

Determining registered nurses' knowledge of diabetes mellitus

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ARTICLE POINTS

1 As nurses are the key providers of diabetes care, it is essential that they have sufficient knowledge to educate patients appropriately.

2 Previous research has shown that nurses' knowledge of diabetes is variable.

3 A replication study among registered nurses at a UK teaching hospital revealed areas of high knowledge as well as areas where knowledge was deficient.

4 A link nurse system is recommended as a way of improving nurses' practical skills.

5 The Diabetes NSF has identified the education of health professionals as a top priority.

KEY WORDS

- Diabetes knowledge
- Registered nurses
- Replication study
- Nurse education

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Introduction

Nurses are the key providers of diabetes care, but research has shown that their knowledge of diabetes is variable. This study sought to determine registered nurses' knowledge of diabetes in one city centre teaching hospital in the UK. Results showed that nurses had a better knowledge of type 1 diabetes than of type 2 diabetes. However, they were markedly more knowledgeable about theory than practical issues. It is recommended that a link nurse per ward be initiated to concentrate on improving nurses' practical skills and knowledge.

As the incidence, prevalence and diagnosis of diabetes increase (Amos et al, 1997), so more people will require care from health professionals. One way to reduce the morbidity and mortality from diabetes is to educate people with diabetes in self-care practices (DCCT Research Group, 1993; Feddersen and Lockwood, 1994). The quality of information they receive will depend on the knowledge and experience of the staff in diabetes care (Park, 1993). Nurses are often the first point of contact for people seeking information on diabetes care (Dunning, 1995; McDermott, 1995); it would therefore seem necessary for all qualified staff to have sufficient knowledge to educate others appropriately.

Literature review

The literature on nurses' diabetes knowledge derives from the USA and Europe. Although findings appear similar, the American studies are larger and more rigorous.

Drass et al (1989) refined a previous questionnaire designed to test registered nurses' knowledge of diabetes. Their version of the questionnaire was called the diabetes basic knowledge test (DBKT), and had a multiple-choice format. They tested the questionnaire for content validity, item reconstruction and test format and reliability. Like the previous questionnaire, the overall pass rate was set at 70%.

Jayne and Rankin (1993), in a replication of Drass and colleagues' study, found that

the areas in which nurses were most lacking in knowledge were the same as those previously identified: action of insulin, sites for insulin injections, storage of insulin, clinical signs of hypoglycaemia and hyperglycaemia, duration of action of oral hypoglycaemic agents, and effects of exercise and illness on blood glucose levels. El-Deirawi and Zuraikat (2001) assessed nurses' actual and perceived knowledge of diabetes using the DBKT and found that they were positively correlated. Other studies in the USA used a variety of questionnaires and smaller sample sizes, making comparison difficult (Moriarty and Stephens, 1990; Leggett-Frazier et al, 1994).

In the UK, Burden and Burden (1993) also replicated the study of Drass et al (1989), using an adapted version of the DBKT. However, the changes were not pre-tested, so the validity and reliability of this version of the DBKT are questionable (Polit and Hungler, 1999). Also, no details of the sample and sampling techniques were given, making comparisons with previous studies difficult.

Other European studies available in this area (Dolan et al, 1984; Knight et al, 1984; Parks, 1993; Piagessi et al, 1993; Christov et al, 1995) were much smaller, and less attention had been paid to the importance of questionnaire selection, validity and reliability. Fewer conclusions can therefore be drawn from the results.

Nevertheless, these studies highlight the need for further research to improve and clarify what is already known. The study described here aimed to determine the level

of diabetes knowledge among registered nurses in a UK city centre teaching hospital.

Research design and methods

The study design used was replication. Replication helps to establish the validity and generalisability of previous findings and increases the core body of knowledge to shape future practice or further research (Parahoo, 1997; Polit and Hungler, 1999). This study replicated the study of Drass et al (1989), using a quantitative research method in the form of a knowledge-based questionnaire for data collection.

Sample

The study was carried out in a large city centre teaching hospital as a site of convenience. The target population was used in its entirety (census sampling; Polit and Hungler, 1999). The target population was defined as all registered nurses within the general medical and surgical wards (n=295). A total of 161 registered nurses from 13 medical wards, and 134 registered nurses from six surgical wards, of grades C to G, made up the sample. Twenty-seven nurses took part in the pilot study, leaving 268 nurses remaining in the sample. Access to staff was obtained from the Director of Nursing and Quality and the personnel department.

In this study, two questionnaires were used for data collection. The first was a demographic questionnaire developed by the researchers specifically for the study. The second was the DBKT of Drass et al (1989), from whom the questionnaire and

permission for its use were obtained.

Pre-testing of instruments

Both questionnaires were pre-tested before use. The DBKT questionnaire of Drass et al (1989) was long (45 questions), and some of the questions concerning treatment were outdated and/or contained American jargon. The questionnaire was therefore anglicised and adapted slightly to bring it in line with current clinical practice, in consultation with an expert panel to ensure content validity (Parahoo, 1997).

To ensure the questionnaire's validity and reliability after slight changes, it was piloted on 27 registered nurses working within the designated diabetes wards of the city centre teaching hospital. These wards are within the general medical directorate and the sample of registered nurses were therefore removed from the overall study. No problems were identified with the questionnaire and the nurses reported that it took about 20 minutes to complete.

After pre-testing, the questionnaires were sent to the 268 nurses in the study sample, with a covering letter and self-addressed envelope, via the internal mail. Two days after distribution, one of the researchers visited each ward to ensure that staff had received the questionnaire and to encourage them to complete it. Personal contact has been found to have a positive effect on response rates (Polit and Hungler, 1999).

A total of 106 questionnaires were returned, giving a response rate of 39.5%. This rate, although similar to that expected (Treece and Treece, 1986), was still low and hence the results may not be generalisable (Polit and Hungler, 1999). Of the 106 questionnaires returned, nine were not completed as the nurses no longer worked within the hospital. This left 97 valid questionnaires for analysis and gave a final response rate of 36.2%.

Anonymous questionnaires meant that demographic and factual details between non-responders and responders could not be compared. It is postulated that non-responders did not participate because their lack of knowledge of diabetes made them feel threatened by the questionnaire, but there may be other reasons for their non-participation (Polit and Hungler, 1999).

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1 Replication was chosen for the study design, to help establish the validity and generalisability of previous findings and increase the core body of knowledge.

2 The questionnaire devised by Drass et al (1989) – the diabetes basic knowledge test – was used for data collection, after it had been anglicised and adapted slightly for current clinical practice.

3 The questionnaire was piloted on 27 registered nurses working in the designated diabetes wards of a large city centre teaching hospital.

4 The sample comprised 161 registered nurses from 13 medical wards and 134 registered nurses from six surgical wards, of grades C to G.

Table 1. Numbers and percentage of nurses suggesting various methods for increasing their own knowledge

Method	No. (%)
Reading journals	61 (62.9)
Attending study days	34 (35.1)
Talking to peers	14 (14.4)
Speaking to nurse specialist	14 (14.4)
Learning on the job	14 (14.4)
Learning from patients	12 (12.4)
Talking to medical staff	12 (12.4)
Reading policy manual	4 (4.1)

Results

Data from both questionnaires were analysed using the statistical package SPSS. The level of significance was $P < 0.05$. The majority (44.3%) of respondents were E grade nurses, closely followed by D grade nurses (34.0%). The rest of the sample comprised 2.1% C grade, 9.3% F grade and 10.3% G grade nurses.

Respondents had a wide range of years of experience – from 6 months to 35 years (average 10 years). In addition, 58.8% had attended short courses of study since qualifying, but only 5.2% had attended a diabetes course within the preceding 5 years.

Most nurses perceived that they had some experience of caring for people with diabetes. The majority felt that they could

Table 2. Percentage of correct and incorrect answers to the DBKT

Question no. and content	% correct	% incorrect	% not answered
1. Treatment for type 1 diabetes	87.6	6.2	6.2
2. Action of insulin on BG	95.9	4.2	0.0
3. When to check urine for ketones	52.6	40.2	7.2
4. Peak effect of soluble insulin	82.5	16.5	1.0
5. Peak effect of intermediate insulin	71.1	27.8	1.0
6. Symptoms of DKA	77.3	3.1	19.6
7. Cause of DKA in type 1 diabetes	77.3	18.6	4.1
8. Effect of acute illness on insulin requirements	73.2	24.8	2.1
9. Insulin and surgery	92.8	7.2	0.0
10. Exercise and effect on insulin requirements	91.8	8.3	0.0
11. Increased exercise and food requirements	83.5	16.4	0.0
12. Food exchange	88.7	11.3	0.0
13. Sites for injections	29.9	67.0	3.1
14. Initial treatment of type 2 diabetes	84.5	13.4	2.1
15. Duration of action of glibenclamide	1.0	95.8	3.1
16. Not side-effect of oral hypoglycaemic agent	49.5	46.4	4.1
17. Meal plan for type 2 diabetes	51.5	46.4	2.1
18. Unresponsive patient and blood glucose	76.3	13.4	10.3
19. BG before meal	83.5	15.5	1.0
20. BG monitoring	47.4	48.4	4.1
21. Negative urine and relation to BG	32.0	66.0	2.1
22. Test for average BG over time	19.6	76.3	4.1
23. Action if 2% glucose in urine or BG >13mmol/l	91.8	5.1	3.1
24. Symptoms of hypoglycaemia	43.3	51.5	5.2
25. Symptoms of hyperglycaemia	70.1	26.9	3.1
26. Cause of hypoglycaemia	99.0	1.0	0.0
27. Cause of hyperglycaemia	88.7	10.4	1.0
28. Long-term complications	56.7	22.7	20.6
29. Footcare	100.0	0.0	0.0
30. Corn treatment	100.0	0.0	0.0
31. Treatment for abrasion on leg	54.6	44.4	1.0
32. Diet and nutrients	68.0	31.9	0.0

BG = blood glucose; DKA = diabetic ketoacidosis

do with increasing their knowledge of diabetes (94.8%) and suggested various ways of achieving this (Table 1).

The pass rate was set at 70% in keeping with previous studies. The overall pass rate for this study was 69% and individual items scored differently (Table 2).

The DBKT was divided into theoretical questions and practice-based questions. Thematic analysis of responses demonstrated a lack of application of theoretical knowledge to clinical practice.

Staff nurses and senior nurses in the sample totalled 95, after exclusion of the two C grade nurses. Comparison of results by grade showed that there was no statistically significant difference in knowledge between the two groups of nurses (grades D/E and F/G, $P=0.255$; Table 3). Comparison of all grades of nurses and their perceived amount of experience of diabetes showed little difference between the grades in actual level of knowledge (Table 4). Hence there was no statistically significant difference either between grade of staff and knowledge, or between self-reported experience of caring for people with diabetes and knowledge.

Specific areas where nurses had a high level of knowledge (Table 5) and where there was a knowledge deficit (Table 6) were identified.

Discussion

The pass rate (69%) was similar to that obtained in previous studies (Drass et al, 1989; Burden and Burden, 1993; Jayne and Rankin, 1993; El-Deirawi and Zuraiikat, 2001). Overall, respondents almost had the required amount of basic knowledge to care for people with diabetes.

Experience and knowledge

Drass et al (1989) reported that the nurses in their study who thought they knew about diabetes scored less than those who thought they knew little. Burden and Burden (1993) also reported this finding.

The present study demonstrated that perception of knowledge had little bearing on the actual score, and this was true for all grades of nursing staff (Table 3). Clinical experience, as determined by grade of staff or self-perception, had no statistically significant influence on actual knowledge level.

Table 3. DBKT scores by grade

Grade	Mean score on DBKT	Standard deviation
D/E	21.96	± 3.12
F/G	22.89	± 3.36
$P=0.255$		

Table 4. Scores on the DBKT by perceived experience

Perceived experience of all nurses	Mean score on DBKT	Standard deviation
Little experience	22.4	± 1.75
Some experience	22.1	± 3.11
A lot of experience	22.1	± 4.49

Table 5. Areas of high level of knowledge

Question	% correct
Treatment for type 1 diabetes	87.6
Action of insulin on BG	95.9
Peak effect of soluble insulin	82.5
Symptoms of diabetic ketoacidosis	77.3
Cause of diabetic ketoacidosis in type 1 diabetes	77.3
Effect of acute illness on insulin requirements	73.2
Insulin and surgery	92.8
Exercise and effect on insulin requirements	91.8
Increased exercise and food requirements	83.5
Food exchange	88.7
Initial treatment of type 2 diabetes	84.5
BG before a meal	83.5
Action if 2% glucose in urine or BG >13mmol/l	91.8
Cause of hypoglycaemia	99.0
Cause of hyperglycaemia	88.7
Footcare	100.0

BG = blood glucose

Table 6. Areas of knowledge deficit

Question	% incorrect
Sites for injections	67.0
Duration of action of glibenclamide	95.8
Blood glucose monitoring	48.4
Negative glycosuria: what is blood glucose level?	66.0
Symptoms of hypoglycaemia	51.5

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1 All the nurses in the sample answered the question on footcare correctly.

2 Only 56.7% of the sample correctly identified all the other long-term complications of diabetes.

3 The majority (95.8%) answered the question on oral hypoglycaemic agents incorrectly, and only 49.5% could identify the side-effects.

4 Almost half the sample (48.4%) were unaware of how to carry out blood glucose monitoring accurately and precisely.

Nurses identified ways of increasing their own knowledge (*Table 1*); however, the findings indicate that either these methods were not being employed or they were ineffective.

The theory–practice gap

The theory-practice gap has been discussed extensively in the literature (Carter, 1996; Fealey, 1997). In our study, there was evidence of links between some of the theory questions answered correctly and the practical questions answered incorrectly, demonstrating a gap between theory and practice. Some of these findings are similar to those obtained in previous studies.

Although nurses had a good understanding of insulin, i.e. how exercise, food intake and blood glucose are related, they were not able to identify the correct storage of insulin or correct sites for insulin injections, or to recognise and treat hypoglycaemia correctly.

Trends in knowledge

It was noted that nurses who answered the first six questions of the DBKT correctly did better overall in the questionnaire, and vice versa. The order of the questions had been altered from the original DBKT, so that the first six questions now related to the fundamentals of diabetes. These findings indicate that where nurses had a basic understanding of diabetes, they were able to relate this in a wider sense to diabetes care.

Respondents did better in questions on type 1 diabetes (average 78% correct) than in those on type 2 diabetes (average 50% correct). Dolan et al (1984), however, reported the opposite effect. Given that the prevalence of type 2 diabetes is expected to increase significantly over the next 5 years, it would seem important to address teaching about type 2 diabetes in greater detail in all aspects of nurse education.

Areas of high level of knowledge

All responses to the question on footcare were correct. Although nurses knew that people with diabetes had problems with their feet, they were unaware of the other long-term complications of diabetes, with only 56.7% correctly identifying all of them.

Responses to the questions on exercise and its relation to insulin and food

requirements were correct. Nurses also had good knowledge of the action of different types of insulin (95.9% correct), in contrast to other studies. They were able to recognise and manage diabetic ketoacidosis.

They also knew the effect that illness has on insulin requirements and how to deal with patients with diabetes who were undergoing surgery. This may be due to the fact that the nurses in the sample were from acute medical and surgical wards, and therefore had more experience of dealing with these types of diabetic crisis.

Areas of knowledge deficit

The majority of nurses (95.8%) answered the question on oral hypoglycaemic agents incorrectly, and only 49.5% could identify the side-effects of these drugs. Poor responses to such questions have been reported in other studies.

Only 29.9% of nurses could identify all the areas in which a subcutaneous injection could be administered. This poor response rate was in keeping with the findings of other studies.

Almost half the respondents (48.4%) were unaware of how to carry out blood glucose monitoring accurately and precisely. The responsibility for this task frequently comes under the nursing staff remit, and there is a risk that diabetes management may be altered on the basis of false blood glucose values. Previous studies have also highlighted this problem.

Questions aimed at determining the nurse's ability to identify the symptoms of a hypoglycaemic episode were answered poorly, with 51.5% of nurses giving incorrect answers; this was similar to findings in other studies. This is an important consideration as hypoglycaemia needs prompt action to ensure that the patient's health does not deteriorate further. Not all studies reported a poor response to questions on hypoglycaemia.

Conclusion

Clearly, the nurses who participated in this study have a certain level of knowledge of diabetes; however, there are large areas of knowledge that need to be improved if the care provided to people with diabetes is to be enhanced. Interestingly, several of these are 'nursing' areas, such as identifying sites for insulin injections and accurately monitoring

blood glucose levels. Such nurse knowledge is particularly important because it could affect the patients' ability to self-care.

Diabetes UK states that people with diabetes should be cared for by health professionals who have a comprehensive understanding of diabetes (Diabetes UK, 2001). The results of this study suggest that nurses do not possess sufficient knowledge in all areas of diabetes care to fulfil these recommendations or to teach people appropriately. However, because of the low response rate of this study, the results might not be generalisable.

Previous studies have highlighted the need for educational support for registered nurses; however, the form that this should take is debated. Research suggests that study days are not the solution, as they need to be held every 6 months to maintain nurses' knowledge. The nurses in this study indicated that reading journals was the most favoured method of increasing nurses' knowledge, with study days being the next favoured, although there is little evidence from this study that these methods are effective. Current methods of educating nurses on diabetes would thus appear to have failed; however, nurses still require further educational input.

From the literature, it would appear that the most effective way of increasing and maintaining nurses' knowledge of diabetes might be to introduce a 'link nurse system' (Fedderson and Lockwood, 1994; Swartz and Davis, 1994; El-Deirawi and Zuraikat, 2001). It is important to narrow the theory-practice gap, and DSNs would find the link nurse a useful vehicle for disseminating new research findings (Huber, 1994).

The findings of this study indicate that the priorities for nurse education on diabetes are knowledge of type 2 diabetes, recognising the symptoms of hypoglycaemia, and observation of practical skills, such as identifying subcutaneous insulin injection sites and blood glucose monitoring.

Nurses' knowledge of diabetes has to increase if we are to progress towards the delivery of high standards of care in the light of clinical governance. The National Service Framework for Diabetes (Department of Health, 2001) has identified the education of professionals as a top priority. Trusts needs to review their methods of

staff development, to ensure that study days and courses in continuing professional development address the knowledge deficits clearly identified here. ■

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PAGE POINTS

- 1** Current methods of educating nurses on diabetes appear to have failed.
- 2** The literature suggests that the most effective way of increasing and maintaining nurses' diabetes knowledge might be to introduce a 'link nurse system'.
- 3** DSNs would find the 'link nurse' a useful vehicle for disseminating new research findings.
- 4** The priorities for nurse education on diabetes identified in this study are knowledge of type 2 diabetes, recognising the symptoms of hypoglycaemia, and observation of practical skills, e.g. subcutaneous insulin injection sites and blood glucose monitoring.