

# Assessment of diabetes-related knowledge among nursing staff in a hospital setting

*Abduelmula R Abduelkarem and Hawa J El-Shareif*

**This study aimed to identify areas of deficient knowledge among hospital nurses regarding diabetes management; the ultimate goal was to improve the quality of care for people with diabetes who are admitted to hospital for other medical reasons. Diabetes-related knowledge was assessed in 116 nurses using a 66-item questionnaire; the mean total score was  $48.5 \pm 15.1$ . Knowledge was highest for nurses working in paediatrics ( $62.0 \pm 5.5$ ;  $P < 0.05$ ) when compared with nurses working in other specialty wards; the mean knowledge scores of nurses working in medicine units ( $53.0 \pm 12.8$ ) was significantly higher than those working in surgery ( $43.6 \pm 16.2$ ;  $P < 0.01$ ) and dermatology ( $38.3 \pm 15.2$ ;  $P < 0.01$ ) units. However, the overall knowledge of diabetes among the nursing staff was found to be lacking; educational programmes covering diabetes and inpatient diabetes management would be useful to improve nurses' knowledge.**

**D**iabetes is a commonly encountered secondary diagnosis for hospitalised patients globally (American Diabetes Association, 2008; Centers for Disease Control and Prevention, 2009). Inpatient hyperglycaemia causes significant morbidity and mortality, with increased length and cost of hospital stay (Estrada et al, 2003; Oliveira-Fuster et al, 2004); however, it is often neglected because most hospitalised people with diabetes are admitted for medical conditions other than diabetes (Roman and Chassin, 2001).

Studies of interventions within the intensive care setting showed that tight glucose control improved health outcomes (Furnary et al, 2003; Gandhi et al, 2007). Thus there is a need to improve glycaemic control in individuals admitted to hospital, whether they have newly recognised hyperglycaemia or known diabetes (Moghissi et al, 2009; American Diabetes Association, 2011). Insulin is often the treatment of choice to control

hyperglycaemia in inpatients (Moghissi et al, 2009). However, it is apparent that insufficient knowledge of diabetes and insulin therapy on the part of healthcare providers can contribute to errors in insulin management (Fowler and Rayman, 2010); this can result in dangerous but preventable hyperglycaemia and hypoglycaemia (Smith et al, 2005; Maynard et al, 2008).

A fear of hypoglycaemia can prevent physicians from adopting a more physiological insulin replacement regimen, marked by a certain tolerance for hyperglycaemia, in the belief that it is better to “do no harm” (Umpierrez and Maynard, 2006; Clement, 2007; Maynard et al, 2008). Moreover, in hospitals it is the responsibility of the staff nurses to administer insulin and to recognise potentially harmful directions and impending hyperglycaemic or hypoglycaemic scenarios (Clement, 2007; Savion et al, 2010). However, some studies have reported that hospital nurses are inadequately trained in diabetes management

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## Article points

1. Nurses have a crucial role to play in the care of people with diabetes in hospital.
2. Diabetes-related knowledge was assessed among 116 nurses working in different hospital departments.
3. The study objective was to identify any areas of diabetes knowledge that were lacking, and to recommend tackling these through educational programmes to improve the management of diabetes in hospital.

## Key words

- Assessment
- Diabetes care
- Hospital setting
- Nursing staff

## Authors

Abduelmula R Abduelkarem is Associate Professor of Clinical Pharmacy and Pharmacy Practice, Department of Clinical Pharmacy and Pharmacy Practice, College of Pharmacy and Health Sciences, Ajman University of Science and Technology Network, Ajman, United Arab Emirates; Hawa J El-Shareif is Adult Endocrinologist, Endocrine Department, Tripoli Medical Centre (Tripoli University, Faculty of Medicine), Tripoli, Libya.

### Page points

1. Studies have demonstrated a need for improvement in general diabetes knowledge among nurses in hospitals.
2. The rationale of the present study was to assess the baseline knowledge of diabetes among nurses working at the Tripoli Medical Centre, Libya.
3. The objective was to identify topics for future educational programmes in the area of diabetes management, with the ultimate goal of improving the quality of care for hospitalised individuals with diabetes.

and particularly insulin therapy (El-Deirawi and Zuraikat, 2001; Derr et al, 2007; Rubin et al, 2007).

Studies have demonstrated a need for improvement in general diabetes knowledge among nurses in hospitals (Baxley et al, 1997), and continuing education for hospital nurses is increasingly becoming more important. This will enable nurses to convey accurate information to people with diabetes regarding their care after discharge (Nettles, 2005; Manchester, 2008).

The rationale of the present study was to assess the baseline knowledge of diabetes among nurses working at the Tripoli Medical Centre, Libya. The objective was to identify topics for future educational programmes in diabetes management, with the ultimate goal of improving the quality of care for hospitalised individuals with diabetes.

## Method

### Study design and study population

For this study, diabetes-related knowledge was assessed among 116 nurses working in different departments at the Tripoli Medical Centre, Libya. A 66-item questionnaire, comprising 51 multiple-choice questions with a single best answer, seven “true” and “false” questions, and eight “open” questions, was designed for the purpose of this study; a copy of the questionnaire can be obtained from the author HE-S (hawa\_elsharif@yahoo.com).

The Tripoli Medical Centre serves as a tertiary care centre and a teaching hospital. Questions addressed topics on basic diabetes knowledge, relevant pathogenesis, acute and chronic diabetic complications, basic rules of nutritional and lifestyle therapy, oral hypoglycaemic agents, insulin therapy and targets of diabetes management. In addition, participants were asked for information on their age, sex, nationality, educational background, years of work experience and their current place of work, as well as whether they have any personal or first-degree family history of diabetes, and the medications used.

The questionnaires were distributed directly to all the nurses attending diabetes educational courses as a pre-course test, organised by the author (HE-S) for the nurses working at the centre. The pre-course test was developed by the author (HE-S); the multiple-choice section of

the questionnaire had been generated using the American Association of Clinical Endocrinologists’ (2002) “knowledge evaluation form”, which was modified and translated into Arabic for the Libyan nurses.

### Post-test course population

During the period of January 2008 to December 2009, six repeated educational courses on diabetes were conducted with the aim to improve the nurses’ understanding of diabetes and to improve the inpatient diabetes care. The nurses’ enrolment was through nomination by their head nurses or by direct registration. The course involved 2 hours of teaching per day for 2 weeks. The author (HE-S) was present during the administration of the questionnaire and collected the forms after completion. Participants were given approximately 1 hour to complete the questionnaire and were not permitted to ask questions, share answers or refer to reference material.

### Scoring of the inpatient diabetes care questionnaire

Each of the multiple-choice questions equally received one point if answered correctly; unanswered items were counted as incorrect, and no points were awarded. For the open questions, one point was given for each required answer. A mean total score and mean scores for different topics were calculated by adding the respective points and expressed as percentages of the maximum score.

### Statistical analysis

Statistical analysis was performed using *SPSS Statistics, version 17*. Comparison of scores between groups was performed using *t*-tests; a *P*-value of <0.05 was considered significant.

## Results

### Demographic characteristics

A total of 116 nurses completed the pre-course questionnaire: 49 were from surgical units (42.2%); 33 (28.5%) from medicine units; 15 (12.9%) from the intensive care unit (ICU); 7 (6.0%) from paediatric units; 5 (4.3%) from gynaecology units; 5 (4.3%) from dermatology units; and 2 (1.7%) from other units. Most of the

pooled sample was female ( $n=103$ ; 88.8%); of the total number of male and female nurses who participated in the study, 35 (30.2%) were non-Libyan. In total, 67 (57.8%) had a diploma in nursing, 34 (29.3%) had higher qualifications in nursing and 15 (12.9%) did not include their qualifications. Almost half of the nurses ( $n=57$ ; 49.1%) reported having a positive family history of diabetes in a first-degree relative. The mean age of nurses was  $31.1\pm 7.1$  years (range 20–52 years). The mean duration of work was  $9.2\pm 5.7$  years: 73 (62.9%) nurses had worked for  $\leq 10$  years; 31 (26.7%) had worked for  $>10$  years; and 12 (10.3%) nurses did not mention their duration of work experience. *Table 1* summarises the participant nurses' gender, education levels, work places and duration of work throughout the study period.

### Knowledge total scores

The mean total score for the 116 nurses who had attended the pre-course test was  $48.5\pm 15.1$ . Knowledge was highest for nurses working in paediatric units ( $62.0\pm 5.5$ ;  $n=7$ ) when compared

**Table 1. Characteristics of the 116 nurses who participated in the study.**

Variables	Number	%	
Gender:	• Male	13	11.2
	• Female	103	88.8
Education	• Diploma	67	57.8
	• Higher	34	29.3
	• Not mentioned	15	12.9
Family member with diabetes	• No	47	40.5
	• Yes	57	49.1
	• Not mentioned	12	10.3
Origin	• Non-Libyan	35	30.2
	• Libyan	81	69.8
Work place: units	• Medicine	33	28.5
	• Surgery	49	42.2
	• Intensive care	15	12.9
	• Gynaecology	5	4.3
	• Paediatric	7	6.0
	• Dermatology	5	4.3
	• Other	2	1.7
Duration of work*	• $\leq 10$ years	73	62.9
	• $>10$ years	31	26.7
	• Not mentioned	12	10.3

\*Mean duration of work= $9.2\pm 5.7$  years

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with nurses in other specialty wards ( $P<0.05$ ). Nurses working in medicine units had a mean score of  $53.0\pm 12.8$  ( $n=33$ ), which was significantly higher than nurses working in surgery ( $43.6\pm 16.2$ ,  $n=49$ ;  $P<0.01$ ) or dermatology units ( $38.3\pm 15.2$ ,  $n=5$ ;  $P<0.01$ ). The nurses in the medicine units ( $n=33$ ), ICU ( $n=15$ ) and gynaecology units ( $n=5$ ) showed a comparable level of knowledge (mean total score  $53.0\pm 12.8$ ,  $52.1\pm 13.7$  and  $50.1\pm 6.4$ , respectively).

### **Knowledge subtotal score**

Subscores were allocated for different aspects of diabetes knowledge. *Table 2* summarises the diabetes knowledge among the 116 nurses who participated in the study from the six different departments in Tripoli Medical Centre, expressed as percentages of total maximal scores (see page 214).

### **Basic knowledge of diabetes pathophysiology**

Nurses' knowledge about the pathophysiology of diabetes did not significantly differ between the 116 nurses working in different specialties; their mean score was  $51.7\pm 25.5$  ( $P>0.05$ ).

### **Diabetes laboratory investigation knowledge**

The mean total knowledge score for diabetes laboratory investigations was  $55.9\pm 25.2$ ; the maximum score was obtained by paediatrics nurses ( $73\pm 12.6$ ) and the minimum score by dermatology nurses ( $40\pm 27.9$ ). Scores from nurses working in medicine and paediatric units were significantly higher than those working in surgery and dermatology units ( $P<0.05$ ).

### **Type 2 diabetes treatment knowledge**

The mean total knowledge score for managing type 2 diabetes was  $43.7\pm 24.2$ . A maximum score of  $51.5\pm 23.3$  was obtained by nurses from medicine units, and a minimum score of  $38.8\pm 25.3$  was obtained by nurses from surgical units; the difference between these two groups of nurses was significant ( $P<0.05$ ).

### **Insulin therapy knowledge**

Mean nurses' knowledge score for insulin treatment was  $46.3\pm 17.2$ . The maximum score of  $54.5\pm 18.3$  was obtained by nurses working in medicine units, and a minimum score of  $41.8\pm 17.7$  was obtained by nurses working in surgery; the difference between these two groups was significant ( $P<0.05$ ).

### **Diabetes and exercise knowledge**

The mean score for knowledge relating to diabetes and exercise was  $48.1\pm 26.1$ ; the maximum score of  $76.2\pm 13.1$  was obtained by nurses from the paediatric units, and a minimum score of  $26.7\pm 25.3$  was obtained by nurses from the dermatology units. Paediatric nurses' scores were significantly higher than those working in medicine units, surgery, ICU and dermatology

units ( $P<0.05$ ); medicine units nurses' scores were significantly higher than those from the dermatology units ( $P<0.05$ ).

#### Diabetes and diet knowledge

The mean score for diabetes and diet knowledge was  $54.8\pm 19.0$ ; the maximum score of  $75.2\pm 9.3$  was obtained by paediatric nurses, and the minimum score of  $42.6\pm 15.8$  was obtained by nurses in the dermatology units. Paediatric nurses' scores were significantly higher than those working in surgery, ICU, gynaecology and dermatology units ( $P<0.05$ ). Nurses working in the medicine and gynaecology units scored significantly higher than those in the dermatology units ( $P<0.05$ ). The ICU nurses' scores were significantly higher than those working in dermatology ( $P<0.05$ ).

#### Chronic complications knowledge

The mean score for knowledge about chronic complications was  $51.3\pm 27.4$ ; the maximum score of  $69.6\pm 18.9$  was obtained by nurses working in

the paediatric units, and the minimum score of  $37.5\pm 29.3$  was from nurses in the dermatology units. The paediatric nurses score was significantly higher than those working in surgical units ( $P<0.05$ ).

#### Diabetic hypoglycaemia knowledge

The mean score for knowledge about diabetic hypoglycaemia was  $47.8\pm 16.3$ . The maximum score of  $55.7\pm 12.7$  was obtained by the paediatric nurses, and the minimum score of  $38.0\pm 13.0$  was obtained by nurses in the gynaecology units; the difference between the two groups was significant ( $P<0.05$ ).

#### Diabetic ketoacidosis knowledge

The mean score for knowledge about diabetic ketoacidosis was  $25.7\pm 12.4$ ; the maximum score of  $31.7\pm 10.0$  was obtained by the paediatric nurses, and the minimum score of  $22.2\pm 13.6$  was obtained by nurses in gynaecology and dermatology units.

**Table 2. Scores of participant nurses' diabetes knowledge on components of the 66-item questionnaire, by department.\***

Knowledge questions	Department						
	Medicine units (n=33)	Surgery units (n=49)	ICU units (n=15)	Gynaecology units (n=5)	Paediatric units (n=7)	Dermatology units (n=5)	All (n=116)
Pathophysiology	57.6±24.3	48.3±25.7	53.3±26.1	60.0±30.3	57.1±21.2	36.7±21.7	51.7±25.5
Laboratory targets	65.7±20.9	47.2±25.6	60.0±28.4	62.3±6.1	73.0±12.6	40.0±27.9	55.9±25.2
Therapy for type 2 diabetes	51.5±23.3	38.8±25.3	42.2±27.3	40.0±14.9	47.6±17.8	46.7±21.7	43.7±24.2
Insulin therapy	54.5±18.3	41.8±17.7	45.6±14.7	43.3±14.9	45.2±8.1	43.3±9.1	46.3±17.2
Exercise	51.5±23.3	44.2±27.8	50.0±21.8	50.0±23.5	76.2±13.1	26.7±25.3	48.1±26.1
Diet	57.3±18.5	49.2±19.3	60.9±14.1	62.6±6.6	75.2±9.3	42.6±15.8	54.8±19.0
Chronic complications	54.5±26.3	45.4±28.5	60.8±28.3	52.5±13.7	69.6±18.9	37.5±29.3	51.3±27.4
Hypoglycaemia	51.8±16.5	44.3±17.8	50.7±11.6	38.0±13.0	55.7±12.7	42.0±13.0	47.8±16.3
Ketoacidosis	27.3±13.6	23.8±12.4	26.6±10.9	22.2±7.8	31.7±10.0	22.2±13.6	25.7±12.4
Total score	53.0±12.8	43.6±16.2	52.1±13.7	50.1±6.4	62.0±5.5	38.3±15.2	48.5±15.1

\*Scores presented as % of total score.

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### Effects of demographic features on nurses' knowledge score

The mean total knowledge score for nurses with a positive family history of diabetes was  $49.1 \pm 13.9$ ; for those with a negative family history of diabetes the mean total knowledge score was  $49.4 \pm 15.8$  ( $P > 0.05$ ). The mean total knowledge score for male nurses was  $47.6 \pm 14.4$  and for female nurses was  $48.6 \pm 15.2$  ( $P > 0.05$ ). There was found to be no significant effect of gender or family history of diabetes on total knowledge score or level of knowledge in the subscale questions ( $P > 0.05$ ).

The mean total knowledge score for Libyan nurses was  $46.4 \pm 14.3$  and for non-Libyan nurses was  $53.3 \pm 16.0$  ( $P < 0.005$ ). The level of knowledge was significantly higher among non-Libyan nurses in questions addressing nutrition ( $P < 0.001$ ), chronic complications ( $P < 0.05$ ) and diabetic ketoacidosis ( $P < 0.005$ ).

The mean total knowledge score for nurses with  $\leq 10$  years of experience was  $46.5 \pm 14.5$  and for those with  $> 10$  years of experience was  $57.2 \pm 11.7$  ( $P < 0.001$ ). The level of knowledge was significantly higher among those nurses with longer duration of work experience in questions addressing exercise ( $P < 0.005$ ), nutrition ( $P < 0.001$ ), chronic complications ( $P < 0.05$ ) and diabetes ketoacidosis ( $P < 0.005$ ). More than three-quarters of non-Libyan nurses (78.1%) had a duration of work experience of  $> 10$  years, compared with the 8.3% of Libyan nurses. No significant difference in level of knowledge between Libyan and non-Libyan nurses was found when the duration of experience was taken into consideration.

The mean total knowledge score for nurses with a diploma was  $46.29 \pm 13.53$  and for those with a higher qualification degree was  $55.24 \pm 13.17$  ( $P < 0.005$ ). The level of knowledge was significantly higher among nurses holding a higher qualification in questions addressing nutrition, chronic complications and hypoglycaemia ( $P < 0.005$ ) when compared with those holding a diploma degree. The qualification-based difference in knowledge persisted in nurses with work experience of  $\leq 10$  years; the difference was significant in mean total score ( $P < 0.001$ ) and in questions addressing investigation, hypoglycaemia ( $P < 0.05$ ), chronic complications and nutrition ( $P < 0.005$ ). Nurses with a duration of work experience of  $> 10$  years generally showed a comparable level of knowledge irrespective of educational qualifications; however, the exceptions were for questions relating to insulin therapy and nutrition, where those with higher qualifications showed a significantly better score ( $P < 0.05$ ).

The effect of duration of experience on level of knowledge was more significant in nurses holding a diploma qualification, as they showed a better level of knowledge with longer duration of experience compared with those with experience of  $< 10$  years. This difference was significant in questions relating to exercise, diabetic ketoacidosis ( $P < 0.05$ ), investigation, nutrition, chronic complications and hypoglycaemia ( $P < 0.005$ ), as well as the mean

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total score ( $P < 0.005$ ). The level of knowledge in nurses with higher qualifications was comparable irrespective of duration of experience, apart from questions addressing nutrition. The mean total score was  $54.81 \pm 15.31$  in those with experience of  $\leq 10$  years and  $58.37 \pm 7.78$  in those with a longer duration of experience ( $P > 0.5$ ).

### Discussion

Diabetes is a common comorbid condition in hospitalised inpatients worldwide (Centers for Disease Control and Prevention, 2009). A relationship of adverse outcomes to inpatient hyperglycaemia has been suggested by many observational studies that have reported on mortality, morbidity, length of stay and infectious complications (Oliveira-Fuster et al, 2004). Tighter glycaemic control has been associated with decreases in complications, infections, length of stay, morbidity and mortality in a variety of clinical settings and populations (Gandhi et al, 2007).

Improving inpatient diabetes management and glucose control has emerged as an important quality-of-care concern, and guidelines and protocols have been developed for the efficient treatment of hyperglycaemia (Moghissi et al, 2009; American Diabetes Association, 2011). However, despite the frequency with which people with diabetes are hospitalised, diabetes management is rarely the focus of care during their hospital stay (Roman and Chassin, 2001). Among the obstacles to better care for people with diabetes in hospital is the lack of medical staffs' awareness of the importance of glycaemic control (Metchick et al, 2002). Many of the medical errors associated with insulin therapy may be related to deficiency in the nursing staff knowledge on diabetes (Derr et al, 2007; Lamont et al, 2010).

Nurses are among the frontline professionals and have a crucial role to play in the care of people with diabetes in hospital. However, hospital nurses have been reported to be inadequately trained in diabetes management, and particularly insulin treatment (El-Deirawi and Zuraikat, 2001; Derr et al, 2007; Rubin et al, 2007). Identification of areas of deficient knowledge among nursing staff represents an important step towards implementation of targeted educational programmes, and ultimately the improvement of care standards for hospitalised patients with diabetes.

In this study, the mean total score of 48.5% showed that the nursing staffs' knowledge of diabetes was found to be lacking, particularly in questions relating to diabetic ketoacidosis. The best level of knowledge was obtained by nurses working in paediatric, medicine and intensive care units, in order of knowledge; the lowest level of knowledge was obtained by nurses working in dermatology and surgical units, in turn. Such differences in knowledge are expected, as nurses working with paediatricians and internist doctors are presumably more concerned about their patients' diabetes and are interested themselves in working with people with diabetes.

Surprisingly, this study disclosed a high positive first-degree family history of diabetes (49.1%) compared with data from the general population (World Health Organization, 2012). Despite this, no significant positive impact on level of knowledge was found when compared with nurses with no first-degree family history of diabetes.

Non-Libyan nurses attained better scores than Libyan nurses; however, the difference disappeared when the duration of experience was taken into account (78.1% of non-Libyans had work experience of  $> 10$  years compared with 8.3% of Libyan nurses). Another contributing factor may be the non-Libyan nurses' good command of the English language, which enabled them to learn more from the doctors who communicate in English on a day-to-day work basis.

As expected, nurses with a longer duration of work experience and those with a higher degree of qualification showed a better level of knowledge than their counterparts. However, the positive impact of duration of experience in nurses with a diploma degree was not observed in those with higher degree of qualifications. Interestingly, except for the insulin-related knowledge there was no significant difference in level of knowledge between diploma and higher degree nurses compared with those with the longer duration of experience. Moreover, this indicates that for nurses a certain level of knowledge is reached during their career that is not enhanced after a period of time.

Our study indicates that this lack of further progression may be because of a lack

**Page points**

1. This study indicates a deficiency in the basic knowledge of diabetes among the nursing staff at the Tripoli Medical Centre, Libya.
2. This study also points out a clear need to develop educational programmes for the nursing staff about diabetes and the management of inpatient hyperglycaemia, to ensure that healthcare providers are continuously trained and provided with the essential tools to comprehensively care for people with diabetes in hospital.
3. As a result of the findings, it was deemed necessary that local hospital officials and administrators be encouraged to devise a system to promote “continuous education”.

of continuing education programmes for the nursing staff. Continuing education programmes for nurses are necessary for nurses’ competence as well as for patients’ safety (Manchester, 2008). Legislations to support and encourage nurses are not available to engage them in continuing education programmes to improve their professional competence. The authors’ experiences have proved repeatedly that no long-lasting effect can be attained for any individual effort to improve awareness and management of hyperglycaemia in hospitals without the support from local hospital officials and administrators.

The recognition that diabetes management is a concern in hospitals is of utmost importance in order for resource allocation and proper management. Improving diabetes care requires competent providers to be actively involved in quality improvements in order to build a system capable of translating their knowledge into optimal outcomes for people with diabetes.

**Conclusion**

This study indicates a deficiency in the basic knowledge of diabetes among the nursing staff at the Tripoli Medical Centre, Libya. This study also points out a clear need to develop educational programmes for the nursing staff about diabetes and the management of inpatient hyperglycaemia, to ensure that healthcare providers have the essential tools to care for people with diabetes in hospital.

As a result of the findings, it was deemed necessary that local hospital officials and administrators be encouraged to devise a system to promote “continuous education”; proposing laws that make it mandatory for nurses to pursue continuous education should also be considered. Furthermore, it would be beneficial to test the prognosis of the research. This could be done by testing the same study group after a period of time, to not only check nurses’ improvement in knowledge but also see if the study has brought about any “self-need” among nurses to take the initiative to update their knowledge about the topic and inculcate it into their daily practice. This procedure can help hospital managers to evaluate hospital patients’ care and to assess changes in the attitude of nurses in their areas of expertise. ■

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