

# Validation of the Revised Brief Diabetes Knowledge Test (DKT2)

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## Purpose

The purpose of this study is to examine the reliability and validity of the revised Diabetes Knowledge Test (DKT2). The original test was updated to reflect current diabetes care and education guidelines. The test has 2 components: a 14-item general test and a 9-item insulin use subscale.

## Methods

Two samples were used to evaluate the DKT2. The first came from an online survey company (Qualtrics, LCC) (n = 101) and the second from University of Michigan's (UofM) Diabetes Registry (n = 89). Cronbach's coefficient alpha was used to calculate reliability. To examine validity, comparisons by type of diabetes, insulin use and oral medication use, and educational level were completed. Correlations between diabetes duration and both the general test and insulin subscale were calculated for the UofM sample.

## Results

The two samples differed demographically. While the reliabilities between the samples were disparate, when combined, the coefficient alphas demonstrated reliability for both the general test (.77) and the insulin use subscale (.84). The validation comparisons proved to be similar; different results occurred between samples but when combined demonstrated validity.

## Conclusions

The reliability and validity tests were inconsistent by sample. The different results can, in part, be attributed to

the demographic differences between the 2 samples. With the exception of age, the samples differed in every other measured variable. However, when the samples were combined, the analyses supported the reliability and validity of the Diabetes Knowledge Test 2. The DKT2 is a quick and low-cost method of assessing general knowledge of diabetes and diabetes self-care.

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**T**he brief Diabetes Knowledge Test, or DKT,<sup>1</sup> was developed by a panel of nationally recognized experts in diabetes education and diabetes care who identified key content domains and developed test items. It was then validated and published in 1998 and has since been used by diabetes researchers and educators throughout the world to assess the knowledge of patients with both type 1 and type 2 diabetes. The DKT uses a 14-item test to evaluate general diabetes knowledge and a 9-item test to evaluate insulin use. The DKT has been adapted for use in Greece, Ireland, Jamaica, Malaysia, New Zealand, Northern Ireland, Norway, and Singapore and translated by researchers into Spanish, Greek, Navajo, Norwegian, and Bahasa Malaysian. The test was also integrated into the automated medical record of Kaiser Permanente HealthConnect located in California.

In 2011, the DKT was modified to be given as a true/false test (the Simplified Diabetes Knowledge Scale).<sup>2</sup> This test targeted a UK population with limited literacy. The DKT's continued demand (10 requests for use in the past 5 months) and popularity demonstrates the need for a reliable and valid diabetes knowledge test. A review of the 1998 version of the DKT indicated that the content of the test has become outdated and in need of revision. As such, we initiated a thorough review of the literature for similar knowledge instruments and reviewed the revisions made by users of the DKT.

## Revised Diabetes Knowledge Test

Our team of diabetes behavioral researchers reviewed and, when required, revised or updated each item included in the DKT. This revised version was then reviewed by a group of diabetes patients and care providers, which included a physician, Certified Diabetes Educator nurse, and Certified Diabetes Educator dietitian. The items were also reviewed to

ensure consistency with current diabetes self-management education standards and current practices.<sup>3,4</sup>

As with the original test, the Revised Diabetes Knowledge Test (DKT2) includes 23 items (see Table 5 at end of the article). While there were no items added or dropped, 13 items were modified. Most changes were minor; 7 items were changed to clarify the question or the response, for example, "Low fat milk" was changed to "Low fat (2%) milk" and "Signs of ketoacidosis include" to "Signs of ketoacidosis (DKA) include," and 2 items were changed to improve grammar, for example, "Low blood glucose may be caused by" to "A low blood glucose reaction may be caused by." The 4 remaining items were changed to match current national standards, for example, "If you have taken intermediate-acting insulin (NPH or Lente), you are most likely to have an insulin reaction in" was changed to "If you have taken rapid-acting insulin, you are most likely to have a low blood glucose reaction in."

The DKT2 contains 2 sections, and each is scored separately. The general knowledge segment of the test has 14 items and is appropriate for adults with type 1 and type 2 diabetes. An additional 9 items constitute the insulin use subscale that is appropriate for adults with type 1 diabetes and type 2 using insulin. Each test segment can be used independently. The 23-item test takes approximately 15 minutes to complete. The test's readability was measured by the Flesch-Kincaid grade level; the reading level was calculated at the fourth-grade reading level.

## Research Design and Methods

The project's overall goal was to review and update the DKT to ensure it reflected the current diabetes care and education guidelines.<sup>3,4</sup> The reliability and validity of the revised test was examined in 2 separate samples and combined.

### Research Questions

This study's purpose is to establish the Revised Diabetes Knowledge Test's (DKT2) utility by examining the following 2 research questions:

*Research Question 1:* Is the Diabetes Knowledge Test 2 reliable (both the general test and the insulin use subscale)?

*Research Question 2:* Is the Diabetes Knowledge Test 2 valid (both the general test and the insulin use subscale)?

## Participants

Two separate patient samples were used to estimate the reliability and validity of the DKT2. The first sample was recruited by Qualtrics, LCC, an online survey company founded in 2002. The second sample was recruited from the University of Michigan's Division of Metabolism, Endocrinology & Diabetes's (MEND) Diabetes Registry.

After an initial analysis of the Qualtrics sample, there was a concern about participants' accuracy in terms of their diabetes type and treatment. The authors decided to recruit a second, diabetes registry-based sample and compare and combine the 2 samples. The use of 2 separate samples also mirrored the recruitment scheme of the original study.

### Qualtrics Sample

Excerpts from the literature that explain Qualtrics recruitment methods are provided in the following:

The majority of our samples come from traditional, actively managed market research panels. While this is our preferred method, social media is also used to gather respondents. Upon client request we can access other sources if it meets the needs of a specific target group. . . . Potential respondents are sent an email invitation informing them that the survey is for research purposes only, how long the survey is expected to take and what incentives are available. Members may unsubscribe at any time. To avoid self-selection bias, the survey invitation does not include specific details about the contents of the survey.<sup>5</sup>

Before completing the test, respondents had to agree to participate, be 18 years or older, and have been told they have diabetes by a physician. The Qualtrics sample was recruited 4 months (October 2014) before the MEND sample (February 2015). One hundred and one individuals were recruited by Qualtrics.

### MEND Sample

The MEND Diabetes Registry contains only individuals with diabetes who previously agreed to participate in research studies at the University of Michigan Health System. MEND provided an email list of 497 individuals with type 1 and type 2 diabetes aged 18 years old or older. Participants recruited from the registry were sent an email invitation informing them that the survey was for

research and all answers would be kept anonymous. The MEND sample was asked an additional question not asked of the Qualtrics participants: "What year were you first told you had diabetes?" Eighty-nine individuals completed the test.

### IRB Exemption Status

The University of Michigan's IRBMED reviewed the study and determined that it was exempt from ongoing IRB review.

### Statistical Analyses

One hundred and ninety participants completed the revised Diabetes Knowledge Test 2: 101 from the Qualtrics sample and 89 from the MEND sample. The demographics of the 2 samples were examined to determine if and how the samples differed. For age and years since diagnosis, *t* tests were used to examine differences. For categorical variables, chi-square analyses were used. Cronbach's coefficient alpha was used to calculate scale interitem reliability (the internal consistency of the DKT2) for each sample and overall (the samples combined). Samples were examined separately and combined for validation testing with a Bonferroni adjustment for multiple statistical tests,  $P = .02$ . Construct validity is supported when hypothesized relationships between test scores and related variables are confirmed. Several hypothesized relationships were examined to assess the DKT2's construct validity.

General test scores were examined by diabetes type (type 1, type 2 using insulin, and type 2 not using insulin). It was hypothesized that type 1 participants would score higher than type 2 participants using insulin, who in turn would score higher than type 2 participants not using insulin. Using analysis of variance (ANOVA), differences among the 3 categories were determined by Tukey-Kramer honest significant difference (HSD; global  $P = .05$ ). Insulin use subscale score differences between self-reported type 1 participants and self-reported type 2 participants using insulin was determined by a *t* test.

General test scores were also examined by whether a participant was using insulin and oral medications using ANOVA. It was hypothesized that insulin only participants would score higher than insulin and medications participants, who would score higher than medication only participants, followed by participants not using

either insulin or other diabetes medications. Differences among the 4 categories were determined by Tukey-Kramer HSD (global  $P = .05$ ). Insulin use subscale score differences between patients using insulin and medications and patients using insulin only was determined by a  $t$  test.

The general test and the insulin use subscale scores were examined by educational level using ANOVA. It was hypothesized that participants with more formal education would score higher than participants with less formal education. Differences were determined by Tukey-Kramer HSD (global  $P = .05$ ).

Correlations between the general test and insulin use subscale scores and duration (years since diabetes diagnosis) were calculated for the MEND sample. It was hypothesized that participants' scores would have a positive correlation with duration of diabetes. The significant level was adjusted to .03.

## Results

### Demographics

The 2 samples were demographically different (see Table 1). While similar in age, there were significant differences for all other demographic characteristics. The Qualtrics participants were ethnically more diverse and more likely to have type 2 diabetes (91%). The MEND participants were more likely to treat their diabetes with insulin alone (54%), have received diabetes education (100%), and have more formal education (71% with a college or a graduate degree). Corresponding demographics collected in the 1998 study are also included for comparative purposes.

When the samples were combined, a more balanced distribution was indicated for type of diabetes, treatment type, and educational level. Caucasians (82%) continued to be the most frequently reported ethnic group, and most participants had received diabetes education (88%).

### Test Scores

Mean test scores for the Qualtrics sample were lower than the MEND sample; the mean correct percentage and standard deviation of the general test was  $65 \pm 21$  (median = 64), and for the insulin use subscale, it was  $49 \pm 28$  (median = 44). For the MEND sample, the mean and standard deviation of the general test was  $90 \pm 9$  (median = 93), and for the insulin use subscale, it was  $90 \pm 12$  (median = 89).

When the samples were combined, a more reasonable distribution was observed. The mean correct percentage and standard deviation of the general test was  $77 \pm 20$  (median = 86), and for the insulin use subscale, it was  $73 \pm 28$  (median = 89).

### Reliability

Similar to the demographics, the reliability estimates for the 2 samples were distinct (see Table 2). For the Qualtrics participants, the coefficient alphas for the general test and the insulin use subscale indicated reliable measures (alphas  $\geq .70$ ). The MEND reliabilities were much lower. However, when samples were combined, the reliabilities improved substantially. The coefficient alphas demonstrated reliability for both the general test and the insulin use subscale for the combined sample.

### Validity

Four separate analyses were completed to examine the test's validity.

### Scores by Diabetes Types

Test scores by type of diabetes are presented in Table 3. For the Qualtrics participants, a difference was indicated between the scores of individuals with type 2 not using insulin and individuals with type 2 using insulin. Those not taking insulin scored higher, counter to expectations. No significant difference was found among the MEND participants.

When samples were combined, significant differences were indicated for both the general test and the insulin use subscale. For both components of the DKT2, individuals with type 1 diabetes scored higher than the type 2 individuals.

### Scores by Treatment Types

Test scores by diabetes treatment had a similar pattern as by diabetes type. For the Qualtrics participants, a difference was indicated between the general test scores of individuals using medications only and individuals using insulin and medications ( $P < .01$ ). Those taking only medications scored higher, again, not as expected. For the insulin subscale, an expected significant difference was indicated between participants using only insulin and participants using insulin and medications ( $P < .01$ ). Again, no significant differences were found among the MEND participants.

Table 1

## Demographics

	Qualtrics n = 101	MEND n = 89	P	Total n = 190	1998 Study <sup>1</sup> n = 811
Age (mean ± SD)	49.1 ± 15.1 (range, 20-82)	48.9 ± 16.7 (range, 19-86)	<.94	49.0 ± 15.8 (range, 19-86)	57.3 ± 14.1 (range, 19-94)
Ethnic origin, %					
Caucasian	71	93	<.01	82	77
African American	18	2		10	13
Hispanic	3	2		3	7
Native American	2	0		1	1
Asian or Pacific Islander	5	0		3	<1
Other	1	2		1	1
Type of diabetes, %					
Type 1	9	43	<.01	25	9
Type 2 using insulin	35	30		33	29
Type 2 not using insulin	56	27		42	62
Insulin and medication (pills) use, %					
Insulin and medications	28	19	<.01	24	
Insulin only	16	54		34	
Medication only	47	21		35	
None	9	6		7	
Years since diagnosis (mean ± SD)	—	16.7 ± 12.7 (range, <1-47)			
Have you ever received diabetes education? (yes %)	77	100	<.01	88	55
Educational level, %					
Graduate degree	13	36	<.01	24	
College graduate	35	35		35	
Some college/technical school	27	26		26	
High school graduate or less	25	3		15	

Abbreviation: MEND, University of Michigan's Division of Metabolism, Endocrinology & Diabetes's (MEND) Diabetes Registry.

When samples were combined, significant differences were indicated for both the general test and the insulin use subscale. For both the general test and the insulin use subscale, individuals using insulin only scored higher than individuals using insulin and medications (both  $P < .01$ ).

#### Scores by Educational Level

Test scores by education level are presented in Table 4. No significant differences were indicated by education level for either the Qualtrics or the MEND participants. In the combined sample analyses, participants at the level

Table 2

## Test Reliabilities

Component	Qualtrics			MEND			Total		
	Percentage Correct	Item-Total Correlation	Alpha	Percentage Correct	Item-Total Correlation	Alpha	Percentage Correct	Item-Total Correlation	Alpha
General test (1-14)	(n = 101)		.70	(n = 89)		.28	(n = 190)		.77
Item 1	0.71	0.68		0.92	0.18		0.81	0.75	
Item 2	0.71	0.68		0.91	0.30		0.81	0.76	
Item 3	0.37	0.71		0.61	0.38		0.48	0.78	
Item 4	0.45	0.68		0.74	0.12		0.58	0.75	
Item 5	0.46	0.70		0.89	0.20		0.66	0.75	
Item 6	0.81	0.69		0.98	0.30		0.89	0.76	
Item 7	0.51	0.70		0.94	0.20		0.72	0.75	
Item 8	0.58	0.67		0.76	0.32		0.67	0.76	
Item 9	0.76	0.68		0.98	0.31		0.86	0.75	
Item 10	0.71	0.70		0.85	0.24		0.78	0.77	
Item 11	0.75	0.67		0.98	0.26		0.86	0.75	
Item 12	0.67	0.68		0.98	0.30		0.82	0.75	
Item 13	0.82	0.68		1.00	0.28		0.91	0.75	
Item 14	0.77	0.65		1.00	0.28		0.88	0.74	
Insulin use (15-23)	(n = 44)		.74	(n = 65)		.45	(n = 109)		.84
Item 15	0.27	0.75		0.54	0.36		0.43	0.85	
Item 16	0.48	0.70		0.89	0.43		0.72	0.82	
Item 17	0.50	0.72		0.91	0.43		0.74	0.82	
Item 18	0.41	0.69		0.98	0.46		0.75	0.80	
Item 19	0.55	0.68		1.00	0.46		0.82	0.81	
Item 20	0.55	0.73		0.98	0.38		0.81	0.82	
Item 21	0.68	0.76		0.94	0.38		0.83	0.84	
Item 22	0.45	0.68		0.94	0.43		0.74	0.80	
Item 23	0.50	0.73		0.89	0.43		0.73	0.83	

Abbreviation: MEND, University of Michigan's Division of Metabolism, Endocrinology & Diabetes's (MEND) Diabetes Registry.

high school graduate or less had significantly lower scores than the other levels. The ANOVA for the general test approached significance but did not meet the adjusted *P* value.

### Scores and Diabetes Duration

Correlations between test scores and diabetes duration was only available for the MEND participants. No

significant correlation was found for the general test ( $P = .47$ ). However, a significant correlation was found for the insulin use subscale ( $0.28, P = .03$ ).

### Conclusions

The reliability and validity of the Diabetes Knowledge Test 2 was supported by the analyses of the combined samples. When examined separately, the Qualtrics

Table 3

## Test Scores and Diabetes Types

Diabetes Type	General Test % Correct Items 1-14		Insulin Use % Correct Items 18-23	
	Mean ± SD	n	Mean ± SD	n
Total (combined samples)				
Type 1	84.7 ± 20.0	47	84.9 ± 24.1	47
Type 2 using insulin	71.7 ± 24.7	62	64.3 ± 28.4	62
Type 2 not using insulin	75.5 ± 15.0	81		
Difference		$P < .01^a$		$P < .01$
Qualtrics sample				
Type 1	56.3 ± 29.1	9	55.6 ± 37.7	9
Type 2 using insulin	57.1 ± 23.2	35	47.0 ± 25.6	35
Type 2 not using insulin	71.2 ± 15.0	57		
Difference		$P < .01^b$		$P = .42$
MEND sample				
Type 1	91.4 ± 8.7	38	91.8 ± 12.6	38
Type 2 using insulin	90.5 ± 8.4	27	86.8 ± 10.2	27
Type 2 not using insulin	85.7 ± 8.9	24		
Difference		$P = .04$		$P = .09$

Abbreviation: MEND, University of Michigan's Division of Metabolism, Endocrinology & Diabetes's (MEND) Diabetes Registry.  
<sup>a</sup>Type 1 scores are significantly different from type 2 using insulin and type 2 not using insulin.  
<sup>b</sup>Type 2 not using insulin scores are significantly different from type 2 using insulin.

sample provided stronger support for reliability than the MEND sample. The validity tests were inconsistent; the MEND sample provided evidence in some comparisons and the Qualtrics sample in others.

With regards to the reliability measure, the MEND sample's poorer showing is most likely due to a ceiling effect, 12 of the 23 items have a percentage correct above 90% (16 items have % correct  $\geq$  85%). The Qualtrics sample's item percentage corrects are lower. The result of combining the samples is a more normal distribution.

Similarly, the different results between the 2 samples in the validity analyses can partially be attributed to the very different demographics of the 2 samples. With the exception of age, the samples differed in every other measured variable. These differences influenced sample comparisons. When the samples were combined, a more demographically balanced sample resulted.

Nonetheless, the preponderance of the combined sample analyses suggests that the DKT2 is valid and reliable measure of diabetes knowledge.

The Diabetes Knowledge Test 2 continues to be a short test (either 14 or 23 items depending on whether the respondent is using insulin). This version also has a lower reading level than the previous version and can be self-administered. However, the length of the test is both a strength and a weakness. While the test can be quickly completed by respondents and easily interpreted by providers, the lack of detail makes it insensitive to many aspects or components of diabetes care, including behavior change.

Another important aspect of the DKT2 is its generalizability. The original test proved to be robust; as noted in the introduction, it was adapted for use in many countries throughout the world and translated by researchers into

Table 4

## Test Scores and Educational Level

Educational Level	General Test % Correct Items 1-14		Insulin Use % Correct Items 18-23	
	Mean ± SD	n	Mean ± SD	n
Total (combined samples)				
Graduate degree	82.1 ± 19.2	45	80.0 ± 26.8	30
College graduate	75.6 ± 22.7	67	73.5 ± 29.4	42
Some college or technical school	77.7 ± 16.7	50	76.5 ± 24.2	26
High school graduate or less	67.6 ± 19.7	28	45.5 ± 24.6	11
Difference		<i>P</i> = .03		<i>P</i> < .01 <sup>a</sup>
Qualtrics sample				
Graduate degree	61.5 ± 23.6	13	41.3 ± 30.0	7
College graduate	62.3 ± 22.7	36	51.9 ± 30.5	18
Some college or technical school	70.9 ± 18.5	27	59.6 ± 27.8	11
High school graduate or less	64.3 ± 18.0	25	33.3 ± 14.5	8
Difference		<i>P</i> = .36		<i>P</i> = .19
MEND sample				
Graduate degree	90.4 ± 7.6	32	91.8 ± 9.0	23
College graduate	91.0 ± 8.8	31	89.8 ± 14.6	24
Some college or technical school	85.7 ± 9.9	23	88.9 ± 10.3	15
High school graduate or less	95.2 ± 8.2	3	77.8 ± 11.1	3
Difference		<i>P</i> = .08		<i>P</i> = .28

Abbreviation: MEND, University of Michigan's Division of Metabolism, Endocrinology & Diabetes's (MEND) Diabetes Registry.  
<sup>a</sup>High school graduate or less scores were significantly different from other levels.

several languages. While changes were implemented in the DKT2, the core structure and content remains the same. As such, we anticipate that the generalizability and robustness of the DKT2 will be similar to that of the DKT.

### Implications

As with the DKT, the usefulness of the DKT2 is dependent on the objective of the clinician, researcher, or

student. The DKT2 provides a quick and low-cost method of assessing a patient's or a population's general knowledge of diabetes and diabetes self-care. The revised DKT2 is available to clinicians and researchers at no cost (see Table 5 for the test and correct responses).

Finally, as mentioned with the original DKT, "although knowledge is not a good predictor of patient behavior, it is a prerequisite for a patient to perform appropriate self-care."<sup>1</sup> The DKT2 is a reliable and valid instrument that can be used

Table 5

Michigan Diabetes Research and Training Center's Revised Diabetes Knowledge Test<sup>a</sup>

<p>1. The diabetes diet is:</p> <ol style="list-style-type: none"> <li>the way most American people eat</li> <li><sup>b</sup> a healthy diet for most people</li> <li>too high in carbohydrate for most people</li> <li>too high in protein for most people</li> </ol>	<p>9. For a person in good control, what effect does exercise have on blood glucose?</p> <ol style="list-style-type: none"> <li><sup>b</sup> Lowers it</li> <li>Raises it</li> <li>Has no effect</li> </ol>	<p>17. If you have taken rapid-acting insulin, you are most likely to have a low blood glucose reaction in:</p> <ol style="list-style-type: none"> <li><sup>b</sup> Less than 2 hours</li> <li>3-5 hours</li> <li>6-12 hours</li> <li>More than 13 hours</li> </ol>
<p>2. Which of the following is highest in carbohydrate?</p> <ol style="list-style-type: none"> <li>Baked chicken</li> <li>Swiss cheese</li> <li><sup>b</sup> Baked potato</li> <li>Peanut butter</li> </ol>	<p>10. What effect will an infection most likely have on blood glucose?</p> <ol style="list-style-type: none"> <li>Lowers it</li> <li><sup>b</sup> Raises it</li> <li>Has no effect</li> </ol>	<p>18. You realize just before lunch that you forgot to take your insulin at breakfast. What should you do now?</p> <ol style="list-style-type: none"> <li>Skip lunch to lower your blood glucose</li> <li>Take the insulin that you usually take at breakfast</li> <li>Take twice as much insulin as you usually take at breakfast</li> <li><sup>b</sup> Check your blood glucose level to decide how much insulin to take</li> </ol>
<p>3. Which of the following is highest in fat?</p> <ol style="list-style-type: none"> <li><sup>b</sup> Low fat (2%) milk</li> <li>Orange juice</li> <li>Corn</li> <li>Honey</li> </ol>	<p>11. The best way to take care of your feet is to:</p> <ol style="list-style-type: none"> <li><sup>b</sup> look at and wash them each day</li> <li>massage them with alcohol each day</li> <li>soak them for 1 hour each day</li> <li>buy shoes a size larger than usual</li> </ol>	<p>19. If you are beginning to have a low blood glucose reaction, you should:</p> <ol style="list-style-type: none"> <li>exercise</li> <li>lie down and rest</li> <li><sup>b</sup> drink some juice</li> <li>take rapid-acting insulin</li> </ol>
<p>4. Which of the following is a "free food"?</p> <ol style="list-style-type: none"> <li>Any unsweetened food</li> <li>Any food that has "fat free" on the label</li> <li>Any food that has "sugar free" on the label</li> <li><sup>b</sup> Any food that has less than 20 calories per serving</li> </ol>	<p>12. Eating foods lower in fat decreases your risk for:</p> <ol style="list-style-type: none"> <li>nerve disease</li> <li>kidney disease</li> <li><sup>b</sup> heart disease</li> <li>eye disease</li> </ol>	<p>20. A low blood glucose reaction may be caused by:</p> <ol style="list-style-type: none"> <li><sup>b</sup> too much insulin</li> <li>too little insulin</li> <li>too much food</li> <li>too little exercise</li> </ol>
<p>5. A1C is a measure of your average blood glucose level for the past:</p> <ol style="list-style-type: none"> <li>day</li> <li>week</li> <li><sup>b</sup> 6-12 weeks</li> <li>6 months</li> </ol>	<p>13. Numbness and tingling may be symptoms of:</p> <ol style="list-style-type: none"> <li>kidney disease</li> <li><sup>b</sup> nerve disease</li> <li>eye disease</li> <li>liver disease</li> </ol>	<p>21. If you take your morning insulin but skip breakfast, your blood glucose level will usually:</p> <ol style="list-style-type: none"> <li>increase</li> <li><sup>b</sup> decrease</li> <li>remain the same</li> </ol>
<p>6. Which is the best method for home glucose testing?</p> <ol style="list-style-type: none"> <li>Urine testing</li> <li><sup>b</sup> Blood testing</li> <li>Both are equally good</li> </ol>	<p>14. Which of the following is usually <u>not</u> associated with diabetes:</p> <ol style="list-style-type: none"> <li>vision problems</li> <li>kidney problems</li> <li>nerve problems</li> <li><sup>b</sup> lung problems</li> </ol>	<p>22. High blood glucose may be caused by:</p> <ol style="list-style-type: none"> <li><sup>b</sup> not enough insulin</li> <li>skipping meals</li> <li>delaying your snack</li> <li>skipping your exercise</li> </ol>

*(continued)*

Table 5

(continued)

7. What effect does unsweetened fruit juice have on blood glucose? a. Lowers it b. <sup>b</sup> Raises it c. Has no effect	15. Signs of ketoacidosis (DKA) include: a. shakiness b. sweating c. <sup>b</sup> vomiting d. low blood glucose	23. A low blood glucose reaction may be caused by: a. <sup>b</sup> heavy exercise b. infection c. overeating d. not taking your insulin
8. Which should <u>not</u> be used to treat a low blood glucose? a. 3 hard candies b. 1/2 cup orange juice c. <sup>b</sup> 1 cup diet soft drink d. 1 cup skim milk	16. If you are sick with the flu, you should: a. Take less insulin b. Drink less liquids c. Eat more proteins d. <sup>b</sup> Test blood glucose more often	

<sup>a</sup>For non-US patient populations, we recommend reviewing the terms used in items 1, 2, 3, 4, and 8 for appropriateness.<sup>b</sup>Correct answer.

by researchers, clinicians, and diabetes educators to assess a patient's or a population's overall knowledge of diabetes.

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