohol in grams has to be subtracted from the total carbohydrates per portion to calculate the glycaemic carbohydrates per portion.

a. True

b. False

c. I don't know the answer or I am unsure

102. **Alpha-lipoic acid is used in Germany as a treatment for:**

a. Diabetic retinopathy
b. Diabetic neuropathy
c. Diabetes related hypertension
d. I don't know the answer or I am unsure

103. **During hyperglycaemia, the metabolism of glucose increases through a pathway called the polyol (sorbitol) pathway. This leads to the production of superoxide, a powerful oxidant.**

a. True
b. False
c. I don't know the answer or I am unsure

104. **The ideal level for a diabetic person's HbA1c is:**

a. < 5%
b. < 7%
c. < 9%
d. I don't know the answer or I am unsure

105. **If resources are limited, which of the following cases would NOT take priority in receiving an appointment with a registered dietitian?**

a. A newly diagnosed Type 1 diabetic child
b. A newly diagnosed Type 2 diabetic
c. A woman with gestational diabetes
d. I don't know the answer or I am unsure

106. **Most diabetic patients, Type 1 and Type 2, admitted to hospital in a critically ill condition, should be treated with:**

a. Insulin
b. Insulin secretagogues
c. Metformin

d. Their usual medication

e. I don't know the answer or I am unsure

107. If blood glucose levels are tested 1 hour before exercise and found to be ≤ 5.5 mmol/ℓ, the appropriate thing to do is:

a. Have a low GI carbohydrate

b. Have a high GI carbohydrate

c. Nothing, the blood sugar level is normal

d. I don't know the answer or I am unsure

108. Some studies have shown that cinnamon helps decrease:

a. Fasting glucose

b. Triglycerides

c. LDL- and total-cholesterol

d. Al l of the above

e. I don't know the answer or I am unsure

109. Hyperglycaemia can be defined as:

a. Fasting blood glucose of > 7.0 mmol/ℓ

b. Random blood glucose of > 11.0 mmol/ℓ

c. All of the above

d. I don't know the answer or I am unsure

110. At discharge, both Type 1 and Type 2 diabetics should receive a glucagon kit.

a. True

b. False

c. I don't know the answer or I am unsure

111. Clinical diagnostics used for the diagnosis of diabetes are:

a. Fasting blood glucose of ≥ 7 mmol/ℓ
b. Random blood glucose of ≥ 11.1 mmol/ℓ
c. 2-hour OGTT reading of ≥ 11.1 mmol/ℓ
d. Polyuria, polydipsia and polyphagia in conjunction with elevated blood glucose levels
e. All of the above
f. I don't know the answer or I am unsure

112. For critically ill hospitalized patients, the target blood glucose is usually lower than for non-critically ill patients.

a. True
b. False
c. I don't know the answer or I am unsure

113. Which of the following conditions is NOT an indication for referral to a registered dietitian?

a. Obesity
b. Renal disease
c. Coeliac disease
d. Hypotension
e. I don't know the answer or I am unsure

114. A person with Type 2 diabetes should be encouraged to do ... minutes of aerobic exercise (cardiovascular exercise) per week.

a. 50
b. 100
c. 150
d. I don't know the answer or I am unsure

115. Shift workers may have more difficulty managing their diabetes than people working during normal business hours.

a. True
b. False
c. I don't know the answer or I am unsure

116. All Hindus are strict vegetarians.

a. True
b. False
c. I don't know the answer or I am unsure

117. When travelling on aeroplanes, diabetics should always put their insulin into their checked-in baggage.

a. True
b. False
c. I don't know the answer or I am unsure

118. In a situation where a child participates in an sporting activity but their energy levels remain low while their blood glucose is increased, one should:

a. Discontinue the activity immediately to prevent diabetic ketoacidosis (DKA).
b. Encourage the child to continue with the activity as their body will start absorbing the glucose soon.
c. Inject an additional 2 units of insulin if no improvement is seen by the time the insulin peaks.
d. I don't know the answer or I am unsure

119. Type 2 diabetics Muslims on Metformin treatment, who wish to participate in Ramadan, should be advised to:

a. Discontinue their Metformin completely during Ramadan
b. Take their medication as prescribed
c. Only use the Metformin with their largest meal, usually Iftari.
d. I don't know the answer or I am unsure

120. **Do you feel that the diabetes manual improved your knowledge of diabetes?**

a. Yes

b. No

121. **Do you think you will be able to provide a better service to your diabetic patients due to the knowledge you gained from the manual?**

a. Yes

b. No

122. **Which chapter(s) did you find most interesting?**

123. **If there is anything you would change about the manual, what would it be?**

124. **Is there any other topic(s) that you feel should have been included which were not?**

125. Would you purchase this manual for CPD / CEU purposes if it were available to you?

a. Yes

b. No

If No, please give a motivation for your answer:

In order for us to process the above information, please provide us with the following information:

Full name(s) and surname:

_____

Please state your profession:

_____

Please provide your HPCSA nr (e.g. DT1234567):

_____

Please provide us with an e-mail address for us to send you your CEU certificate (should you qualify): _____

Thank you for completing the questionnaire! You may return the questionnaire by using the self-addressed envelope provided or by scanning the document and e-mailing it to diabetesmanual@gmail.com. **Please return the questionnaire to us by 30 April 2013!**

Appendix 5. Diet and the Nutritional Management of Diabetes Mellitus: a Comprehensive Guide for Health Practitioners