

THE DNT15

A Shortened Version of the Diabetes Numeracy Test (DNT)

Last Revised: **May 13, 2007**

Time Started: _____

Time Completed: _____

Total Time: _____

The DNT 15

Description

The DNT15 is a shortened version of the Diabetes Numeracy Test (DNT). The DNT and DNT15 are assessment tests designed to investigate numeracy skills in patients with diabetes. Numeracy can be defined as the ability to understand and use numbers and math skills in daily life. Numeracy is particularly important to patients with diabetes because these patients apply math skills to diabetes self-management activities such as, glucose monitoring, carbohydrate counting, and adjustment of insulin. The questions in the DNT and DNT15 were formulated from directions given by health care practitioners to patients with diabetes during a routine clinic visit. In addition, question development was guided by reviewing validated math and literacy tests. Arriving at the answers will require not only the ability to perform a variety of math skills, such as addition, subtraction, and multiplication, but also the application of those skills in the daily setting.

The DNT was shortened to a more clinically useful 15 items (the DNT15) and then verified through random split sample analysis. To perform a split sample analysis, the sample data was randomly split into two smaller sub-samples. Sub-sample 1 was used for the development of the shortened scale and sub-sample 2 was used for confirmation of the results. The DNT was shortened by first selecting the items with >0.6 loading on the primary factor (from principal components factor analysis) in sub-sample 1. Those items with $>80\%$ mean score were discarded. Three items with high clinical utility, as determined by practicing diabetologists, were added to bring the total number of items to 15.

Reliability was tested by internal consistency (Kuder-Richardson 20) and validity was established through correlation testing using Spearman's correlations between the DNT15 and the full DNT and comparing the DNT15 to the *a priori* construct validity model for both sub-samples. The DNT15 showed similar internal consistency and validity in both sub-samples as the full DNT. The KR-20 of the DNT15 was 0.90 in the development sample (sample 1) and 0.89 in confirmation sample (sample 2). Correlations with the *a priori* model were similar to the full DNT. Correlations were also similar in both population sub-samples.

Funding

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Test Administration

The DNT15 can be written or orally administered. It consists of 15 questions in four domains: nutrition, exercise, blood glucose monitoring, and medication. The scale covers many math problem types including: addition, multiplication or division, fractions, multi-step mathematics, and numeration/ number hierarchy. The estimated time for administration is 10-15 minutes.

General Guidelines

- Introduce yourself to the respondent.
- If the respondent wears glasses, please ask him or her to put them on. If the respondent wears contacts, remind him or her to wear them to the exam.
- Test the patients' visual acuity using a Rosenbaum Pocket Vision Screener. Patients with corrected visual Acuity $>20/50$ should be excluded from test.

- Explain the purpose and time frame of the test.
- Hand the respondent a pencil, paper and calculator before starting the exam.
- Ask the respondent to write any calculations on the scrap sheet.
- Ask the respondent to write his or her final answers on the numeracy test in the spaces provided.
- Explain to the respondent that if he or she is to erase, erase completely without leaving smears or markings.
- Do not look at the answer choices while administering the exam.
- Remind respondents who wear hearing aids to bring them to the test.

For oral administration, the test administrator is to follow these directions:

- Read the questions out loud to the respondent
- Allow the patient to examine any figures associated with the question.
- Repeat the question if asked
- Give the respondent time to answer the question
- Only read what's printed in the question. Improvising or interpreting a question for a respondent can invalidate the test results and decrease test efficiency.
- Allow time for the respondent to calculate and record his or her answers
- After the respondent has answered a question, immediately proceed to the next item
- There is no time limit on a particular item.
- Remind respondents who wear hearing aids to bring them to the test.

For respondents who are having difficulty:

- Repeat any question when asked by the respondent. However, do not repeat the question more than three times.
- If the respondent is having difficulty, please encourage the respondent to continue. Appropriate comments are “you’re doing fine.” However, do not establish a pattern, such as saying “good” only after correct responses.
- If the respondent does not want to resume the test, please respond by saying, “I am not trying to embarrass you or put you down. We can stop now, but I would like to pause to let you know that you are very important to this study, and the information you are providing could be used to help patients with diabetes. May I continue...”
- Record any information that you think is relevant or important about the respondent’s behavior.

Domains

Domain	Question number
Nutrition	1-3
Exercise	4
Blood Glucose Monitoring	5-7
Medication	8-15

Math Problem Type	Question number
Addition/Subtraction	8,15
Multiplication/Division	1,6,10
Fractions/ Decimals	2,3
Multi-step mathematics	4, 12-15
Time	7
Numeration/Counting/Hierarchy	5, 9, 11

1. If you ate the entire bag of chips, how many total grams of carbohydrate would you eat?



The image shows a nutrition label for chips. The label includes the following information:

- Serving Size 1 oz. (28g/About 10 chips)
- Servings Per Container 3.5
- Amount Per Serving
- Calories 140
- Calories from Fat 60
- % Daily Value*
- Total Fat 6g 10%
- Saturated Fat 0.5g 4%
- Cholesterol 0mg 0%
- Sodium 160mg 7%
- Total Carbohydrate 18g 6%

1. ANSWER _____ total grams

2. 1/2 cup of potatoes counts as 1 carbohydrate choice. How many choices does 2 cups of potatoes count as?

2. ANSWER _____ choices

3. You ate 1 and 1/2 cups from the food labeled below. How many grams of carbohydrate did you eat?

Nutrition Facts	
Serving size: $\frac{3}{4}$ cup	Servings per container 10
Amount per Serving	
Calories 150 Calories	
Total Fat 7g	
Total Carbohydrates 18 grams	
Dietary Fiber 3g	
Sugars 3g	
Protein 3g	

3. ANSWER _____ grams

4. You have to eat 6 grams of carbohydrate for each 30 minutes you plan to walk. You are planning to walk for one hour. You have a bag with 12 crackers. Each cracker contains 10 grams of carbohydrate. How many crackers do you need to eat before your walk?

4. ANSWER _____ crackers

5. Your target blood sugar is between 60 and 120. Please circle the values below that are in the target range (circle all that apply):

55

145

118

6. You test your blood sugar 4 times a day. How many strips do you need to take with you on a 2-week vacation?

6. ANSWER _____ strips

7. You test your blood sugar 3 times a day. You purchase a prescription of 50 strips on March 5th. Of the dates below, by when will you need to buy new strips?

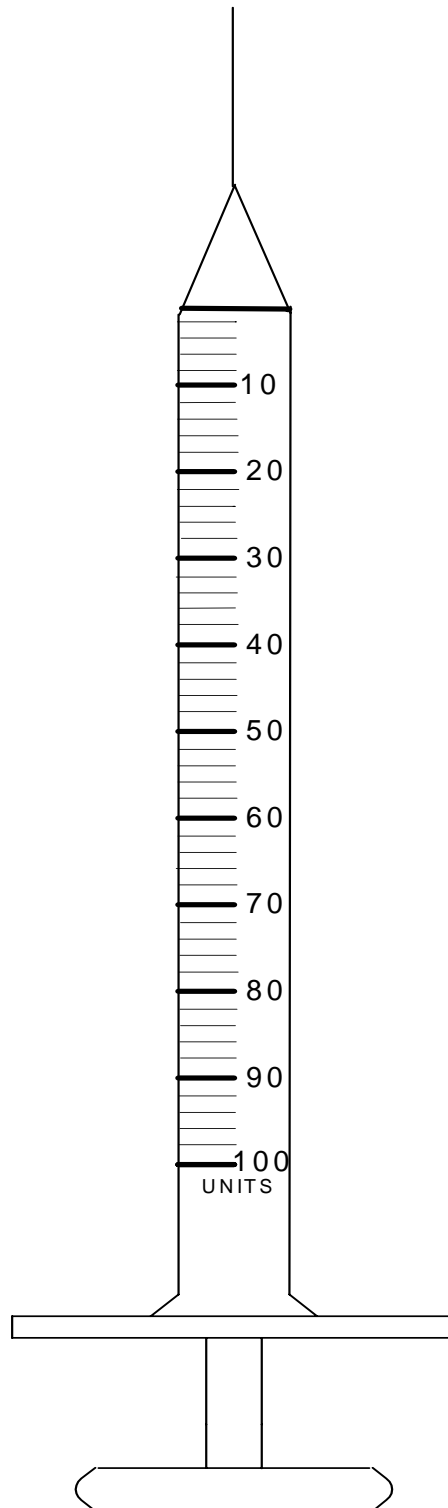
March 21 st
April 21 st
May 21 st
June 21 st

8. You have a prescription for metformin extended release 500 mg tablets. The label says, "Take 1 tablet with supper each night for the first week. Then, increase by 1 tablet each week for a total of 4 tablets daily with supper."

How many tablets should you take with supper each night the **second** week?

8. ANSWER _____ tablets

9. Your insulin dose is increased to 54 units and you begin using a larger syringe that holds 100 units. On the syringe below, circle the line/marking that shows you have drawn 54 units.



10. Please round down to the nearest whole number.

You are given the following instructions: "Take 1 unit of insulin for every 7 grams of carbohydrate you eat." How much insulin do you take:

When you eat 98 grams at supper?

98g

10. ANSWER _____ units

11. You are told to follow the sliding scale shown here. The sliding scale indicates the amount of insulin you take based upon your blood sugar levels.

If Blood sugar is:	Units of Insulin
130-180	0
181-230	1
231-280	2
281-330	3
331-380	4

How much insulin would you take for a blood sugar of 295?

11. ANSWER _____ units

Use the following information for questions 12, 13

You check your blood sugar just before eating. You take 1 unit of insulin for every 10 grams of carbohydrates you eat. You are also given the sliding scale shown below. The sliding scale indicates the amount of insulin you should add to your usual dose based upon your blood sugar levels:

If your blood sugar is greater than 120 points at breakfast, lunch or supper, add 2 units of insulin.

If your blood sugar is greater than 150 points at breakfast, lunch or supper, add 4 units of insulin.

If your blood sugar is greater than 180 points at breakfast, lunch or supper, add 6 units of insulin.

Insulin Dose Schedule

1 unit of Insulin /10 grams carbohydrate at meals

If Blood sugar is:	Breakfast	Lunch	Supper
> 120	+ 2	+ 2	+ 2
> 150	+ 4	+ 4	+ 4
> 180	+ 6	+ 6	+ 6

12. Your blood sugar is 284 and you ate 40 grams of carbohydrate at breakfast. How much total insulin do you need to take?

284 mg/dl	40 grams
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12. ANSWER _____ units

13. Your blood sugar is 380 and you will eat 60 grams of carbohydrate at supper. How much total insulin do you need to take?

380 mg/dl	60 grams
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13. ANSWER _____ units

Questions 14-15

You have been asked to start taking 32 units of NPH insulin tonight at bedtime. This insulin will work during the night and will lower your blood sugar first thing in the morning. You were given the following instructions:

- Your goal is to have the morning (fasting) blood sugar below 120.
- Check your blood sugar every morning before breakfast.
- Start with 32 units of NPH tonight. Increase the dose by 2 units **every other** day until your blood sugar is at or below 120.
- Your fasting blood sugar **must** be above 120 for 2 mornings in a row in order for you to increase the insulin dose by 2 units.
- Once your blood sugar is staying below 120, stop increasing the nighttime insulin.

You begin with 32 units of NPH insulin last night. How much NPH insulin will you take on each of the following nights?

14. Morning of day 1, your blood sugar is 164. How much insulin will you take that night?

14. ANSWER _____ units

15. Morning of day 2, your blood sugar is 136. How much insulin will you take that night?

15. ANSWER _____ units

Answer Key

<i>Question #</i>	<i>Answer</i>
1	63 grams
2	4 choices
3	36 grams
4	1-2 crackers
5	Circled 118 only
6	56
7	March 21
8	2 tablets
9	See Question sheet
10	14 units
11	3 units
12	10 units
13	12 units
14	32 units
15	34 units