

DIABETES KNOWLEDGE: ARE RESIDENT PHYSICIANS AND NURSES ADEQUATELY PREPARED TO MANAGE DIABETES?

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ABSTRACT

Objective: To assess and compare the diabetes knowledge of nurses and residents in surgery, internal medicine, and family practice.

Methods: A 21-question survey based on current diabetes standards of care was developed and administered. The results were stratified by type of participant and analyzed statistically.

Results: A total of 52 internal medicine residents (IMR), 21 family practice residents (FPR), 42 surgery residents (SR), and 48 registered nurses (RN) participated. The survey had good overall internal consistency (Cronbach α of 0.78) and test-retest reliability (Pearson correlation coefficient of 0.71). The total mean percent correct for all participants was 61%. The total scores of IMR, FPR, and RN groups were similar (69%, 64%, and 66%) and significantly greater ($P < 0.001$) than the SR score (44%). Collectively, all survey participants averaged less than 50% correct on several items. The IMR scored higher than the SR and FPR on several items. The nurses outscored the physicians on items regarding insulin preparations, treatment of hypoglycemia, and perioperative insulin management. A subgroup of 13 RN with additional diabetes training earned the highest total score (82%).

Conclusion: Our novel survey was shown to be a statistically valid tool for assessment of diabetes knowledge. IMR, FPR, and inpatient RN have similar but insufficient levels of knowledge about diabetes. SR may have a more profound deficit of diabetes knowledge. Previous additional diabetes training among nurses was associated with greater diabetes knowledge. Most nurses and residents require additional education in order to provide optimal care to patients with diabetes. (*Endocr Pract.* 2007;13:17-21)

Abbreviations:

FPG = fasting plasma glucose; FPR = family practice residents; IMR = internal medicine residents; RN = registered nurses; SR = surgery residents

BACKGROUND

Diabetes care is guided by numerous diagnostic and treatment standards. Health care providers must have sufficient knowledge of these guidelines to deliver optimal care. Measurement of such knowledge can be used to identify areas of deficiency and to improve educational programs on diabetes.

Multiple studies have examined the diabetes knowledge of nurses (1-4); however, assessment of diabetes knowledge among physicians is underrepresented in the literature. Furthermore, we are not aware of any published study that has assessed the diabetes knowledge of surgeons. Because diabetes is widely prevalent, it is important for all physicians and nurses to be familiar with diabetes standards of care (5,6). The most commonly used diabetes knowledge assessment tool, the Diabetes: Basic Knowledge Test, was developed for testing nurses (1). This test, however, has several limitations, including a focus on nursing-specific issues, a lack of items related to treatment goals, and an inclusion of antiquated medicines (such as chlorpropamide). We developed and administered a questionnaire based on current standards of care to assess the diabetes knowledge of nurses and residents in surgery, internal medicine, and family practice.

RESEARCH DESIGN AND METHODS

Development, Administration, and Assessment

A team consisting of an academic endocrinologist, 2 endocrinology fellows, 3 residents in internal medicine, and a nurse diabetes educator developed the questionnaire. Fill-in-the-blank responses were required for all 21 items. Institutional review board approval was obtained.

The questionnaire was given to internal medicine residents (IMR), surgery residents (SR), family practice resi-

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dents (FPR), and inpatient registered nurses (RN) at an academic medical center in Philadelphia, Pennsylvania. Almost all the questionnaires were administered after routine meetings or conferences. The response rate within each group was 90% or greater. A total of 163 individuals participated. For determination of test-retest reliability, the survey was readministered to 20 subjects 1 to 3 weeks after the first administration.

Statistical Analysis

Statistical analysis was performed with the SAS computer software package. Overall internal consistency of the survey was measured with a raw Cronbach α . Test-retest reliability was determined by the Pearson correlation coefficient. Because the variances of each group were different, total score group means were compared by Welch's variance-weighted analysis of variance, which does not assume homogeneity of group variances. Pairwise comparison between groups was performed with the honestly significant difference test (7). Mean scores for individual survey items were compared by use of a 2-tailed Fisher exact test with a Hommel correction for multiple comparisons (8). The primary hypothesis was that nurses and residents lack important diabetes knowledge.

RESULTS

A total of 52 IMR (24 interns), 21 FPR (7 interns), 42 SR (11 interns), and 48 RN participated. Of the SR, 16 were general surgery residents, and 26 were residents in subspecialty surgical disciplines. The mean percent of correct answers for all participants was 61%. Scores for each group are shown in Table 1. There was a highly significant difference in the mean scores across the 4 groups (global P value <0.0001). Pairwise comparisons indicated that the SR had a significantly lower fraction of correct answers than did the other 3 groups (P <0.001 for all 3 pairwise comparisons; Table 2). All participants collectively averaged less than 50% correct on items about the fasting plasma glucose (FPG) criterion for the diagnosis of diabetes, blood pressure goal, insulin pharmacokinetics, treatment of severe hypoglycemia, and perioperative management of type 1 and type 2 diabetes. A significantly greater percentage of IMR than SR knew the FPG criterion for the diagnosis of diabetes, the components of 70/30 insulin, when to discontinue insulin infusion after subcutaneous administration of insulin, and perioperative management of type 1 diabetes. IMR scored significantly higher than FPR on items related to treatment of hypoglycemia and perioperative management of type 1 diabetes. The nurses outscored the physicians on items relating to insulin preparations, treatment of hypoglycemia, and perioperative insulin management (Table 1). The 13 nurses who reported having additional diabetes training scored higher than the remaining 35 nurses (82% versus 61%). Because of the small sample size, statistical analysis was not independently performed with this group of 13 nurses.

The survey was found to have high overall internal consistency by a raw Cronbach α of 0.78. Test-retest reliability, as assessed by the Pearson correlation coefficient, was 0.71 based on 20 test-retest pairs. The distribution of scores among the test-retest pairs roughly approximated a normal distribution. Of note, most of the retest scores deviated by 2 points or less from the original test score. One subject, however, had an initial score of 15 (of a total of 21) and a retest score of 11. Removing this single outlier from the reliability analysis yielded a Pearson correlation coefficient of 0.78.

DISCUSSION

With this novel diabetes knowledge questionnaire, the mean score for all participants was 61%. The IMR and FPR scores are comparable to scores from 2 previously reported studies in the United Kingdom—one among general residents (73%) and another among general practitioners (60%) (9,10). Likewise, the overall RN score of 66% is similar to scores of 64% to 77% found in other studies (1-4,9,11). This is the first study reported in the United States to examine the diabetes knowledge of nurses and residents.

The results indicate that these participants lack important diabetes knowledge. Specifically, only 49% of all participants knew the FPG diagnostic criterion for diabetes, 46% knew the peak time of action of insulin, and 31% knew the blood pressure goal for a patient with diabetes. All groups may have scored poorly on the severe hypoglycemia item because of a failure to recognize that $\frac{1}{2}$ ampule (25 mL) of a 50% dextrose solution rather than 1 ampule is the preferred treatment to achieve euglycemia (12). Low scores related to perioperative management of patients with type 1 diabetes reflect a lack of awareness that continuous insulin infusion is required. In particular, SR scored the lowest on several items. This result might be explained by less specific medical training and experience than IMR and FPR as well as a reliance on endocrinology consultants. Care of patients with diabetes undergoing surgical procedures may be improved by better educating SR on these diabetes-related topics.

In order to address these diabetes knowledge deficiencies, several modifications were made to our existing educational program. More diabetes lectures by endocrinology faculty have been added to the curriculum for residents. Faculty members have also developed Internet-based patient scenarios to highlight various aspects of diabetes care. These cases are followed by questions and answers intended to educate the house staff. Before the survey, diabetes education for the nursing staff consisted of a monthly diabetes newsletter with reviews on clinical topics as well as new developments in diabetes care, annual continuing education courses, and staff-prepared bulletin boards reviewing diabetes-associated material. After the survey, our diabetes nurse educator instituted lectures every 2 weeks for the nursing staff.

Table 1
Mean Percent Correct of Representative Questionnaire Items,
Shown Collectively and Stratified by Survey Group*

Fill-in-the-blank questions (answers to questions are underlined)	Mean % correct					P
	All (163)	IMR (52)	FPR (21)	RN (48)	SR (42)	
<i>Outpatient setting</i>						
The diagnostic criterion for diabetes mellitus is a fasting plasma glucose of at least <u>126</u> mg/dL on two occasions	49	71 71 71	52	40	31	NS NS 0.007
The American Diabetes Association hemoglobin A1c goal for a patient with diabetes is <u><7%</u>	69	69 69 69	81	71	60	NS NS NS
<i>Medications</i>						
Renal insufficiency is a contraindication to <u>metformin</u>	75	77 77 77	86	71	74	NS NS NS
A patient with diabetes taking glipizide, rosiglitazone, and insulin who develops congestive heart failure should stop taking the <u>rosiglitazone</u>	73	75 75 75	81	69	71	NS NS NS
Regular insulin peaks in <u>2-4 hours</u> †	46	37 37 37	43	60	43	NS NS NS
70/30 insulin is <u>70% NPH and 30% regular</u>	77	88 88 88	81	94	40	NS NS <0.001
70/30 insulin is best administered <u>before meals</u>	84	90 90 90	90	92	64	NS NS NS
<i>Inpatient setting</i>						
An insulin drip <u>should not</u> be discontinued in a patient with DKA who has ketones in the urine	87	94 94 94	100	88	71	NS NS NS
<u>Potassium</u> is the most important electrolyte to follow for a patient with DKA on an insulin drip	91	94 94 94	95	81	98	NS NS NS
The blood glucose decline per hour on an insulin drip should be <u>50-100</u> mg/dL†	56	67 67 67	71	58	33	NS NS NS
An insulin drip should be discontinued <u>30-90 minutes following subcutaneous administration of insulin</u> †	66	81 81 81	81	67	40	NS NS 0.004
<u>Oral glucose or orange juice</u> is the preferred treatment for a hypoglycemic patient able to swallow	85	85 85 85	95	94	71	NS NS NS
<u>½ ampule (25 mL) of 50% dextrose</u> is the preferred treatment for a hypoglycemic patient unable to swallow	25	25 25 25	0	50	10	0.015 0.013 NS
<u>Continuous insulin infusion</u> is preferred for a patient with type 1 diabetes undergoing surgery	20	25 25 25	0	38	2	0.015 NS 0.003
<i>Overall mean % correct and standard deviation</i>	61 ±19	69 ±15	64 ±13	66 ±21	44 ±11	<0.0001

*DKA = diabetic ketoacidosis; FPR = family practice residents; IMR = internal medicine residents; NS = no significant difference; RN = registered nurses; SR = surgery residents; numbers in parentheses in column headings = number of survey participants in the indicated groups.

†For answers consisting of a range of values, a single number within the range was accepted as correct.

Table 2
Pairwise Comparison of Mean Percent Correct,
Stratified by Survey Group,
With Use of the Honestly Significant Difference Test*

Group comparison	Difference between means	95% confidence limits	P value
Surgery residents versus			
Family practice residents	-20.1	-31.2, -8.8	<0.001
Registered nurses	-22.7	-31.6, -13.8	<0.001
Internal medicine residents	-25.2	-33.9, -16.5	<0.001
Family practice residents versus			
Registered nurses	-2.7	-13.6, 8.3	NS
Internal medicine residents	-5.1	-16, 5.7	NS
Registered nurses versus			
internal medicine residents	-2.5	-10.9, 5.9	NS

*NS = no significant difference.

Despite the overall lack of knowledge, greater baseline diabetes training and experience were associated with higher scores on the knowledge assessment. As expected, nurses with prior specialty training and experience in diabetes (diabetes resource nurses) scored higher than nurses without such training. An unexpected result was that the RN group scores were similar to IMR and FPR scores and exceeded the resident scores on items related to insulin and hypoglycemia. The high RN scores were predominantly attributable to the high scores of the diabetes resource nurse subgroup.

Because our diabetes knowledge assessment tool was newly designed, statistical validation of it was important. The high internal consistency and test-retest reliability suggest that the survey is statistically valid for use among nurses and residents.

Some limitations warrant mention. The fact that all participants were from a single academic center limits generalizability to other settings. Furthermore, the test-retest reliability analysis was based on only 20 subjects.

CONCLUSION

A novel, current diabetes knowledge assessment tool showed that nurses and residents in family practice and internal medicine have similar levels of knowledge about diabetes. The survey also revealed considerable gaps in the diabetes knowledge of all survey participants, especially residents in surgery. Nurses and residents generally require additional education in order to provide optimal care to patients with diabetes. In light of the fact that additional training focused on diabetes was associated with higher questionnaire scores, it is our hope that the mea-

asures we subsequently instituted will improve the diabetes knowledge of our nurses and residents and, ultimately, the care of our patients with diabetes.

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DISCLOSURE

The authors have no conflicts of interest to disclose.

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