Diabetes Symptoms Reported in SHIELD by People with or at High Risk for Type 2 Diabetes

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Abstract

The American Diabetes Association (ADA) provides a list of 7 diabetes symptoms and suggests people with ≥1 symptom see their doctor. The Study to Help Improve Early evaluation and management of risk factors Leading to Diabetes (SHIELD), a 5-year longitudinal study, provides a unique opportunity to report prevalence of these symptoms and their association with diagnosed diabetes.

A 64-item baseline survey was sent to 22,001 people who had self-reported diabetes or risk factors associated with type 2 diabetes (T2D) diagnosis: abdominal obesity, high body mass index, hypertension, dyslipidemia, history of cardiovascular events. Respondents reported occurrence of each ADA symptom, along with others, within the last year.

The most frequently reported symptoms in all groups were frequent urination and increased fatigue. Each ADA symptom was reported most often by those with T2D. Fifty-six percent of T2D respondents reported ≥1 ADA symptom, whereas only 46% of those with 3–5 risk factors (high risk) and 31% of those with 0–2 risk factors (low risk) did so. In multivariate logistic regression, each ADA symptom, except irritability, was significantly associated with T2D diagnosis.

ADA Symptom	Low Risk (n=5295)	High Risk (n=5400)	T2D (n=3898)
Frequent urination	13.2%	24.2%	33.9%
↑ Fatigue	14.4%	23.2%	27.4%
Excessive thirst	5.9%	8.8%	20.1%
Blurry vision	6.3%	10.5%	18.2%
Irritability	12.4%	14.0%	17.8%
Extreme hunger	3.2%	4.5%	9.5%
Unusual weight loss	2.4%	1.9%	4.4%

ADA symptoms were positively associated with T2D diagnosis, but many T2D respondents did not report any symptoms and many without diabetes did, indicating that using ≥1 symptom alone as the impetus to see a doctor may not discriminate between those who do or do not have diabetes. Longitudinal SHIELD data will evaluate if combinations of these symptoms are predictive of receiving a diabetes diagnosis or if addition of other conditions/ symptoms can better identify people who should be urgently evaluated for T2D.

Introduction

- Diabetes is an epidemic disease in the US and worldwide. Currently, there are approximately 20.8 million Americans with diabetes, including 6.2 million who are undiagnosed. An additional 41 million Americans aged 40–74 years have pre-diabetes (FPG >110 mg/dL but < 125 mg/dL) and carry an increased risk for outcomes such as heart disease and stroke.[1] It has been projected that this disease will impact 29 million Americans by the year 2050.[2]
- Despite the enormous public health implications, it is not uncommon for individuals with T2D to remain undiagnosed for many years, until complications of the disease appear.[3] Diagnosing diabetes is not difficult, as there are accurate tests available; however, the challenge is in screening the right people at the right time.
- Groups such as the ADA and the IDF have led efforts to increase awareness leading to early diagnosis and treatment in order to improve the long-term outcomes associated with this disease. Both groups list diabetes symptoms on their Web sites.[3,4]
- While symptoms have been validated in patients with diabetes, it is not known how specific they are, either singly or in groups, for the initial diagnosis of diabetes. Identifying the symptoms or other patient characteristics that are highly associated with a diagnosis of T2D is valuable in pursing the ultimate goal of early diagnosis and treatment.
- SHIELD (the Study to Help Improve Early evaluation and management of risk factors Leading to Diabetes) is a large, ongoing longitudinal survey in the US adult population. We examined symptoms reported by respondents to help resolve this question.

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Objectives

- Determine the frequency at which ADA symptoms are reported by those individuals with diabetes or at high risk for diabetes
- Test the utility of the ADA symptom checklist and its individual components in identifying individuals requiring urgent testing for diabetes.

Methods

- SHIELD is a 5-year, national, longitudinal study of diabetes, CVD, and metabolic disease risks in US adults.
- As the first phase of the SHIELD study, a screener questionnaire was developed by a panel of healthcare experts (the SHIELD Study Group) and mailed to a stratified random sample of 200,000 US households (part of the TNS NFO household panel) in 2004.
  - TNS NFO maintains a survey panel of more than 600,000 households throughout the US, constructed to represent the US population in terms of geographic residence, age of head of household, and household size and income.
- The screener questionnaire consisted of 12 questions and was completed by the head of household, who answered for up to 4 adult household members (≥18 years of age).
- Respondents were asked if they had ever been diagnosed as having each of several conditions, including diabetes, high BP, or cholesterol problems. SHIELD data on 211,097 adults were collected.
- In addition to self-reported diabetes, the screener survey included several risk factors for a diabetes diagnosis, of which logistic regression modeling determined the following were independently predictive of a diagnosis, with approximately the same effect size: abdominal obesity, high BMI, dyslipidemia, hypertension, and CV events. We calculated the risk factor level as the unweighted number of risk factors reported by each respondent on the screener survey. For example, if a person reported 3 risk factors on the screening survey, they were classified into risk factor level 3. The analyses presented here report cohorts with 0–2 risk factors (low risk for a diagnosis of diabetes) or 3–5 risk factors (high risk for a diagnosis of diabetes).
- A baseline survey consisting of 64 detailed questions was then sent to a sample of the screener respondents (N=22,001) to collect further information, including symptoms. A total of 17,630 surveys were returned (80% response rate); of those, 15,794 were usable (no missing data).
- SHIELD data were analyzed to determine the occurrence and number of self-reported ADA symptoms in respondents with diabetes and those at low and high risk of receiving a diagnosis of diabetes.
- Logistic regression modeling of symptoms associated with the diagnosis of T2D was performed.

Results

Occurrence of Symptoms

- The ADA symptoms are listed in **Figure 1**. The most frequently reported symptoms in all groups were frequent urination and increased fatigue.
- Respondents with T2D were more likely to report each of the ADA symptoms than were those in the other groups. Even so, the most common symptom, frequent urination, was reported by only one third of the T2D respondents.

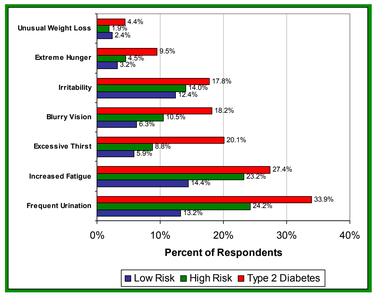

Figure 1. Percent of SHIELD respondents reporting each ADA symptom in the past 12 months

Number of Symptoms

- Percent of respondents who reported one or more ADA symptom in the past 12 months:
  - 56% T2D
  - 46% 3–5 risk factors (high risk)
  - 31% 0–2 risk factors (low risk)
- Most respondents (~2/3) with T2D reported either 0 or 1 ADA symptom (**Figure 2**).

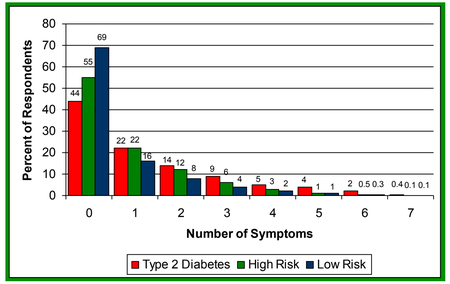

Figure 2. Number of ADA symptoms reported in past 12 months by risk group

Logistic Regression

- In multivariable logistic regression, each ADA symptom except irritability was significantly associated with the likelihood of a T2D diagnosis (adjusted odds ratios ranged from 1.15 to 2.5) (**Table 1**). The strongest association was for people reporting excessive thirst in the last 12 months, who were 2.5 times more likely to be diagnosed with T2D.
- Other factors associated with a higher likelihood of diagnosis included:
  - Higher age
  - African American race or Hispanic heritage
  - Lower household income levels
  - Household size of 2 to 4 members
  - Higher BMI
  - Other health conditions, such as sleep apnea or other sleep problems, asthma, cholesterol problems, hypertension, kidney problems, and circulation problems of any kind.

Table 1. Multivariable logistic regression analysis of symptoms associated with a diagnosis of T2D

Variable	Adjusted Odds Ratio	*P*-value
Age ranges		<.001
Age 18−24	0.032	<.001
Age 25−34	0.369	<.001
Age 35-44 (reference category)	1.000	
Age 45−54	1.586	<.001
Age 55−64	2.306	<.001
Age 65−74	2.348	<.001
Age +75	2.186	<.001
Race		<.001
White (reference category)	1.000	
African American	1.470	<.001
Other/Not available	1.150	.321
Spanish/Hispanic heritage		.036
No (reference category)	1.000	
Yes	1.463	.010
Household size		.016
1 Member (reference category)	1.000	
2 Members	1.143	.018
3 Members	1.245	.003
4 Members	1.202	.031
5 or More Members	1.028	.771
Household income ($)		<.001
Under $22,500	1.546	<.001
$22,500−$39,999	1.369	<.001
$40,000−$59,999	1.239	.003
$60,000−$89,000	1.112	.137
≥$90,000 (reference category)	1.000	
BMI Range		<.001
Obese	1.948	<.001
Overweight	1.402	<.001
Normal (reference category)	1.000	
Underweight	0.814	.467

Variable	Adjusted Odds Ratio	*P*-value
Other health conditions		
Allergies	0.844	<.001
Anxiety	0.820	.002
Sleep apnea/problems	1.132	.037
Arthritis	0.871	.003
Asthma	1.133	.047
Cholesterol problems	1.533	<.001
Chronic fatigue syndrome	0.738	.005
Hypertension	1.409	<.001
Kidney problems	1.202	.015
Narrow or blocked arteries	0.820	.003
Circulation problems, any	1.374	<.001
ADA symptoms		
Frequent urination	1.272	<.001
Excessive thirst	2.462	<.001
Extreme hunger	1.533	<.001
Unusual weight loss	1.642	<.001
Increased fatigue	1.149	.014
Blurry vision	1.565	<.001
Other symptoms		
Erectile/sexual dysfunction	1.396	<.001
Shortness of breath	0.762	<.001
Chest pressure/pain	0.670	<.001
Severe illness	0.680	.039

Clinical Implications

- SHIELD found that approximately two thirds of respondents with T2D reported having no or just one ADA symptom. The most commonly reported ADA symptoms, in any of the respondent groups, were frequent urination and increased fatigue.
- This suggests that most diagnosed diabetes patients have little symptomatology, or that the list of symptoms does not perform well in distinguishing people who have diabetes from those who do not. It is also possible that respondents poorly reported symptoms. As early diagnosis of diabetes is central to better health outcomes, an important goal is to determine whether this large pool of diagnosed but largely asymptomatic respondents in SHIELD reflects earlier diagnosis and adequate symptom control through appropriate treatment, or simply attention being focused on the wrong symptoms.
- The screening and diagnostic usefulness of the ADA symptoms may be limited by their occurrence in a restricted window of time somewhere between asymptomatic disease onset and treatment-induced symptom control.
- Respondents reporting excessive thirst were 2.5 times more likely to be diagnosed withT2D, suggesting that patients and their physicians are more sensitive to this symptom. However, only one fifth of T2D respondents reported this symptom, which could mean that people with other common symptoms of diabetes, such as frequent urination and fatigue, may not be appropriately targeted for testing.
- Furthermore, because only slightly more than half (56%) of diabetes respondents reported ≥1 ADA symptom, using 1 or more of the ADA symptoms as the criteria to see one's doctor for diabetes screening is not likely to discriminate between those with and without diabetes. In fact, it is common for patients with T2D to remain undiagnosed until complications appear, suggesting that the disease may be asymptomatic during the initial years.[3]

Conclusions

- The occurrence of one or more diabetes symptoms alone is not specific enough to adequately identify those individuals who should be evaluated for T2D.
- Additionally, these symptoms may not be prevalent enough among those with diabetes to drive testing.
- The longitudinal data from SHIELD will evaluate whether clusters of these symptoms are more predictive of diabetes diagnosis or if the addition of other conditions or symptoms can better identify people who should be urgently evaluated for T2D.

References

1. Centers for Disease Control and Prevention. National diabetes fact sheet: general information and national estimates on diabetes in the United States, 2003. Rev ed. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2004.
2. Boyle JP, Honeycutt AA, Narayan KMV, et al. Projection of diabetes burden through 2050. Impact of changing demography and disease prevalence in the U.S. *Diabetes Care* 2001;24:1936-1940.
3. http://www.diabetes.org
4. http://www.idf.org

Abbreviations

ADA = American Diabetes Association; BMI = body mass index; CV = Cardiovascular; CVD = cardiovascular disease; FPG = fasting plasma glucose; IDF = International Diabetes Federation; OR = odds ratio; SHIELD = Study to Help Improve Early evaluation and management of risk factors Leading to Diabetes; T2D = type 2 diabetes; TNS NFO = Taylor Nelson Sofres National Family Opinion

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