

Assessment of diabetes dietary knowledge and its impact on intake of patients in Senwabarwana, Limpopo, South Africa

MH Mphasha^a , TM Mothiba^{b,*} and L Skaal^{a,c} 

^aDepartment of Public Health, University of Limpopo, Polokwane, South Africa

^bFaculty of Health Sciences, University of Limpopo, Polokwane, South Africa

^cSchool of Health Care Sciences, University of Limpopo, Polokwane, South Africa

*Correspondence: Tebogo.mothiba@ul.ac.za



Background: Dietary diabetes knowledge is a significant contributor to the improvement of eating habits. Adequate dietary knowledge leads to adherence to a dietary plan, which is viewed as a cornerstone in diabetes treatment, and linked with better diabetes outcomes. The aim of the study is to assess diabetes dietary knowledge and intake of patients.

Method: A convergent mixed-methods parallel study design was conducted with 217 participants (200 quantitative and 17 qualitative). The quantitative phase used a cross-sectional descriptive design; data were collected using a close-ended questionnaire and analysed using SPSS Software v24.0. The qualitative phase used a phenomenological exploratory design; data were collected using interviews and analysed using 8 Steps of Tesch's inductive, descriptive open coding technique.

Results: About 81% and 81.5% of quantitative participants understand the importance of nutrition, and that eating large portion sizes may lead to increased blood sugar, respectively, compared with all qualitative participants. However, qualitative participants further reported intake of large portion sizes due to family eating patterns. Only 28.5% of quantitative participants consume breakfast, compared with all qualitative participants.

Conclusion: Diabetes patients know the disadvantages of consuming large food portions, but a family culture of eating patterns prohibits patients eating accordingly, justifying the need for the adoption of family-centred diabetes care.

Keywords: adherence, diabetes, dietary, intake, knowledge, patients

Introduction and background

Dietary diabetes knowledge is a significant contributor to the improvement of eating habits.¹ Inadequate dietary knowledge leads to poor diabetes outcomes, complications, comorbidity, poor quality of life and death.^{2,3} Various international studies reported inadequate knowledge among patients,^{4,5} including among South African patients.⁶ Adequate dietary knowledge is essential in diabetes care and may persuade patients to adopt healthy eating,⁷ and prevent health problems.⁸ Ajzen *et al.*⁹ contended that knowledge alone is no guarantee for the adoption of healthy dietary intake, much as ignorance contributes to poor dietary intake.

Unhealthy eating habits contribute to the rising diabetes prevalence,¹⁰ which is estimated to affect 9% of the population globally.¹¹ According to Hill *et al.*¹² the burden of diabetes in sub-Saharan Africa (SSA) is growing rapidly and is expected to increase by 142.9% from 19.4 million people in 2019 to 47.1 million in 2045. South Africa (SA) is the country with the second highest diabetes prevalence in SSA, standing at 12.8% among adults aged 20–79 years of age. However, diabetes prevalence in SA is underestimated as most people in Africa have undiagnosed diabetes.¹³ Limpopo province has the fourth highest diabetes prevalence rate of 5.2%.¹³ Several dietary practices are linked to unhealthy bodyweight, high intake of saturated fatty acids and inadequate consumption of dietary fibre,¹⁴ as well as high consumption of sugar-sweetened beverages.¹⁵

The World Health Organization¹⁴ recommends achievement and maintenance of healthy bodyweight and dietary intake, and avoidance of sugar and saturated fats. A healthy diet

lowers haemoglobin A1c.¹⁶ A healthy diet includes daily intake of 400 g of fruits and vegetables, 30% of total energy intake of fats,¹⁷ less than 10% of total energy intake from free sugars, which is equivalent to 50 g or about 12 teaspoons,¹⁸ less than 5 g of salt, which is half a teaspoon,¹⁹ and consumption of a variety of food.

Diabetes management requires dietary modification characterised by quality and quantity of food,¹¹ medication and exercise for better glycaemic control.¹⁰ Adherence to a dietary plan is viewed as a cornerstone of diabetes treatment,¹ and linked with better outcomes. However, adherence remains a problem worldwide, in both developed and developing nations.²⁰ Jordanian²¹ and Egyptian²² studies both reported inadequate knowledge. A South African study reported suboptimal adherence to dietary modification.⁵ Non-adherence is associated with inadequate knowledge,²³ poor family support⁷ and lack of motivation.²⁴ Therefore, this study aimed at assessing dietary diabetes knowledge and its impact on intake among patients.

Method

Design

A convergent mixed-methods parallel study design was used, which enabled the researcher to collect data throughout both quantitative and qualitative phases. The quantitative phase used a cross-sectional descriptive design, which involved collection of data using a questionnaire, whereas the qualitative phase used a phenomenological exploratory design, which enabled collection through one-to-one interviews with patients.

Study setting

This study was conducted in rural-based Blouberg Municipality in the Senwabarwana area of Capricorn District, in the Limpopo province of South Africa.

Study participants

Participants were diabetes patients receiving treatment at the clinics in Blouberg Municipality, and had lived with diabetes for six or more months, because they could relate lived experiences. A total of 217 participants (200 quantitative and 17 qualitative) were selected from a population of 406. An additional 20 patients were included in the quantitative sample to cater for attrition and spoilt questionnaires. The sample was calculated using Yamane's formula,²⁵ which is as follows: $n = N \div 1 + N(e)^2$; where n = Sample size, N = Population size ($N = 406$), and e = error margin (5%). The qualitative sample depended on data saturation and used purposive sampling to select participants. The mixed-methods results involved the integration of findings from 200 quantitative and 17 qualitative participants through merging for comparison using joint display.

Data collection and instruments

Quantitative data were collected using a close-ended questionnaire with three sections, i.e. demographic profile, knowledge and practices related to dietary intake. Eleven questions were used to establish knowledge and practices related to dietary intake, derived from studies by Muchiri *et al.*²⁶ and Le Roux *et al.*²⁷ using 3-point Likert scale "Yes, Not Sure; No", and "Regular; Sometimes; Never", respectively. Qualitative data were collected through unstructured interviews using voice recorders, and field notes for observed non-verbal cues that could not be captured by the voice recorder during interviews. Participants were informed when voice recorders were switched on and off. The interviews were done in Sepedi as the dominant language in the area. The central question for the interview was 'Kindly describe your understanding of the importance of diet in diabetes care and how knowledge impacts on your eating'. Probing and clarity-seeking questions were asked to obtain in-depth information.

Measures of rigour

A quantitative measure of rigour was ensured through reliability and validity. Reliability was ensured through piloting the questionnaire in non-participating clinics and yielded no changes. Content validity was ensured by using peers (dietitians and supervisors). A qualitative measure of rigour was ensured through trustworthiness, by ensuring credibility, transferability, confirmability and dependability.²⁸ Credibility was ensured by follow-up interviews with participants; transferability was ensured through probing; confirmability was ensured by an independent coder after the researcher's own independent analysis, and dependability was ensured through depending on the supervisors and use of both voice recorders and field notes;

Data analysis

Quantitative data analysis was done through coding data and entered it into the Statistical Package for the Social Sciences version 24 (IBM Corp, Armonk, NY, USA) for analysis. Descriptive statistics was used where frequency distributions, means and standard deviations were calculated. A chi-squared test was used to calculate associations at 95% CI where a p -value of < 0.05 was considered statistically significant. Qualitative data analysis was analysed using 8 steps of Tesch's open coding.²⁹ The researcher first analysed data from individual in-depth

interviews, and also submitted data in the form of verbatim transcripts to an independent coder. A researcher and an independent coder met in a consensus meeting and agreed on themes and sub-themes based on those that emerged when analysing independently. Participants' direct quotations are also given to support the findings. Literature is also used to support the findings.

Ethical consideration

Turfloop Research Ethical Committee (TREC) approved the study and allocated clearance certificate number TREC/35/2019: PG. The Limpopo Department of Health (DOH) gave permission to conduct the study (Ref: LP 201903-007). This study is part of the bigger study; however, this article focused only on assessment of diabetes dietary knowledge and its impact on intake. All participants provided written informed consent. Participation was voluntary and participants were informed of their right to withdraw from the study at any stage without penalty. Privacy and confidentiality of the participants data were also maintained.

Results

Quantitative results

Table 1 shows that about two-thirds (65%) participants were aged above 61 years, most were females (81.5%), had primary education or had never been to school (81%), and were married (74.5%). This may imply that participants are residing with their partners or families and are eating food prepared by the family

Table 2 shows that most participants know the importance of nutrition in diabetes care (81%) and that fruits and vegetables must be eaten (88.5%), implying that participants will eat a healthy diet including fruits and vegetables.

Table 3 shows that about a third of participants eat fried and fatty food sometimes (31%), while over a third eat sugary food sometimes (39%), which confirms the correlation of dietary knowledge and intake since most participants know that fatty and sugary food should be avoided.

Qualitative results

Sociodemographic data of qualitative participants

The study participants comprised 17 participants, 10 males and 7 females. Eleven of the 17 participants were above the age of 60 years and had lived with diabetes for over 5 years.

Table 1: Sociodemographic profile of quantitative participants

Demographic data of participants	Frequency (n=200)	Percentages	
Age	≤ 60 years	70	35%
	> 61 years	130	65%
Gender	Male	37	18.5%
	Female	163	81.5%
Education	Primary or never been to school	162	81%
	Secondary or higher	38	19%
Marital status	Single	51	25.5%
	Married	149	74.5%

Table 2: Knowledge of patients regarding nutrition diabetes care

Knowledge of patients regarding diabetes care through nutrition	Yes	Not sure	No
Nutrition plays an important part in diabetes management	162 (81%)	3 (1.5%)	35 (17.5%)
Fruits and vegetables must be eaten because they are good in managing blood sugar	177 (88.5%)	1 (0.5%)	22 (11%)
It is good to eat small, frequent meals regularly to manage blood sugar	165 (82.5%)	5 (2.5%)	30 (15%)
Whole grains high in fibre are recommended as a healthy source of carbohydrate	159 (79.5%)	2 (1%)	39 (19.5%)
When overweight and diabetic, it is good to skip meals to lose weight	134 (76%)	11 (5.5%)	55 (27.5%)
When preparing meat, it is recommended to remove visible fats from red meat, and also to eat chicken without skin	174 (87%)	6 (3%)	20 (10%)
Eating a large portion of food at once may lead to increased blood sugar	163 (81.5%)	6 (3%)	31 (15.5%)
High fat dairy products including high animal proteins must be avoided	163 (81.5%)	4 (2%)	33 (16.5%)
It is good to cut back on salty food including high sodium food such as processed food	172 (86%)	2 (1%)	26 (13%)
It is good to cut back on sugary food including avoiding added sugar in drinks and food	177 (88.5%)	5 (2.5%)	18 (9%)
Fried food and other food high in fats must be avoided	168 (84%)	5 (2.5%)	27 (13.5%)

Theme 1: description of food to eat or not when diagnosed with diabetes mellitus

Nutrition is the cornerstone of diabetes management and the quality and amount of food eaten are essential for better outcomes. All participants indicated knowledge of foods diabetes patients should eat or not, as evident in the following five sub-themes.

Sub-theme 1.1: description of knowledge of type of food diabetic person should or should not eat, time to eat and reasons provided

Diabetes dietary knowledge is significant for the adoption of healthy dietary intake. All participants showed knowledge of foods to eat or not, as reflected by the following statements:

Participant 1: "I know I don't have to eat sugary and fried food, and that I should eat vegetables, beans, fish and chicken, in addition to porridge."

Participant 5 said: "I know that we [diabetes patients] should not eat salty and sugary food since they raise blood sugar, but eat more of skinless chicken and vegetables."

Table 3: Practices related to dietary intake of participants, % in rows (n = 200)

Practice of related to dietary intake of participants	Regularly (4 or more times a week)	Sometimes (1–3 times a week)	Never
In the past week, how often did you eat breakfast?	57 (28.5%)	136 (68%)	7 (3%)
In the past week, how often did you eat lunch and supper?	110 (55%)	89 (44%)	1 (1%)
How often do you eat fried and fatty food?	8 (4%)	61 (31%)	131 (65%)
How often do you eat sugary food and drink sugary drinks?	5 (3%)	79 (39%)	116 (58%)
How often do you take alcoholic drinks	6 (3%)	38 (19%)	156 (78%)
How often do you eat vegetables?	84 (42%)	101 (51%)	15 (7%)
How often do you eat fruits?	70 (35%)	121 (61%)	9 (4%)
How often do you eat meat, chicken, fish, mopani-worms, eggs and milk	53 (27%)	132 (66%)	15 (7%)
How often do you eat fibre-rich food such as beans, lentils, legumes and wholegrain foods among others?	72 (36%)	123 (62%)	5 (2%)
How often do you eat starchy food such as pap, rice, samp and bread?	191 (96%)	9 (4%)	0 (0%)
How often do you eat salty food such as processed food like polony or added salt?	19 (10%)	66 (33%)	115 (57%)

Healthy eating is characterised by appropriate food choices and is key for better glycaemic control.¹⁴ Participants in our study may eat appropriately as a result of knowledge of a diabetic diet.

Sub-theme 1.2: description of knowledge of preparation of a diabetic meal and required portions

The quality of food consumed by diabetes patients is essential for glycaemic control. Participants showed knowledge of how to prepare a diabetic meal, and portion sizes to eat, as supported by the following quotes:

Participant 2: "I know that I should not add salt when cooking, since diabetes patients are not supposed to eat salty food."

Participant 6: "I know that I should not add sugar when preparing tea, and that I should drink it as is."

Portion control and intake of small meals frequently are encouraged for better diabetes management.³⁰ Participants in our

study indicated knowledge of the importance of portion control.

Sub-theme 1.3: knowledge of existence of food when taking diabetic medications

Dietary and medication intake are crucial for diabetes treatment. All participants know the importance of eating food when taking medication, as evident in the following statements:

Participant 10: "I know that I should eat before or within an hour after taking medication and I do so by eating three times a day, i.e. breakfast, lunch and supper, in order to take medication."

Participant 15: "I know I should eat before taking medication; however, I use insulin, I inject myself and wait for about an hour before eating my breakfast."

Knowledge may persuade patients to adopt a healthy lifestyle and always take medication with food to avoid hypoglycaemia.⁸ Participants indicated knowledge of the importance of taking food with medications, implying that they will always take medications with food.

Sub-theme 1.4: description of the amount of food to eat at a time

Quantity of food eaten influences diabetes outcomes. Participants reported the intake of large portions, despite knowledge the disadvantage of doing so and they attributed this to family culture, as evident in the following statements:

Participant 13: "I know I should eat small amounts of food at a time when eating; however, I eat large amount of food, since at my family we eat twice a day."

Participant 16: "I know that I should eat small frequent meals, but I'm unable to do so since at home they cook twice a day, and no snacking in between, and that if I can eat half of my plate with the hope of eating the remaining after some time, I will not find my food, someone would have eaten them."

Consumption of small frequent meals is crucial to diabetes management.³⁰ However, portion size control is a challenge in this study because participants reported eating large portions and attributed this to family culture.³⁰

Sub-theme 1.5: description of the importance of consulting dietitians for diabetic dietary advice

Dietitians advise patients and the general population on the importance of nutrition in improving nutritional status and health outcomes. Participants indicated knowledge and willingness to consult dietitians, as supported by the following quotes:

Participant 1: "I can see a dietitian every six months to get nutritional education, respectively, so as to better control my diabetes and minimize complications."

Participant 10: "I can consult dietitians, so that I manage my diabetes better. If they can tell me to leave certain food, I will stop since I will be told by knowledgeable and qualified professionals with patients' interest."

Nutrition is fundamentally important in diabetes management.¹¹ Participants in our study reported the importance of

consulting dietitians who primarily provide healthcare services related to dietary diabetes care, implying that participants would benefit more and improve their dietary diabetes care knowledge, which helps in the achievement of good glycaemic control.

Theme 2: description of existing challenges by people living with diabetes mellitus

Living with diabetes brings health challenges related to maintenance of quality of life and challenges related to self-care practices that influence diabetes outcomes. Participants highlighted existing challenges faced by people living with diabetes, which impact on the dietary intake.

Sub-theme 2.1: difficulties experienced related to maintenance of quality of life due to societal expectations (scared to tell anyone that you have diabetes, thus ending up eating the wrong food)

Social support and behaviours may influence adherence to dietary recommendations. Participants indicated consumption of the wrong food due to societal expectations for fear of disclosure, as supported by the following claims:

Participant 8: "I don't eat salty food, though I'm sometimes forced to eat it at other people's ceremonies, since I cannot go around telling people what I eat and what I don't eat."

Participant 13: "At home, I don't eat fatty foods; however, when I attend funeral and parties, I usually eat them since we are served from same dishes for all the people without considering special diet."

Adherence to a dietary plan is critical in diabetes care and leads to better outcomes, prevents complications and improves quality of life.¹⁴ Participants in our study reported that they do not adhere to a dietary plan, due to societal expectations of eating at other people's ceremonies and houses, for fear of disclosure.

Sub-theme 2.2: commencement of health seeking following diagnosis of diabetes (going to traditional healers or churches hoping for a cure)

Starting diabetes treatment early minimises associated health problems. Participants demonstrated delayed start of treatment due to seeking alternative health options, as evident in the following statements made by participants:

Participant 11: "I didn't understand when I was diagnosed with diabetes, until I experienced sexual problems. I went to traditional doctors and churches for the treatment of my manhood, it remained not working, then I started diabetes treatment, and still not working."

Participant 17: "When I was diagnosed with diabetes, I went to church to get opinion, and was told is witchcraft and I will health, they also told me to stop eating red meat and have since seen changes and no longer experiencing complications such as pains and shakiness."

Diabetes treatment that includes a dietary plan may prevent complications and improve the quality of life if started early.¹¹ Participants in our study reported delay in commencing diabetes treatment, predisposing them to complications.

Theme 3: description of existing family support related to diet for people living with diabetes mellitus

Poor family support negatively affect adherence to treatment, which is essential for good diabetes outcomes. Participants reported the existence of family support, as evident in the only sub-theme that emerged.

Sub-theme 3.1: existence of support from family related to dietary intake

Family support related to preparation and serving of food influences diabetes outcomes. All participants indicated existence of support from families related to diet, as supported by the following comments by the participants:

Participant 11: "My family knows that I'm diabetic and are supportive. They cook for me and also serve me food at the three times a day."

Participant 16: "My wife still cooks for me and makes sure I eat food which diabetes patients are supposed to eat such as less or no fats, sugar and salt."

Family support is associated with better diabetes outcomes; therefore, participants are likely to achieve better glucose outcomes as a result of family support with regard to cooking.³¹

Mixed-methods results

Table 4 shows that the overwhelming majority of quantitative participants (89%) know the importance of eating fruits and vegetable, compared with all qualitative participants. Quantitative participants do not consume breakfast regularly as compared with the qualitative participants. Only 42% and 35% of quantitative participants consume vegetables and fruits

regularly, respectively, whereas qualitative participants reported eating fruits and vegetables when available.

Discussion

Adequate diabetes dietary knowledge may influence the adoption of healthy eating habits,²³ subsequently leading to prevention of complications,¹¹ comorbidity,⁸ improved diabetes control²³ and reduction of new cases.⁹ The overwhelming majority of quantitative participants (81%) and all qualitative participants know that nutrition is important in diabetes care. Knowledge alone does not give the assurance of adoption of healthy eating.⁹ It has been found that factors such as food accessibility, availability and affordability impact on consumption.³² Both quantitative and qualitative participants reported knowledge of the disadvantage of the intake of large portions. Qualitative participants further indicated that they still consume large portions due to their family eating culture. Our study confirmed findings that behaviours of family members may at times be unfavourable to diabetes care,³³ particularly in the presence of inadequate knowledge.

There is a need for the adoption of family-centred care (FCC), which is regarded as the provision of healthcare in partnership,³¹ and begins with the family consulting alongside patients,³³ with the aim of responding to the needs, values and cultural needs of the patient and family members.³⁴ In the context of diabetes, FCC has been shown to improve the knowledge of both patients and family members of self-care practices, adherence to treatment, and subsequently better outcomes, the prevention or reduction of complications and new diabetes cases, and to improve patients' health and quality of life.³³

Food security comprises four dimensions, namely, food availability, accessibility, utilisation and stability.³⁴ While South

Table 4: Mixed-methods results through merging quantitative and qualitative results

Joint display for merging quantitative and qualitative results			
Factor	Quantitative	Qualitative	Comment
Dietary knowledge:			
Nutrition in diabetes care	81% of participants know that nutrition is important in diabetes care	All participants know that food intake is important in managing diabetes	Both quantitative and qualitative participants know that nutrition is important in managing diabetes
Fruits and vegetables	88.5% of participants reported that fruits and vegetables must be eaten because they are good in managing blood glucose	All participants reported that fruits and vegetables are important in diabetes care and should be eaten regularly	Both quantitative and qualitative results showed that participants know the importance of consumption of fruits and vegetables
Portion size control	82.5% of participants indicated that small portion sizes must be eaten regularly to manage blood glucose	All participants indicated that they know that they should eat small portion sizes	Both quantitative and qualitative results showed that participants know the importance of eating small portions in managing blood glucose
Dietary intake:			
Breakfast	Only 28.5% of participants eat breakfast regularly	All participants indicated daily eating of breakfast to take medication. The time of consumption of breakfast varies	Quantitative and qualitative results do not correspond as all qualitative participants consume breakfast, while less than a third of quantitative participants eat breakfast
Fruits and vegetables	Only 35% and 42% eat fruits and vegetables regularly	Participants reported regular intake of vegetables, and intake of fruits when available	The quantitative and qualitative results correspond on consumption of fruits, since only 35% consume regularly and when available, respectively
Fatty, sugary and salty food	On the other hand, 57%, 58% and 68% never ate salty, sugary and fried food respectively	All participants indicated that they do not eat sugary, fatty or salty food	A significant number of quantitative patients eat salty, sugary and fatty food, while all qualitative participants do not
Starchy food	96% of participants eat starchy food	All participants eat starchy food	Starchy food is mainly eaten by all
Legumes, beans and whole grains	35% of participants eat beans, legumes and whole grains	All participants indicated that they do eat them when available	The majority of quantitative participants not eating beans, legumes and whole grains regularly can be attributed to availability

Africa is food secure through domestic food production and imports, some households are food insecure due to poverty and income inequality.³⁴ Household food security or insecurity influences dietary intake and may impact on consumption of breakfast. Breakfast is the most important meal of the day,³⁵ for both diabetic and non-diabetic individuals, and helps in weight management, improves general well-being, and reduces the risk of cardiovascular diseases and type-2 diabetes mellitus.³² Eating breakfast reduces the chances of hypoglycaemia among diabetics and also improves glycaemic control.³³ Dwyer³⁵ further reported that despite the benefits of eating breakfast, it is frequently skipped. Only 28.5% of quantitative participants in our study reported regular intake of breakfast, confirming the skipping of breakfast. However, 10 of the 17 qualitative participants indicated daily intake of breakfast, though after doing household chores, which exposes participants to the risk of hypoglycaemia,³⁶ particularly after prolonged and more intense household exercise. Hypoglycaemia has been found to contribute significantly to diabetes mortality.³⁰

Fruit and vegetable consumption provides a micronutrient-dense diet and also assists in achieving better glucose control.³⁷ South African Food Based Dietary Guidelines (FBDGs) recommend eating plenty of fruits and vegetables every day and dry beans, peas, lentils and soya regularly.³⁸ Participants in our study also reported low intake of fruits and vegetables, confirming reports that consumption of fruits and vegetables, including grains, is a problem worldwide,³⁹ as well as in South Africa.³⁷

Early detection and treatment of diabetes through dietary modification helps in the prevention and delaying of complications and the reversing of reversible complications, which may exist.¹⁴ Initiating diabetes treatment early may prohibit denial and delayed acceptance of the disease, as reported by participants in our study. Our study suggests that a diabetes diagnosis is a sensitive issue that is not easy to accept. A diabetes diagnosis causes shock, heightened emotions and anger, and includes denial.⁴⁰ Heightened emotions and the resultant burden triggers complications of diabetes and makes acceptance difficult.⁴¹

Conclusion

Diabetes patients continue to eat large food portions, despite knowledge of the disadvantages of doing so. Our study shows that family eating culture or patterns impact negatively on dietary intake. Therefore, there is a need for the adoption of family-centred diabetes care. Delayed acceptance of a diabetes diagnosis has been identified as prohibiting early initiation of diabetes dietary treatment.

Authors' contribution

Mphasha was the project leader responsible for data collection and interpretation; he contributed 50% in writing this article. Mothiba analysed the data, and supervised data collection and interpretation; and contributed 40% in writing this article. Skaal co-supervised data collection and interpretation; she contributed 10% in writing this article. The final manuscript was approved by all the authors.

Recommendation

Adoption of family-centred diabetes care.

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ORCID

MH Mphasha  <http://orcid.org/0000-0002-4812-5051>

L Skaal  <http://orcid.org/0000-0002-5614-4017>

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