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Diabetes knowledge of nurses providing community care for diabetes patients in Auckland, New Zealand



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ABSTRACT

Aims: To quantify and compare knowledge of diabetes including risk factors for diabetes-related complications among the three main groups of primary health care nurses.

Methods: In a cross-sectional survey of practice, district and specialist nurses ($n = 1091$) in Auckland, New Zealand, 31% were randomly sampled to complete a self-administered questionnaire and telephone interview, designed to ascertain nurses' knowledge of diabetes and best practice, in 2006–2008.

Results: All 287 nurses (response rate 86%) completed the telephone interview and 284 the self-administered questionnaire. Major risk factors identified by nurses were excess body weight for type 2 diabetes (96%) and elevated plasma glucose levels or glycosylated haemoglobin (86%) for diabetes-related complications. In contrast, major cardiovascular risk factors were less well identified, particularly smoking, although by more specialist nurses (43%) than practice (14%) and district (12%) nurses ($p = 0.0005$). Cardiovascular complications, particularly stroke, were less well known than microvascular complications, and by significantly fewer practice (13%) and district (8%) nurses than specialist nurses (36%, $p = 0.002$).

Conclusions: In general, nurses had better knowledge of overweight as a risk factor for type 2 diabetes mellitus and elevated plasma glucose levels as a risk factor for diabetes-related complications compared with knowledge of cardiovascular risk factors, particularly smoking.

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1. Introduction

As in most westernised countries, the incidence of diabetes in New Zealand (NZ) is continuing to increase [1]. This increase,

along with the on-going shortage of specialist health professionals, to manage the condition in NZ [2], has led to greater opportunities for nurses who are expected to play a major role in the management of diabetes, particularly in primary health care (PHC).

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Major international intervention studies have shown that intensive management of blood glucose levels (BGLs) reduces the risk of microvascular complications [3] and reductions in low-density lipoprotein cholesterol (LDL-C) [4–6] and blood pressure [7,8] reduce all diabetes-related complications, while smoking is a well-established risk factor for cardiovascular disease (CVD) [9] and premature mortality [10,11]. Several weight loss lifestyle trials have also shown a reduction in the progression to T2DM in those with pre-diabetes [12–16]. In addition, several primary care-based randomised control trials (RCTs) among diabetes patients show that nurse-delivered lifestyle interventions have significantly reduced HbA1c [17–21], improved lipids [18,19,22] or blood pressure [22,23], and achieved increases in smoking cessation [24]. As a consequence of these studies, there have been calls for active screening, identification and implementation of lifestyle interventions for those at risk of type 2 diabetes mellitus (T2DM) [25]. This is in addition to opportunistic screening for diabetes by primary health carers [26,27], and an integrated approach to risk factor management in reducing the incidence of cardiovascular events in those with T2DM [28].

Most people with T2DM are now managed in primary care [27], and recent national surveys show that patients are increasingly consulting nurses [29]. A sound knowledge of risk factors associated with the development of T2DM and diabetes-related complications, appropriate diagnostic tests, underlying pathologies of type 1 and 2 diabetes is essential in prevention, detection and the education and management of people with diabetes. However, to our knowledge, the only paper to report the diabetes knowledge of nurses providing community care for diabetes patients is a small study of South African nurses and doctors [30].

Although PHC nurses include all community-based nurses, the main groups involved in diabetes management in NZ are practice nurses (PNs), district nurses (DNs) and two specialist nurse-groups (diabetes specialist nurses (DSN) and chronic care management (CCM) nurses). Most PNs are employed in general practice as generalist nurses, and although constrained by the practice they work in, are expected to use the NZ guidelines for the management of T2DM intended for general practitioners (GPs) and PNs [28]. First published in 2000 [31] and most recently updated in 2012 [28], they outline ideal HbA1c levels, blood pressure, lipid levels, frequency of retinal, renal and foot screening and specific pharmaceutical and lifestyle advice (diet and physical activity) [28]. PNs are expected to develop nursing expertise in diabetes management [32,33], screen patients for T2DM, undertake diabetes annual reviews and cardiovascular assessments and advise patients on lifestyle (including writing 'Green Scripts' for physical activity and 'Quit Cards' for nicotine replacement therapy), laboratory test results, medication and foot care.

In contrast, DNs are employed by secondary care services, primarily to carry out wound care for patients at home after hospitalisation, or referred by GPs and other health professionals. DSN traditionally work within a hospital-based multi-disciplinary team and provide specialist diabetes care, while CCM nurses who represent a more recently developed specialist nursing group, work in general practices and for independent community providers [34]. The latter group, typically oversee the management of people with chronic health

conditions, who are least likely to access existing health care services.

At the time of the survey PHC nurses were not able to prescribe medications. However, nurses have always been expected to discuss medications with patients, know their action and dosage, assess compliance, recognise common side effects and give appropriate advice.

The aims of this paper are to quantify and compare diabetes knowledge held by each of the three main groups of nurses providing community care for diabetes patients in Auckland, a large urban area with a third of the NZ population [35].

2. Methods

A cross-sectional survey was carried out among nurses providing community or out-patient care to patients in Auckland, NZ, between September 2006 and February 2008. Ethical approval was obtained from the Northern Regional Ethics committee. The sampling frame of the three groups of nurses is described in Fig. 1. In 2006/7, a total of 1091 PHC nurses were identified throughout the greater Auckland region. With the aim of randomly sampling 25% from each of the four main nurse groups (PNs, DNs, DSN and CCM nurses), 383 nurses were stratified (by nurse-group) and randomly selected. Of those, 88% ($n=335$) were still currently working in PHC and were invited to participate in the survey. A total of 287 nurses (86%) agreed to participate, and although all completed the telephone interview including 210 PNs, 49 DNs and 28 specialist nurses (SNs), who were either DSN ($n=19$) or CCM nurses ($n=9$), three nurses; two PNs and one DN, did not complete the self-administered questionnaire. Biographic details of the nurses randomly sampled have been described elsewhere [34]. Briefly, 98% were female, 80% were aged >40 years, 74% described themselves as European New Zealanders, 49% had, or were working towards, post-registration qualifications (mostly a certificate) and over 80% had received diabetes education [34].

Biographic details of the nurses were obtained through the self-administered questionnaire ($n=284$) while knowledge of diabetes held by the nurses was gathered during the telephone interview ($n=287$), without soliciting responses, and recorded in writing. All randomly selected nurses were sent information about the study, and were informed there would be a telephone interview that would include questions on their knowledge of diabetes management. Specifically, all nurses were asked to rate their knowledge of best practice and identify risk factors for T2DM and those associated with diabetes-related complications. For example, nurses were asked, 'what are the most important risk factors for getting type 2 diabetes' and 'what are the main (modifiable) risk factors for diabetes complications'. In addition, they were asked to: identify diagnostic tests; state the underlying pathology of type 1 and 2 diabetes; identify the main complications of diabetes and if they would like more diabetes education. When nurses were asked if they would like further diabetes education, if they answered affirmatively, they were asked to specify which areas and were prompted regarding interpreting laboratory test results, medication, cultural understanding and on

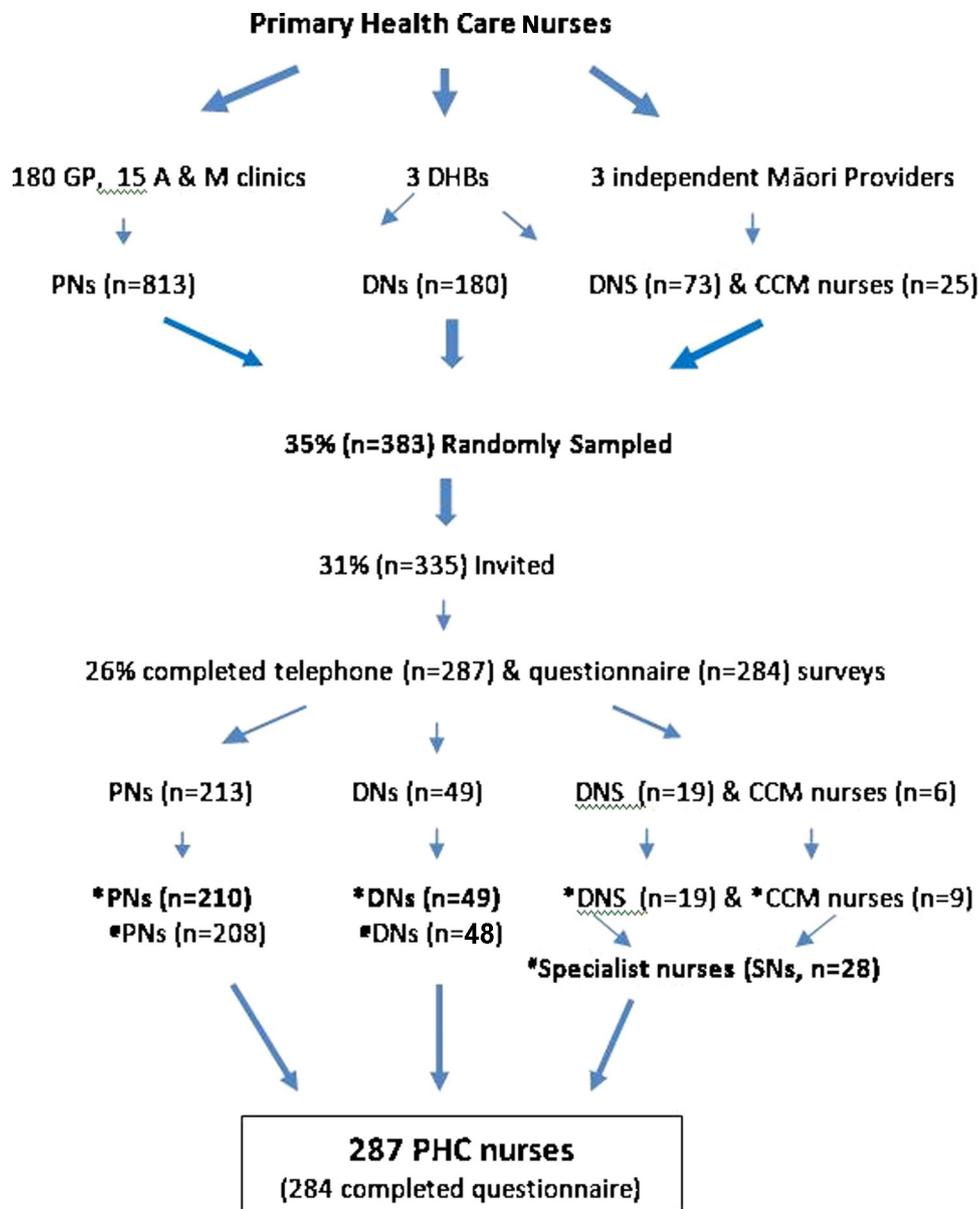


Fig. 1 – Recruitment of primary health care (PHC) nurses. PHC nurses ($n = 1091$) PHC were identified by nursing group, 35% were randomly sampled, 31% were invited to participate and 26% agreed (ranging from 24% for CCM nurses to 27% for DNs). All nurses who agreed to participate completed the telephone interview ($n = 287$) and 284 completed the self-administered questionnaire – 86% response rate. PNs, practice nurses; DNs, district nurses; DNS, diabetes nurses specialist; CCM, chronic care management; GP, general practices. *Self-reported role description used in all analyses; #DNS & CCM nurses were combined for all analyses and classed as specialist nurses (SNs); @Two PNs and one DN did not complete the self-administered questionnaire.

giving lifestyle advice to patients if they did not initially volunteer those topics. All questions designed to ascertain nurse's knowledge of diabetes were open and unprompted.

Standard univariate methods were used for analyses of categorical outcome data, using PROC FREQ in SAS version 9.2 (SAS Institute, Cary, NC, 2008). For all statistical analyses, self-reported nursing roles were used, which were very similar to pre-survey categorisation. DSN and CCM nurses were combined as SNs for all analyses due to their small numbers.

3. Results

Table 1 shows how nurses rated their knowledge of best practice in managing people with diabetes. All nurses were asked to rate their knowledge of best practice and if they were aware of, and how often, they used the then current national guidelines for the management of T2DM. Almost 40% of nurses rated their knowledge of best practice in the management of diabetes as either 'excellent or very good' and although over two-thirds knew of the national guidelines, only 21% of all

Table 1 – Proportion of PHC nurses, by group, and how they rated their knowledge of best practice in the management of diabetes patients (n = 287).

Variable and level	Total N (%)	Practice nurses (n = 210) %	District nurses (n = 49) %	Specialist nurses (n = 28) %	P-value
Knowledge of best practice					
Excellent (n = 286)	12 (4)	3	0	18	<0.0001
Very good	97 (34)	33	18	64	
Good	153 (54)	56	67	14	
Fair	22 (8)	7	14	0	
Poor	2 (1)	0.5	0	4	
Aware of national guidelines ^a					
Yes (n = 287)	199 (69)	70	51	93	0.0005
If yes-do you use guidelines					
Always (n = 199)	20 (10)	8	4	27	<0.0001
Often	41 (21)	18	4	50	
Sometimes	39 (20)	23	4	12	
Rarely	9 (5)	5	0	4	
Never	90 (45)	44	88	8	
Sufficient knowledge to: (n = 279)					
Discuss laboratory results	194 (70)	75	29	93	<0.0001
Advise on lifestyle interventions	258 (92)	92	91	100	0.28
Advise on medications (n = 281)	81 (29)	25	22	68	<0.0001

^a Evidence-based best practice guideline. Management of type 2 diabetes [38].

P-value showing significance of variation in percentages in subgroups, from the chi-square value.

nurses were 'always or often' likely to use the guidelines. The majority of nurses reported that they had sufficient knowledge to discuss laboratory results with diabetes patients and advise on lifestyle interventions, although less than a third indicated they had sufficient knowledge to advise on medications. Overall, SNs rated highest, followed by PNs, and then DNs (Table 1).

Table 2 reports on diabetes knowledge held by nurses on major risk factors for T2DM, appropriate diagnostic tests and the underlying pathologies of type 1 and 2 diabetes. Nurses were asked to state the most important risk factors for T2DM to ascertain knowledge of patients at higher risk. Almost all nurses correctly identified overweight as a major (or most important) risk factor for T2DM, a third identified lack of exercise and less identified hypertension. Furthermore, less than a fifth of the nurses could state that elevated total- or LDL-cholesterol were also risk factors and only a small minority, stated elevated triglycerides and low high-density lipoprotein cholesterol (HDL-C). Generally, SNs were more likely to correctly identify risk factors, followed by PNs and then DNs (Table 2). In addition, most nurses (n = 225) stated many other factors which are not risk factors for T2DM or were complications or possible symptoms of diabetes, such as wounds, ulcers, urinary tract infections, fatigue, stress, alcohol consumption, and thirst.

The majority of nurses correctly named at least one of the three diagnostic tests, listed in the then current national guideline for managing T2DM, oral glucose tolerance test (OGTT), fasting and random blood glucose (Table 2). Proportionally more SNs were able to name all three of the tests appropriate for diagnosing T2DM, with significantly more SNs and PNs identifying the OGTT compared with DNs, ($p < 0.0001$). Almost half of the nurses stated other tests (commonly used in

practice) – most commonly HbA1c and capillary blood testing. In contrast, only a minority of the nurses correctly stated the underlying pathology of type 1 diabetes was an autoimmune condition, although almost a third pointed out destruction of β -cells occurred and most knew there was a decrease in, or no insulin produced, and significantly more SNs knew this compared with PNs ($p = 0.045$). Similarly regarding T2DM, less than a third of the nurses stated insulin resistance as the underlying pathology and less than 20% said that a lack of glucose entered body cells, although two-thirds knew a lack of insulin was secreted. Generally, SNs rated highest, followed by PNs and DNs (Table 2).

Table 3 documents the nurses' knowledge of diabetes-related complications and associated risk factors. All nurses were asked to state the main complications or diseases that occur in those with diabetes and identify the main modifiable risk factors associated with these complications. Most commonly, nurses correctly identified retinopathy and renal and heart disease as major diabetes-related complications. In contrast, less than half of the nurses correctly identified neuropathy, ulcers or wounds, peripheral vascular disease and only 14% identified stroke as complications. Generally, SNs were most aware of these complications, followed by PNs, except for neuropathy and ulcers/wounds, which DNs were most aware of and probably reflected their experience with wound care.

Most nurses correctly identified elevated blood glucose or HbA1c and over half identified a lack of exercise and elevated total- or LDL-cholesterol as modifiable risk factors for diabetes-related complications (Table 3). However, far less nurses correctly identified other major modifiable risk factors such as hypertension and smoking. Again, SNs were more likely to correctly identify modifiable risk factors for complications than other nurses.

Table 2 – Proportion of PHC nurses, by group, who identified major risk factors for type 2 diabetes in response to open questions (n = 287).

Variable and level	Total N (%)	Practice nurses (n = 210) %	District nurses (n = 49) %	Specialist nurses (n = 28) %	P-value
Major risk factors identified (n = 285)^a					
Overweight	273 (96)	97 (n = 208)	90 (n = 49)	100 (n = 28)	0.05
Hypertension	75 (26)	28	16	29	0.22
Elevated triglycerides	14 (5)	5	0	14	0.02
High total- or LDL-cholesterol	49 (17)	19	8	21	0.17
Low HDL cholesterol	6 (2)	1	0	11	0.003
Lack of exercise	96 (34)	31	33	54	0.06
Knowledge of diagnostic tests (n = 287)					
OGTT/GTT	198 (69)	73	41	86	<0.0001
Fasting venous plasma	115 (40)	40	31	54	0.14
Random venous >11 mM	56 (20)	21	10	25	0.17
Other tests stated	134 (47)	52	31	36	0.01
HbA1c	101 (35)	39	27	21	0.07
Capillary BGLs	38 (13)	16	4	11	0.09
Knowledge of type 1 and type 2 underlying pathologies (n = 287)					
Pathology of type 1					
Autoimmune	39 (14)	10	4	54	<0.0001
Destruction of β cells	78 (27)	26	16	57	0.0004
No insulin produced	228 (79)	76	86	93	0.06
Did not know	50 (17)	20	14	4	0.08
Other peripheral factors	65 (23)	24	12	32	
Pathology of type 2					
Insulin resistance	80 (28)	25	18	68	<0.0001
Lack of glucose into cells	54 (19)	19	10	32	0.06
Lack of insulin secreted	193 (67)	61	80	89	0.002
Did not know	64 (22)	26	16	4	0.01
Other peripheral factors	81 (28)	30	10	46	
LDL-C, low-density lipoprotein cholesterol; HDL-C, high-density lipoprotein cholesterol.					
^a It was not possible to collect valid data from two PNs.					
P-value showing significance of variation in percentages in subgroups, from the chi-square value.					

Table 3 – Proportion of PHC nurses, by group, and knowledge of the major diabetes-related complications (n = 287).

Variable and level	Total N (%)	Practice nurses (n = 210) %	District nurses (n = 49) %	Specialist nurses (n = 28) %	P-value
Diabetes related complications					
Heart disease/MI	175 (61)	61	43	89	0.0003
Stroke	41 (14)	13	8	36	0.002
PVD/decreased circulation	119 (41)	42	37	43	0.76
Retinopathy	255 (89)	90	78	100	0.006
Renal disease	214 (75)	74	63	96	0.006
Neuropathy	139 (48)	44	65	54	0.02
Ulcers/wounds	124 (43)	43	59	18	0.002
Major modifiable risk factors of diabetes-related complications					
High BGL/HbA1c	246 (86)	83	90	96	0.12
Hypertension	90 (31)	32	12	61	<0.0001
Smoking	48 (17)	14	12	43	0.0005
High total Chol. or LDL-C	165 (57)	59	37	82	0.0004
Low HDL-C	24 (8)	7	4	25	0.003
Elevated TAGs	27 (9)	9	4	21	0.04
Lack of exercise	179 (62)	60	67	71	0.37

MI, myocardial infarction; PVD, Peripheral vascular disease; BGL, blood glucose levels; HbA1c, glycosylated haemoglobin; Chol, cholesterol; LDL-C, low-density lipoprotein cholesterol; HDL-C, high-density lipoprotein cholesterol; TAGs, triglycerides.

P-value showing significance of variation in percentages in subgroups, from the chi-square value.

Table 4 – Proportion PHC nurses, by group, who reported interest in increasing knowledge about specific test results and further education (n = 287).

Variable and level	Total N (%)	Type of nurse			P-value
		Practice nurses (n = 210) %	District nurses (n = 49) %	Specialist nurses (n = 28) %	
Interested in increasing knowledge on: (n = 281)					
Abnormal lab. results (n = 232)	232 (83)	82	91	71	0.87
HbA1c (n = 230)	153 (67)	62	83	74	0.02
Total cholesterol	109 (47)	40	71	63	0.0004
LDL-C	110 (48)	43	62	63	0.03
HDL-C	107 (47)	41	62	63	0.02
TAGs	158 (69)	65	79	84	0.07
Serum creatinine	198 (86)	87	83	84	0.80
Microalbuminuria	202 (88)	89	81	89	0.32
Interest in further diabetes education and specific topics: (n = 287)					
Further diabetes education (287)	248 (86)	85	86	96	0.26
Interpreting laboratory results					
Volunteered (n = 248)	38 (15)	13	26	11	
Prompted	117 (47)	46	60	37	0.007
Medication					
Volunteered	54 (22)	20	29	26	0.007
Prompted	108 (44)	45	55	19	
Cultural understanding					
Volunteered	9 (4)	4	2	0	0.006
Prompted	97 (39)	37	60	19	
Giving lifestyle advice					
Volunteered	15 (6)	6	10	0	0.01
Prompted	88 (35)	36	48	19	
Other topics: (n = 248)					
Insulin management	40 (16)	17	12	15	0.68
Renal disease	27 (11)	12	10	7	0.76
General/research updates	120 (48)	44	55	70	0.02

Lab, Laboratory; HbA1c, glycosylated haemoglobin; LDL-C, low-density lipoprotein cholesterol; HDL-C, high-density lipoprotein cholesterol; TAGs, triglycerides.
P-value showing significance of variation in percentages in subgroups, from the chi-square value.

Table 4 outlines nurses' preferences for further diabetes education. All nurses were asked if they would like to increase their knowledge on specific laboratory tests and on what topics they would like more education. A high proportion of all nurses were interested in learning more about abnormal test results to enable them to advise diabetes patients independently of a physician. Specifically, and significantly, more DNs wanted to know more about HbA1c and total cholesterol compared with PNs and SNs, and more DNs and SNs wished to know more about LDL-C and HDL-C compared with PNs ($p < 0.05$). A high proportion of all nurses were interested in learning more about triglycerides, serum creatinine and microalbuminuria (Table 4). In addition, eleven PNs and SNs were interested in learning more about renal and liver function tests, glucose tolerance testing, antibody and inflammatory markers and a full blood count.

Furthermore, most nurses indicated they would like further diabetes education (Table 4). Among those wanting further education, combining those volunteering or agreeing after prompting, over 60% wanted this for understanding medication, and for interpreting laboratory results and over 40% for cultural understanding and giving lifestyle advice. In addition, almost a half of the 248 nurses who stated they would like more diabetes education wanted general or latest research

updates and a number of nurses specifically stated they would like more education on insulin management and renal disease (Table 4).

4. Discussion

We have reported for the first time information on diabetes knowledge of a random sample of nurses providing care to people with diabetes in the community, in a large urban area. As far as we are aware, no survey has previously reported on nurse's knowledge of, or promotion of primary prevention, or specifically on what nurses wanted to know, in relation to diabetes and effective management strategies. This is particularly important given the evidence from several large RCTs, which show that long term improvements in all the major modifiable risk factors decrease the risk of diabetes-related complications [3,4,7,8,36,37].

Most nurses were able to identify excess body weight as a major risk factor for T2DM, but were less likely to identify lack of exercise and other cardiovascular risk factors, such as, hypertension and dyslipidaemia. In addition, cardiovascular complications, particularly stroke, were less well known than microvascular complications. However, most nurses identified retinopathy as a complication, comparable with results

from a South African audit [30], the only previous study identified reporting on the diabetes knowledge of PHC nurses. In this audit, 35 experienced staff members (12 doctors and 23 nurses) were administered questionnaires during a 40 min, private, face-to-face interview to ascertain staff knowledge, attitudes and practice with the intention of improving primary care for diabetes patients, in areas populated by 'Black South African' people, attending large day-hospitals in Cape Town [30].

Almost all nurses identified elevated BGLs or HbA1c as risk factors for diabetes-related complications. However, less than a third identified hypertension as a risk factor for complications, lower than the 40–50% of the nurses surveyed in South Africa who knew that reducing hypertension protected the cardiovascular system, and up to a third also knew it protected against stroke [30]. In addition, less than 20% of nurses identified smoking as a major risk factor for complications, and only a minority identified low HDL-C and elevated triglycerides, although more identified elevated total- or LDL-cholesterol – not reported in previous surveys.

Although SNs had the highest level of diabetes knowledge, there is a need to increase their knowledge regarding cardiovascular risk factors and their strong association with T2DM and diabetes-related complications. In NZ, SNs have traditionally been mentored by diabetologists and their diabetes knowledge reflects their focus on blood glucose control. The findings from this study highlight a trickle-down effect of knowledge from SNs to both PNs and DNs, with the latter group showing the least knowledge in most areas. Despite this, only 70% of PNs and half of DNs knew of the then 2003 guidelines [38], and of those, only 26% of PNs and less than 10% of DNs 'always or often' used the guidelines in their practice. The PNs use of the guidelines was comparable, but slightly lower than the 46% response rate reported in another NZ PN postal survey [39], which may be an over-estimate as people who participate in a survey are more likely to have an interest in the topic than non-respondents [40].

Regarding education, most nurses (86%) wished to further their diabetes education, a much higher proportion than that reported for 36% of PNs in Scotland [41]. Furthermore, in this survey nurses particularly wanted to know more about interpreting laboratory test results and medications. The specific type of diabetes education wanted by nurses has not previously been reported.

Limitations of the survey include self-reported data and not formal training in behaviour modification. There is also potential for under-reporting of nurse's actual diabetes knowledge as the telephone interview required spontaneous responses to specific questions and did not allow for deeper consideration over a longer timeframe. Further, the combining of DSN and CCM nurses for all analyses reflects some unexpected results, regarding knowledge of diabetes, as one CCM nurse with poorer knowledge worked solely with children and did not work with those with diabetes. Despite these potential limitations, this study highlights a lack of core knowledge held by nurses particularly of the association between T2DM, CVD and associated modifiable risk factors. This is the largest comprehensive cross-sectional survey of the main groups of nurses involved in the community management of people with diabetes in the largest city in NZ.

Far fewer nurses, although more DNs, were interested in additional education on cultural issues. The increased time DNs spend in patient's homes might have influenced their perceived need for more education on cultural practices related to specific ethnic groups. Findings indicated that no nurses sampled reported using a framework when delivering diabetes education or adopting strategies such as goal setting with patients. Future research should test effective strategies for delivering diabetes education within a culturally diverse population cognisant with the DAWN1 and DAWN2 recommendations [42,43].

5. Conclusion

In summary, most nurses were able to identify excess body weight as a major main risk factor for T2DM, and elevated BGLs or HbA1c for diabetes-related complications or microvascular complications. However, cardiovascular risk factors (hypertension, dyslipidaemia, smoking and lack of physical activity), and cardiovascular or macrovascular complications (particularly stroke) were less well known. With further training and education, which most PHC nurses have indicated they want, there is the potential to increase their knowledge of major risk factors associated with T2DM and CVD, and effective behavioural intervention strategies. PHC nurses can play a greater role in the primary prevention of diabetes and the effective management of all major risk factors for diabetes-related complications including the proportion of diabetes patients who smoke to less than 10%, as achieved in both arms of the ACCORD [44] and ADVANCE [45] trials. Practice and district nurses will need to be better informed about smoking cessation and achieving optimal lipid and blood pressure levels to become actively involved in the management of diabetes patients in the future.

Conflict of interest

The authors state they have no conflict of interest.

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