

# Management of diabetes by primary health care nurses in Auckland, New Zealand

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## ABSTRACT

**INTRODUCTION:** The increasing prevalence of diabetes has led to expanded roles for primary health care nurses in diabetes management.

**AIM:** To describe and compare anthropometric and glycaemic characteristics of patients with diabetes and their management by practice nurses, district nurses and specialist nurses.

**METHODS:** Primary health care nurses in Auckland randomly sampled in a cross-sectional survey, completed a postal self-administered questionnaire (n=284) and telephone interview (n=287) between 2006 and 2008. Biographical and diabetes management details were collected for 265 (86%) of the total 308 patients with diabetes seen by participants on a randomly selected day.

**RESULTS:** Nurses were able to access key clinical information for only a proportion of their patients: weight for 68%; BMI for 16%; HbA1c for 76% and serum glucose levels for 34% (for either measure 82%); although most (96%) records were available about whether patients self-monitored blood glucose levels. Most nursing management activities focused on giving advice on dietary intake (70%) and physical activity (66%), weighing patients (58%), and testing or discussing blood glucose levels (42% and 43%, respectively). These proportions varied by nurse group ( $p < 0.05$ ), generally being highest for specialist nurses and lowest for district nurses.

**DISCUSSION:** Most practice and specialist nurses could access patients' weight and HbA1c levels and focused their clinical management on health education to decrease these if indicated. Communication and organisational systems and contracts that allow district nurses to work across both primary and secondary health services are necessary to improve community-based nursing services for patients with diabetes.

**KEYWORDS:** Blood glucose; diabetes mellitus type 1; diabetes mellitus type 2; nurses; primary health care; risk management

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## Introduction

The incidence of Type 2 diabetes continues to rise, due to increasing proportions of overweight and obese adults, an ageing population, and improved management of those with diabetes.<sup>1</sup> Six percent (n=205 000) of New Zealand (NZ) adults had been diagnosed with Type 2 diabetes in the latest national survey<sup>2</sup> and this includes a large increase for Pacific peoples, from 10%<sup>3</sup> to 13%.<sup>2</sup> An older report calculated

that NZ had only 20% of the required diabetologists, 17% of the required podiatrists, 50% of the required dietitians, and 70% of the required diabetes nurse specialists (DNS) to meet levels recommended by the British Diabetic Association,<sup>4</sup> based on traditional models of care, which may be inefficient. Recently, the NZ Society for the Study of Diabetes highlighted a continuing shortage of specialist diabetes physicians<sup>5</sup> and possibly of DNS although no ideal reference has been identified.<sup>6</sup>

During the 1990s, results from several major international Type 1 diabetes,<sup>7</sup> and more recently the Type 2 diabetes<sup>8</sup> intervention trials, have shown that lowering blood glucose levels (BGLs) improved at least one microvascular or surrogate endpoint, and one group of overweight patients with Type 2 diabetes assigned to metformin had a significant reduction in total mortality.<sup>9</sup> Despite this, an increase in mortality was reported in one trial<sup>10</sup> and significantly more hypoglycaemic episodes in several trials<sup>7,8,10-12</sup> for patients assigned to intensive glucose control, and a greater gain in body weight was seen, particularly for those assigned insulin.<sup>8,11</sup>

Management recommendations include lifestyle changes that comprise a cardioprotective diet and daily physical activity<sup>13,14</sup> (associated with lower body mass index [BMI],<sup>15</sup> blood pressure<sup>15,16</sup> and BGLs<sup>17</sup>), followed by treatment with hypoglycaemic agents.<sup>14</sup>

The large increase in numbers of patients with Type 2 diabetes has required general practitioners (GPs) and primary health care (PHC) nurses, predominantly practice nurses (PNs), to familiarise themselves with the underlying pathology, prevention of, and management of Type 2 diabetes.

In 2013, 25% of the total NZ nurse population were based in community and rural settings, with PHC nurses and PNs comprising the largest group (42%)<sup>18</sup> and seeing the greatest proportion of diabetes patients.<sup>19</sup> District nurses (DNs) primarily consult patients in their own home, within the context of family, culture and social networks. DNS evolved as a specialist nurse group in the mid-1900s and were formally recognised in the UK after establishment of the first diabetes specialty course, in 1978.<sup>20</sup> In the NZ context, DNS are self-defined, have completed a variety of diabetes courses,<sup>21</sup> have expert knowledge and clinical experience, but have not necessarily completed formal post-registration qualifications.<sup>21</sup> DNS in NZ historically aligned with secondary care services, working within multidisciplinary teams based in hospital-outpatient clinics, and typically following a biomedical model of care. Recently, some primary health care-based nurses with a special interest in diabetes have identified themselves as DNS. Nurse practitioners (NPs)

## WHAT GAP THIS FILLS

**What we already know:** Most patients with diabetes are managed in primary care. Primary health care nurses play a major role in the community management of diabetes and consult a large numbers of patients, but few reports exist on the type of nursing care provided.

**What this study adds:** This is the first cross-sectional study to report on the nursing management of patients with diabetes. As such, it becomes a landmark study by providing a baseline for comparison in future studies. Primary health care nurses, particularly practice and specialist nurses, focus on monitoring capillary glucose, weighing patients and giving advice on reducing serum glucose, improving dietary intake and increasing physical activity.

and chronic care management (CCM) nurses, (formally disease state management nurses) are newer nursing roles. CCM nurses were developed in response to new CCM programmes, with the overall aim of improving health care for the most disadvantaged populations.<sup>22</sup> Of these nurse groups, PNs have the greatest capacity and opportunity to develop their roles. Funding for PNs altered in 2001, following the Primary Health Care Strategy, where primary health organisations encouraged PNs to work more independently through diabetes-specific programmes (Get Checked) that have engaged PHC nurses,<sup>23,24</sup> and more generic programmes that can focus on diabetes (Care Plus), where work done by either GPs or PNs could be eligible for reimbursement.<sup>25</sup>

Since the role of the PHC nurses in diabetes management is expected to increase, the main aims of this report are to describe and compare the anthropometric and glycaemic characteristics of patients with Type 1 and Type 2 diabetes, and their diabetes management, by the three main groups of PHC nurses: PNs, DNs and specialist nurses.

## Methods

From all 1091 PHC nurses identified in the greater Auckland region in 2006-7, 335 (31%) were randomly selected and 287 (86%) agreed to participate in the study, after stratification into PNs (n=210), DNs (n=49), DNS (n=19) and CCM nurses (n=9). All 287 nurses completed a telephone interview between 2006 and 2008 and

284 returned a self-administered postal questionnaire. Characteristics of the nurses have been previously described,<sup>21</sup> with most nurses (96%) having completed a generic three-year registered nursing or midwifery degree or diploma. The main differences between the two specialist nurse groups were in higher education and diabetes education, with a greater proportion of CCM nurses having a master's degree (33%) compared with 16% for DNS, while all DNS had attended over 20 hours of specific diabetes education compared with 67% of CCM nurses.<sup>21</sup> Ethical approval was granted for the study (Ref. NTX/05/10/128).

Towards the end of the telephone interview, one day in the past week was randomly selected from the days each nurse had worked. Nurses were asked how many patients with diabetes they had seen for a consultation on that day. Sampling of patients has been previously reported,<sup>26</sup> and is briefly outlined here. A total of 308 patients were seen for consultation on the randomly selected day by 42% of the sampled nurses, and information was provided for 265 (86%) patients. The 265 patients sampled are considered representative of all diabetes patients treated by PHC nurses during the study period, due to the random sampling of nurses and the randomly selected day of the week the nurses worked.

Patient information was reported by the nurses from electronic or paper records on anthropometric characteristics, glycosylated haemoglobin (HbA1c) and related health status, and also on the type of nursing assessments and care provided by the nurse during the consultation. During the telephone interview, all nurses who had seen patients with diabetes for consultation on the randomly selected day were asked: 'During this consultation, did you weigh the patient?'; 'test their capillary BGLs?'; 'discuss patients self-monitoring or discuss their BGLs?' and 'did you give advice about diet or physical activity?'

Further questions focused on prescribed medications and health promotion advice.

The PROC FREQ in SAS version 5.1 (SAS Institute, Cary, N.C. 2012) was used to analyse categorical outcome data from the nurses. The PROC

CROSSTAB and PROC MULTLOG in SAS (version 11 Research Triangle Institute, 2012) were used to analyse data from patients and correct for any clustering effects by nurses who had seen more than one patient with diabetes for consultation on the randomly selected day, for calculation of relative risks (RR) and to generate adjusted Wald *F* *p*-values. The DNS and CCM nurses were combined as specialist nurses (SNs), due to small numbers of CCM nurses, and self-reported nursing roles were used in all analyses.

## Results

Fifty-four percent of the 265 patients with diabetes seen for consultation were male. The median age was 59 years and ranged from 7 to 93 years. Their ethnicity was 41% NZ European, 31% Pacific, 18% Māori and 11% Other, and 93% had Type 2 diabetes. DNs consulted a significantly greater proportion of patients >67 years (48%) and NZ European patients (60%), compared with PNs (36% and 39%, respectively) and SNs (22% and 32%, respectively). SNs consulted more patients with Type 1 diabetes (*n*=9, 14%), compared with PNs (*n*=7, 5%) and DNs (*n*=3, 7%).

Table 1 outlines anthropometric and glycaemic characteristics of patients accessible in their clinic records, by nurse group. Nurses were able to identify key clinical information for only a proportion of their patients: weight for 68%; BMI for 16%; HbA1c for 76% and BGLs for 34% (either HbA1c or BGLs for 82%); although nearly all (96%) records were available on patients' self-monitoring of BGLs. These proportions varied by nurse group, generally being highest for SNs and lowest for DNs. Where anthropometric and glycaemic records were accessible, 57% of patients had HbA1c levels >58 mmol/mol (7.5%), and Pacific and Māori ethnicity was strongly associated with an elevated risk of HbA1c levels (RR=2.16, 95% confidence interval [CI], 1.58–2.95, *p*<0.0001; and RR=1.88, 95% CI, 1.32–2.69, *p*=0.003, respectively) compared with NZ European patients, and this association remained after adjusting for age and sex. Mean HbA1c levels did not vary by nurse group (*p*=0.44).

Table 2 reports on accessible prescribing information and prescribed hypoglycaemic medications,

Table 1. Patient anthropometric and glycaemic characteristics, accessible and reported (N=265), by nurse group

Variable and level	n (%)	Type of nurse			p-value <sup>†</sup>
		Practice nurses n (%)	District nurses n (%)	Specialist nurses n (%)	
<b>Total sample of patients*</b>	<b>265</b>	<b>153</b>	<b>47</b>	<b>65</b>	
<b>Anthropometric characteristics</b>					
<b>Body weight</b>					
Records accessible	181 (68%)	109 (71%)	11 (23%)	61 (94%)	<0.0001
Mean weight kg (95% CI)	92 (88–97)	93 (88–97)	99 (81–118)	90 (79–101)	0.68 <sup>‡</sup>
<b>BMI</b>					
Records accessible	41 (16%)	28 (18%)	0 (0%)	13 (20%)	0.004
Mean BMI (95% CI)	32 (30–33)	31 (29–33)		33 (29–38)	0.41 <sup>‡</sup>
<b>Glycaemic measurements</b>					
<b>HbA1c</b>					
Records accessible	202 (76%)	119 (78%)	20 (43%)	63 (97%)	<0.0001
Mean (mmol/mol, 95% CI) <sup>§</sup>	66 (63–69)	64 (61–67)	68 (60–78)	68 (60–78)	0.44 <sup>‡</sup>
(%, 95% CI)	8.2 (7.9–8.5)	8.0 (7.7–8.3)	8.4 (7.6–9.3)	8.4 (7.6–9.3)	
<b>BGLs</b>					
Records accessible	91 (34%)	47 (31%)	10 (21%)	34 (52%)	0.08
Mean (mmols/L, 95% CI)	11.1 (10.0–12.1)	10.7 (9.0–12.4)	12.1 (9.7–14.6)	11.4 (10.2–12.6)	0.61 <sup>‡</sup>
<b>Either HbA1c or BGLs</b>					
Records accessible	217 (82%)	125 (82%)	28 (60%)	64 (99%)	0.0002
<b>Patients self-monitor BGLs</b>					
Records accessible	253 (96%)	145 (95%)	43 (92%)	65 (100%)	–
Proportion that self-monitor <sup>  </sup>	189 (75%)	107 (74%)	33 (77%)	49 (75%)	0.93

BGLs Blood glucose levels

BMI Body mass index

CI Confidence interval

HbA1c Glycosylated haemoglobin

\* Total patients consulted (n=308). Data was not able to be reported for 28 patients seen by one mobile specialist ophthalmology nurse, 10 patients consulted by three practice nurses and five patients consulted by one chronic care management nurse

† p-value showing significance of variation in percentages by nurse group, from the log-likelihood Chi-square value and not applied with low cell values

‡ Wald p-value shows significance of variation in percentages in subgroups, from the log-likelihood Chi-square value

§ Geometric means were calculated from the antilog<sub>e</sub> of the mean and 95% CIs from multiplying and dividing the tolerance factor (antilog<sub>e</sub> 1.96 x standard error) from the mean

|| Number of patient records: Total nurses (n=253); PNs (n=145); DNs (n=43) and SNs (n=65)

by nurse group. Records for hypoglycaemic medications were accessible for nearly all patients ( $\geq 95\%$ ), although these proportions varied by nurse group, being highest for SNs and lowest for DNs ( $p < 0.05$ ). The most common hypoglycaemic medication was metformin (57%), followed by insulin (31%) and sulphonylureas (27%), with glitazones (5%) and an alpha-glucosidase inhibitor (0%) rarely or never used. Significantly more patients seen for consultation by PNs and SNs were prescribed metformin compared with patients

seen for consultation by DNs ( $p = 0.04$ ), while a greater proportion of patients prescribed insulin were seen for consultation by DNs and SNs compared with those patients seen for consultation by PNs ( $p = 0.0008$ ).

Table 3 outlines the diabetes-related activities by nurses during the patient consultations. The most common activities were advising on diet (70%), advising on physical activity (66%), weighing patients (58%) and testing or discussing BGLs (42%)

and 43%, respectively). These activities varied by nurse group ( $p < 0.05$ ), generally being highest for SNs and lowest for DNs. Māori and Pacific patients combined were significantly more likely to be weighed compared with NZ European patients (RR=1.39, 95% CI, 1.03–1.88).

Of the 185 patients who received dietary advice:

- 22% received general advice on healthy food options and were given reading material or had referrals made, predominantly to dietitians;
- 21% were advised to decrease at least one of the following: carbohydrates (including sugar), fat, high glycaemic index foods, takeaways and snacks;
- 20% were encouraged to change their diet to improve one of the following: HbA1c or insulin management, uric acid levels, salt consumption or wound healing;
- 15% were advised to decrease food portions or improve the frequency or regularity of meals;
- 12% were advised to reduce body weight and
- 10% were advised to continue with their current diet.

Of the 175 patients advised on physical activity, 34% were advised to increase their level: 23% to walk; 8% were advised on mobility-limited activities; and 7% to either swim, join a gym or exercise class; a further 23% were advised to maintain their current level; and 4% were either not able, or not motivated, to be physically active.

## Discussion

This report describes anthropometric details of a representative sample of patients with diabetes who had consultations with PHC nurses, and nursing management related to BGLs. No previous reports have been identified for patients with diabetes seen by PHC nurses for consultations, although one NP survey from the United States (US) reported that 74% of patients had HbA1c levels monitored, and goals were set to improve risk factors for complications.<sup>27</sup>

Of the patients sampled in Auckland, only 68% and 16% of patients had body weight and BMI recorded, respectively. This is recommended for all patients with diabetes<sup>14</sup> and highlights the lack of

Table 2. Current hypoglycaemic medications, accessible in patient records and reported, by nurse group

Variable and level	n (%)	Type of nurse			p-value*
		Practice nurses n (%)	District nurses n (%)	Specialist nurses n (%)	
<b>Total sample of patients</b>	<b>265</b>	<b>153</b>	<b>47</b>	<b>65</b>	
<b>Metformin</b>					
Records accessible	252 (95)	147 (96)	40 (85)	65 (100)	0.02
Prescribed	143 (57)	93 (63)	14 (35)	36 (55)	0.04
<b>Insulin</b>					
Records accessible	256 (97)	149 (97)	42 (89)	65 (100)	0.02
Prescribed	80 (31)	30 (20)	20 (48)	30 (46)	0.0008
<b>Sulphonylurea</b>					
Records accessible	251 (95)	146 (95)	40 (85)	65 (100)	0.02
Prescribed	67 (27)	40 (27)	10 (25)	17 (26)	0.94
<b>Glitazone</b>					
Records accessible	252 (95)	147 (96)	40 (85)	65 (100)	0.02
Prescribed	12 (5)	5 (3)	0 (0)	7 (11)	0.02
<b>Alpha-glucosidase inhibitor</b>					
Records accessible	251 (95)	146 (95)	40 (85)	55 (85)	0.02
Prescribed	0 (0)	0 (0)	0 (0)	0 (0)	–

\* p-value showing significance of variation in percentages by nurse group, from the log-likelihood Chi-square value and not applied with low cell values

Table 3. Nursing activities undertaken during the consultation, with diabetes patients (n=265), by nurse group

Nurse activity	N (%)	Type of nurse			p-value*
		Practice nurses n (%)	District nurses n (%)	Specialist nurses n (%)	
<b>Patients with recorded data</b>	<b>265</b>	<b>153</b>	<b>47</b>	<b>65</b>	
<b>Weight, BGLs and diet</b>					
Nurses weighed patients	153 (58)	101 (66)	1 (2)	51 (78)	<0.0001
Tested BGLs <sup>†</sup>	109 (42)	66 (44)	6 (13)	37 (57)	0.003
Advised on diet	185 (70)	109 (71)	20 (43)	56 (86)	0.007
<b>Physical activity and 'Green Scripts'</b>					
Advised on physical activity	175 (66)	107 (70)	16 (34)	52 (80)	0.0007
Prescribed a 'Green Script'	11 <sup>‡</sup> (4)	9 (6)	0 (0)	2 (3)	0.02
Previous 'Green Script'	28 (11)	20 (13)	1 (2)	7 (11)	
Previous records not available	97 (37)	33 (22)	45 (96)	19 (29)	<0.0001
<b>Blood glucose levels</b>					
Discussed BGLs <sup>§</sup>	109 (43)	55 (39)	14 (30)	40 (64)	0.04
Gave advice on medication <sup>  </sup>	48 (19)	25 (17)	2 (4)	21 (33)	0.007
Insulin management	19 (7)	5 (3)	0 (0)	14 (22)	
Medication change/review	12 (5)	6 (4)	1 (2)	5 (8)	–
Compliance	10 (4)	8 (5)	0	2 (3)	
Prescription/side effects/action	7 (3)	6 (4)	1 (2)	0 (0)	

BGLs Blood glucose levels

'Green prescription'—prescription for physical activity

\* p-value showing significance of variation in percentages by nurse group, from the log-likelihood Chi-square value and not applied with low cell values

† Number of patient records: total nurses (n=262); PNs (n=151), DNs (n=46), and SNs (n=65)

‡ Five patients were referred to an organisation, four prescribed walking, and one each to swim and undergo a gym exercise routine.

§ Number of patient records: total nurses (n=252); PNs (n=143), DNs (n=46) and SNs (n=63).

|| Number of patient records: total nurses (n=257); PNs (n=146), DNs (n=47) and SNs (n=64).

patient recordings and access to records by DNs. Nurses accessed and reported on HbA1c for 76% of patients, of whom 57% had levels above the international recommendation of 58 mmol/mol.<sup>28</sup> Mean HbA1c was similar to that reported in a large Auckland cohort study,<sup>29</sup> and Pacific and Māori ethnicity was strongly associated with elevated HbA1c levels, as reported previously.<sup>30</sup> Three-quarters of patients in this study self-monitored their BGLs; higher than the 60% estimated by NPs in the US.<sup>27</sup>

The proportion of nurses who gave advice or discussed serum glucose (43%) during the consultation was similar to that reported in this survey for routine practice (41%);<sup>31</sup> although, the proportion for PNs in this survey (39%) was

lower than in previous surveys of PNs in 1990 (81%) and 1999 (91%) in NZ who reported educating patients on home glucose testing.<sup>32</sup> Possible reasons for this are re-categorisation of responses, respondent variation, self-reported bias, or an actual change in nursing management.

During the nurse consultations, of which 64% were over 15 minutes,<sup>26</sup> 58% of patients were weighed and 42% had capillary glucose tested, despite a lack of evidence linking the latter practice with improving HbA1c.<sup>33</sup> Over two-thirds of all patients were advised on diet and physical activity, which is highly recommended,<sup>14</sup> although far less than the 100% reported for DNs in the UK,<sup>34</sup> but similar to diabetes educators (32% and 54%) who prescribed exercise in

two US surveys.<sup>35,36</sup> Although most SNs gave dietary advice, specific dietary advice related to patient's blood test results was only given to 27% of patients consulted in this survey.<sup>31</sup> This was similar to the 28% of NPs in the US who used the 'ABC' mnemonic (to educate patients about [Hb] A1c, blood pressure and cholesterol)<sup>27</sup> and who have a similar role to that of GPs in NZ in risk factor management, prescribing medication, follow-up and referral of patients.<sup>27</sup> Only 4% of patients received a Green Prescription—recommended for patients who are less physically active,<sup>37</sup> overweight, hypertensive or at higher risk of cardiovascular events.<sup>37,38</sup>

SNs were more likely to give advice to patients on BGLs and medication, particularly on insulin, compared to PNs and DNs. This reflects DNS' historical focus on serum glucose management for patients with both Type 1 and Type 2 diabetes, following reports of reduced retinopathy from the large DCCT intensive glucose Type 1 diabetes trial.<sup>12</sup> SNs reported routinely educating patients on glucose control (55%),<sup>31</sup> which is comparable with diabetes educators in the US who adjusted insulin (42–63%) and oral hypoglycaemic agents (21–23%),<sup>35,36</sup> although fewer than the 77% of the trusts or multidisciplinary teams surveyed in the UK who reported that all DNS adjusted hypoglycaemic agents.<sup>34</sup>

The increasing burden of diabetes necessitates further development of community-based nursing roles in diabetes management. Within the broader context of nursing development there has been a call to address post-registration education, nurse-prescribing, mentorship and leadership structures and new graduate career pathways.<sup>39</sup>

Future developments for PHC nursing in NZ include increased capacity in diabetes management, such as the new Diabetes Care Improvement Package,<sup>40</sup> and advanced roles for DNS that include prescribing the full array of medications required by many patients, as recently piloted in NZ.<sup>41</sup> This parallels developments in the UK, US, Canada and Australia.<sup>42</sup>

Data were missing for the majority of patients on BMI, limiting analyses. Combining the two specialist nurse groups for analyses, and fewer

patients seen for consultation by DNs were potential limitations of the survey. Information on nursing management was only reported during one consultation, which may not have captured additional related care given. Nevertheless, this was the first large cross-sectional survey among PHC nurses in a large, urban, multicultural population and provides an overview of their role in the management of patients with diabetes. The results add a valuable contribution to the relatively sparse international research on the role of nurses in the community management of diabetes. In addition, data were reported for 86% of the patients sampled who are expected to be representative of patients with diabetes who consult nurses and live in urbanised areas of NZ.

In conclusion, results suggest that PNs and SNs manage BGLs through appropriately advising patients on self-management of serum glucose and lifestyle. However, gaps in practice include a lack of patient recordings on BMI, body weight and goal setting, which is recommended,<sup>43</sup> for improving HbA1c, BMI and physical activity. Organisational changes, including permissive and flexible contracting, are required in district nursing to ensure its inclusion in both secondary and PHC organisations. In addition, access to patient management systems and the ability to contribute to them is needed to fully engage in the management of diabetes. In addition, nurses need to be aware of the ongoing international debate on ideal HbA1c levels,<sup>28</sup> due to the adverse effect of hypoglycaemic episodes.<sup>8,10</sup> Continued government funding and support from health care providers are required for further PHC nurse education and developing capability in diabetes management.

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#### COMPETING INTERESTS

None declared.