Community Screening for Diabetes

Low detection rate in a low-risk population

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OBJECTIVE — To evaluate glucose-based community screening for diabetes with regard to detection rate.

RESEARCH DESIGN AND METHODS — A retrospective analysis of a community-screening questionnaire data base that included a screening for blood glucose. Referred subjects had fasting glucose levels >6.4 mM (115 mg/dl) or postprandial levels ≥8.9 mM (160 mg/dl). An attempt was made to contact referred subjects and to ascertain whether follow-up was undertaken and current status. A random sample of subjects not meeting the glucose criteria (nonreferred) also was contacted in an analogous fashion to referred subjects.

RESULTS — In 2,016 questionnaires, glucose-based referral criteria were exhibited by 148 (7.3%) individuals, and subsequent evaluation data were available for 111. Of those 111 individuals, 37 (33%) knew they had diabetes before the screening, and 39 (36%) did not seek further evaluation. Of the remaining 35 subjects, 6 (13%) were told of their new diagnosis of diabetes, and 29 were told they did not have diabetes. Three of 50 nonreferred subjects knew of their diabetes before screening. Thirty percent (14 out of 47) of nonreferred subjects underwent subsequent evaluation, although they were not told to do so. A single new case of diabetes occurred in the nonreferred group.

CONCLUSIONS — Community screening for diabetes that is based on measured glucose is of low yield. The known problems of glucose-based screening, coupled with its low yield, make a glucose-based approach difficult to justify. These results indicate that glucose-based community screening should be done only under the careful supervision of a health professional who is trained both in glucose measurement instrumentation and in screening.

Community screening for diabetes is common, but little information is available regarding its outcome. Further, the proper approach to community screening is controversial. A white paper on community glucose screenings for diabetes mellitus, submitted to the Executive Committee of the American Diabetes Association (ADA) in February of 1991, advocates abandoning the use of blood glucose measurement as a screening aid. In contrast, an ADA position statement that was revised in 1993 describes in detail the technique necessary for glucose measurement during community screening (1).

Community screening as commonly practiced is not rigorous epidemiological screening. Non–health-care professionals with limited training and undocumented proficiency often perform community diabetes screening in situations where individuals appear for evaluation under remarkably diverse circumstances. Screening occurs at health fairs, shopping malls, and institution lobbies at various hours with no control over patient prandial status and little control over patient response reliability. Records from community screenings are often incomplete, which decreases the health-care provider's ability to assess data and to track subjects from whom further information is needed.

We evaluated the frequency of new diabetes detection using data from community screening in North Dakota to support or refute the use of glucose measurement as a screening tool.

RESEARCH DESIGN AND METHODS

— The 2,016 questionnaires obtained between 13 October 1988 and 6 December 1992 under the supervision of the ADA North Dakota Affiliate constitute the patient population for this study. Community screening in North Dakota, which was also done under sponsorship of the ADA North Dakota Affiliate, followed closely the recommendations of the ADA position statement on diabetes screening (1). Screened individuals self-completed a questionnaire encompassing current diabetes status, height, weight, risk factors for diabetes, symptoms of hyperglycemia, medications, and signed consent. No verification of subject-reported information was undertaken.

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ADA, American Diabetes Association.

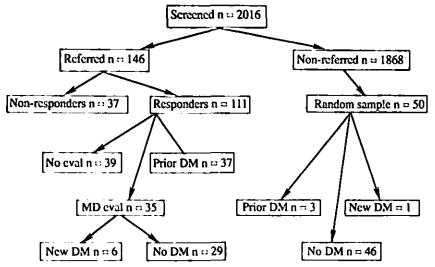

Figure 1—*Flow diagrams for population and subgroups of individuals in screened and nonscreened studies.*

Numerous volunteers of diverse backgrounds, who had no glucose instrumentation proficiency documentation, conducted screenings throughout the state. Various brands of reflectance meters were used at screening sites, with no documentation of meter brands or quality control evaluation. The glucose and prandial status were recorded on each questionnaire by volunteers, who then forwarded the questionnaires to the ADA North Dakota Affiliate offices.

Figure 1 illustrates the population and subgroups studied. Referred subjects include those whose postprandial glucose was ≥8.9 mM (160 mg/dl) and those whose fasting glucose was >6.4 mM (115 mg/dl). Attempts were made to contact the referred subjects: twice by stamped, self-addressed response cards and once by telephone. Those who could be contacted are labeled responders, and the residual noncontacted referred subjects are labeled nonresponders.

Responders fell into three categories: those who sought no further evaluation, those who previously had been diagnosed with diabetes, and those who underwent physician evaluation. Those responders undergoing physician evaluation were labeled as having either new diabetes or no diabetes.

A random sample of 50 subjects whose glucose-screening characteristics did not suggest further evaluation (nonreferred) were assessed in an analogous fashion to referred subjects by personal interview.

The SAS Institute (Cary, NC) provided computer programs for all statistical analysis (2). Data are presented as means ± SD.

RESULTS — Of the 2,016 people who completed questionnaires, 1,243 were females and 702 were males. Age averaged 41.0 ± 17.6 (range 18–93) years and body mass index averaged 25.5 ± 4.9 (range 17.1–54.9) kg/m^2

Of the screened individuals, 148 (7.3%) had a glucose of >6.4 mM (115 mg/dl) fasting (n = 16) or a glucose of ≥8.9 mM (160 mg/dl) random (n = 132). There were 111 (75%) respondents. Thirty-seven respondents (33%) already knew they had diabetes, but this fact was not indicated on the screening form. No further evaluation occurred in 39 referred screened individuals (35%). This nonevaluated portion of the referral group differed from those undergoing evaluation only by having a lower blood glucose (9.7 ± 1.7 vs. 12.2 ± 3.1 mM [175 ± 31 vs. 219 ± 56 mg/dl]; $P < 0.01$).

The remaining 35 subjects who met screening criteria underwent a medical evaluation that included a physician visit. Of this group, 6 (17% true positives) were told they had diabetes (new cases), and 29 were told they did not have diabetes.

Four of 50 nonreferred subjects (Fig. 1) related the presence of diabetes, but 3 were known to have diabetes before screening, leaving only one case detected subsequent to screening. This difference—1 of 47 for nonreferred versus 6 of 74 for referred—is not statistically significant (Fisher's exact test = 0.24). Fourteen of 47 of this criteria-negative population underwent subsequent testing, which is a proportion of borderline statistical significance compared with the 35 of 74 that were criteria-positive (χ^2 = 3.7; P = 0.06).

CONCLUSIONS — These data indicate that community screening for diabetes is of low yield. Given a best-case scenario (in which all individuals designated for evaluation actually seek evaluation), under the ADA glucose screening criteria, 17 new cases would be detected per ~2,000 individuals screened in a low-risk setting. Costs to screen participants are not trivial. Even if the indirect costs of the volunteers' time and transportation are not included, the direct costs of meters, control solutions, strips, lancets, prep pads, gloves, paperwork, and postage approximate $1.00 per screened individual.

Although community screening for diabetes will likely remain controversial, it is difficult to justify glucose-based community screening as it is currently performed in low-risk populations based on detection numbers (3,4,5). Community diabetes screening with blood glucose is a costly, potentially risky undertaking and has a small diabetes detection frequency when measured against current epidemiological survey information (6,7,8). These data support the ADA white paper position of abandoning glucose-based community screening. Known glucose measurement problems occur in the areas of *1*) undocumented volunteer proficiency; 2) inherent inaccuracy of the method; 3) handling of potentially infectious, blood-contaminated supplies; and 4) the medical and legal ramifications of blood testing. The low diagnostic yield and the admitted glucose measurement problems indicate that glucose testing for diabetes should be done only under the close supervision of a health-care professional who is specifically trained both in the glucose instrumentation and in diabetes screening.

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References

1. American Diabetes Association: Position Statement: Screening for diabetes. *Diabetes Care* 16:7–9, 1993
2. SAS Institute: *SAS/STAT User's Guide*. 6.03 Edition. Cary, NC, SAS Inst., 1988

3. Singer DE, Samet JH, Coley CM, Nathan DM: Screening for Diabetes Mellitus. *Ann Intern Med* 109:639–649, 1988
4. Nathan DM, Singer DE: Screening for diabetes (Letter). *Diabetes Care* 13:542–543, 1990
5. Zimmerman B: Screening for diabetes (Letter). *Diabetes Care* 13:543, 1990
6. Harris Mi, Hadden WC, Knowler WC, Bennett PH: Prevalence of diabetes and impaired glucose tolerance and plasma glucose levels in U.S. population aged 20–74 yr. *Diabetes* 36:523–523, 1987
7. French LR, Boen JR, Martinez AM, Bushhouse SA, Sprafka JM, Goetz FC: Population-based study of impaired glucose tolerance and type II diabetes in Wadena, Minnesota. *Diabetes* 39:1131–1137, 1990
8. Mykkanen L, Laakso M, Uusitupa M, Pyorala K: Prevalence of diabetes and impaired glucose tolerance in elderly subjects and their association with obesity and family history of diabetes. *Diabetes Care* 13: 1099–1105, 1990