

# How Are Individuals Diagnosed with Type 2 Diabetes Mellitus?

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## BACKGROUND

- Multiple studies have indicated that earlier diagnosis of diabetes mellitus is beneficial by reducing the risk of complications<sup>1,2</sup>
- Diabetes complications are often present at the time of diagnosis, suggesting that subclinical onset of the disease occurred years prior to diagnosis<sup>3,4</sup>
- Previous studies suggest that symptoms may be the initiating factor for some percentage of patients' diagnosis of diabetes mellitus<sup>1,5</sup>
- ADA endorses screening of individuals at high risk for diabetes at 3-year intervals beginning at age 45, and more frequently for overweight individuals with other risk factors<sup>2</sup>
- It is important to determine whether there have been changes in patterns of diagnosis of diabetes mellitus over time

## OBJECTIVE

- Evaluate how individuals learned they have type 2 diabetes mellitus (T2DM), the specialties of physicians who made the diagnosis, and the rates of screening for T2DM

## METHODS

### Study Design

- Data were derived from the **Study to Help Improve Early evaluation and management of risk factors Leading to Diabetes (SHIELD)**, a 5-year population-based survey conducted to better understand the risk for the development of diabetes, as well as disease burden
  - Based upon a screening questionnaire mailed to 200,000 nationally representative households, responses were obtained for 211,097 adults from 127,420 households (64% response rate)
  - A 64-item baseline survey was sent to 22,001 individuals from the screening respondents, a representative, stratified, random sample, to understand health status, health knowledge and attitudes, and current behaviors and treatments (72% response rate, n = 15,794)
  - Annual follow-up surveys were mailed to all individuals in the baseline panel. Respondents to the 2006 follow-up survey were included in this analysis, n=13,887 out of 18,445 (75% response rate)

- This investigation is a cross-sectional analysis of the respondents who reported a diagnosis of T2DM

### Study Population

- Respondents were categorized as having T2DM based upon self-report of having been told by a doctor, nurse or other healthcare professional that they have the condition
  - T2DM was defined as a diagnosis of type 2 diabetes and age of onset > 21 years of age
  - T2DM respondents were stratified as high risk or low risk based on their reported number of cardiometabolic risk factors
    - High cardiometabolic risk was defined as 3 or more risk factors
    - Low cardiometabolic risk was defined as 0–2 risk factors
    - Risk factors identified from epidemiological studies and national guidelines<sup>6,7</sup> included: 1) abdominal obesity (waist circumference: men ≥ 97 cm, women ≥ 89 cm), 2) BMI ≥ 28 kg/m<sup>2</sup>, 3) reported diagnosis of dyslipidemia, 4) reported diagnosis of hypertension, and 5) history of cardiovascular disease (reported heart disease/heart attack, narrow or blocked arteries, stroke, heart bypass surgery, angioplasty/stents or surgery to clear arteries)

## Study Measures

- Method of diagnosis of T2DM
  - Self-report of whether they were diagnosed:
    - After having health symptoms
    - During routine screening or laboratory work
    - After being treated for another health problem
- Time since diagnosis of T2DM
  - Time since diagnosis = current age – age at diagnosis
  - Categorized into 3-year increments to capture changes before and after the ADA screening guidelines published in 2004
  - Six categories: <3 years, 3 to 5 years, 6 to 8 years, 9 to 11 years, 12 to 14 years, or >14 years previously
- Specialty of physician who made the diagnosis
  - Respondents indicated the specialty of the physician who made their diagnosis of T2DM:
    - Family doctor/general practitioner
    - Endocrinologist
    - Cardiologist
    - Neurologist
    - Other physician

## Statistical Analyses

- Comparisons between high-risk T2DM and low-risk T2DM groups were made using chi-square tests for proportions and t-tests for comparisons of two means
- Two-sided p values < 0.05 were considered significant

## RESULTS

**Table 1. Characteristics of SHIELD respondents with T2DM who reported one method of diagnosis, n = 2, 749**

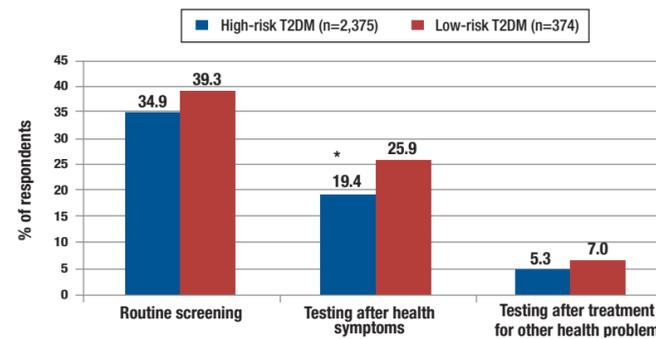
Characteristics	High-risk T2DM n = 2,375	Low-risk T2DM n = 374
Age, years, mean (SD)	61.2 (11.9)	61.3 (13.7)
Women, %	59*	53
Race, % white	85	84
Income, % <\$35,000/year	46*	41
Underweight or normal weight (BMI < 25 kg/m <sup>2</sup> ), %	5	37
Overweight (BMI 25.0-29.9 kg/m <sup>2</sup> ), %	23	39
Obese (BMI ≥ 30 kg/m <sup>2</sup> ), %	71*	24
Time since T2DM diagnosis, years, mean (SD)	9.8 (8.2)	10.2 (8.2)

\*p < 0.05 for comparison of high risk vs. low risk

- The majority (86%) of T2DM respondents who reported one method of diagnosis were high risk, having 3 or more cardiometabolic risk factors
- More high-risk T2DM respondents were women and obese and had low household income compared with low-risk T2DM respondents, p < 0.05

## RESULTS (Continued)

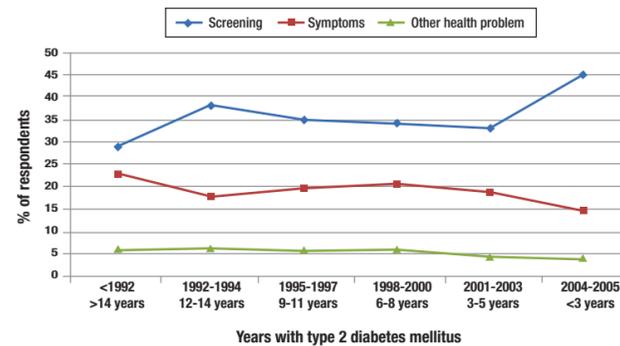
**Figure 1. Method of diagnosis for T2DM**



\*p < 0.001 comparing high risk vs. low risk  
Respondents who checked only one method of diagnosis were included

- The largest percentage of T2DM respondents reported a diagnosis based on routine screening, 35% of high-risk group and 39% of low-risk group
- Significantly greater percentage of low-risk T2DM respondents (26%) reported a diagnosis based on symptoms compared with high-risk T2DM individuals (19%), p < 0.001
- A diagnosis based on being treated for another health problem was reported by a small percentage of T2DM respondents (<10%), even though the majority of respondents had dyslipidemia (83%), hypertension (76%), or prior cardiovascular event (42%)

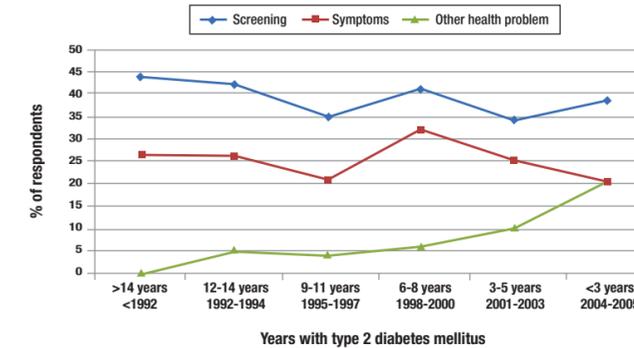
**Figure 2. Method of diagnosis for high-risk individuals with T2DM (n = 2,375)**



p < 0.001 for "routine screening" change over time, p = 0.10 for "symptoms" change over time, p = 0.59 for "other health problem" change over time

- Percentage of high-risk individuals reporting the diagnosis of T2DM based on "screening" increased approximately 16% points over time (55% increase), from 29% in the >14 year category to 45% in the <3 year category, p < 0.001
- Percentage of individuals receiving a diagnosis based on "symptoms" decreased >8% points over time but was not statistically significant
- Percentage of high-risk individuals receiving a diagnosis when being treated for "other health problem" did not change significantly

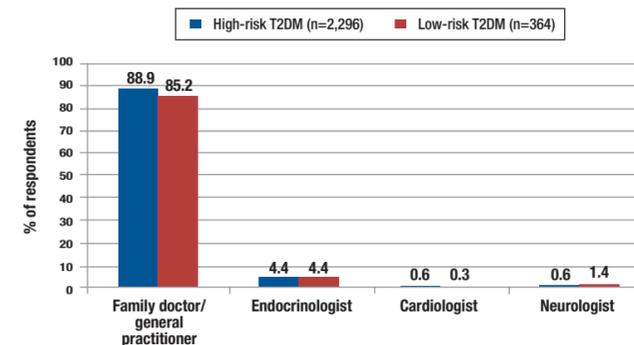
**Figure 3. Method of diagnosis for low-risk individuals with T2DM (n = 374)**



p = 0.84 for "routine screening" change over time, p = 0.72 for "symptoms" change over time, p < 0.001 for "other health problem" change over time

- Percentage of low-risk individuals reporting the diagnosis of T2DM based on "screening" decreased by 5% points over time, but was not statistically significant
- Percentage of individuals receiving a diagnosis based on "symptoms" decreased by 6% points over time, but was not statistically significant
- Percentage of low-risk individuals receiving a diagnosis when being treated for "other health problem" increased significantly from 0% to 21% over the 15-year period, p < 0.001

**Figure 4. Specialty of physician who made the diagnosis of T2DM**



- Majority of individuals with T2DM (>85%) reported that they received their diagnosis from their family doctor/general practitioner
- Few respondents reported that an endocrinologist (4.4%) had made the diagnosis
- The pattern did not differ significantly for individuals with high risk vs. low risk

## LIMITATIONS

- The determination of T2DM, method of diagnosis, age at diagnosis, and the physician specialty were made based upon self-report, without independent confirmation by the physician or examination of medical records
- Household panels, like the SHIELD study, tend to under-represent the very wealthy and very poor segments of the population and do not include military or institutionalized individuals
- Recall of clinical information by the respondent could potentially differ for recently diagnosed respondents compared with respondents given the diagnosis more than 10–15 years previously

## SUMMARY

- These study findings reveal that in high-risk individuals with T2DM, there is a clear pattern of increase in screening for T2DM over the years between 1991 and 2006
- There was no clear pattern of increase or decrease in screening of low-risk individuals with T2DM
- There was no significant change over time in the rate of diagnosis of T2DM due to symptomatic presentation in either the high- or low-risk individuals
- Even though routine physician visits may be an ideal time and setting for implementing screening, the proportion of respondents diagnosed on the basis of "other health problem" was low
- Generalists (family doctor/general practitioner) are the predominant specialty of physician making the diagnosis of T2DM

## CONCLUSIONS

- Screening for T2DM in individuals at risk is recommended by the ADA based on clear evidence of the benefits of early detection and treatment
- Many individuals reported being diagnosed with T2DM on the basis of screening, but others were diagnosed on the basis of symptoms and medical testing as part of their care for acute or other chronic illnesses
- More aggressive screening is needed to maximize early detection and the benefits of early intervention

## References

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## List of Abbreviations

<b>ADA</b>	American Diabetes Association
<b>BMI</b>	Body mass index
<b>SHIELD</b>	Study to Help Improve Early evaluation and management of risk factors Leading to Diabetes
<b>T2DM</b>	Type 2 diabetes mellitus

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