HbA_{1c}-Based Classification Reveals Epidemic of Diabetes and Prediabetes in Vietnam

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DOI: 10.2337/dc16-0654

The Asia Pacific region, with its rapid economic development and changes in lifestyles, has been identified as an epicenter of diabetes. However, the prevalence of diabetes in this region has not been well documented. Glycated hemoglobin (HbA_{1c}) has been introduced as a new diagnostic test for diabetes, but its impact on disease prevalence is unknown. In this study, we sought to estimate the prevalence of undiagnosed diabetes in an urban population in Vietnam by using new HbA_{1c} diagnostic criteria.

The study was designed as a population-based investigation that involved 1,339 individuals (973 women) randomly sampled from Ho Chi Minh City. All individuals aged 30 years and above (average age ~53 years, no significant difference between women and men). Blood samples were collected after overnight fasting and analyzed within 24 h after collection. HbA_{1c} was measured with high-performance liquid chromatography (ARKRAY, Japan). Fasting plasma glucose (FPG) was measured by the hexokinase method (Advia Autoanalyzer; Siemens Healthcare Diagnostics, Tarrytown, NY). Diabetes was defined as HbA_{1c} ≥6.5% (≥47.5 mmol/mol) or FPG ≥7.0 mmol/L. Prediabetes was classified as HbA_{1c} between 5.7 and 6.4% (38.8 and 46.4 mmol/mol).

On the basis of the HbA_{1c} test, the overall prevalence of diabetes and prediabetes was 12.3% (95% CI 10.5–14.0%; $n = 164$) and 40.1% (95% CI 37.5–42.7; $n = 537$), respectively. There was no significant difference in prevalence between women and men ($P = 0.22$). The prevalence of HbA_{1c}-diagnosed diabetes significantly increased with advancing age (Fig. 1) such that among those aged 70 years and older, 27% had HbA_{1c}-diagnosed diabetes, which is almost tenfold higher than for those aged between 30 and 39 years.

There was a significant discordance between HbA_{1c} and FPG in the diagnosis of diabetes. On the basis of the FPG test, the prevalence of diabetes and prediabetes was 7.4% (95% CI 6.0–8.8%; $n = 99$) and 11.7% (95% CI 10.0–13.4; $n = 156$), respectively. Among 164 individuals classified by HbA_{1c} as having diabetes, 88 were

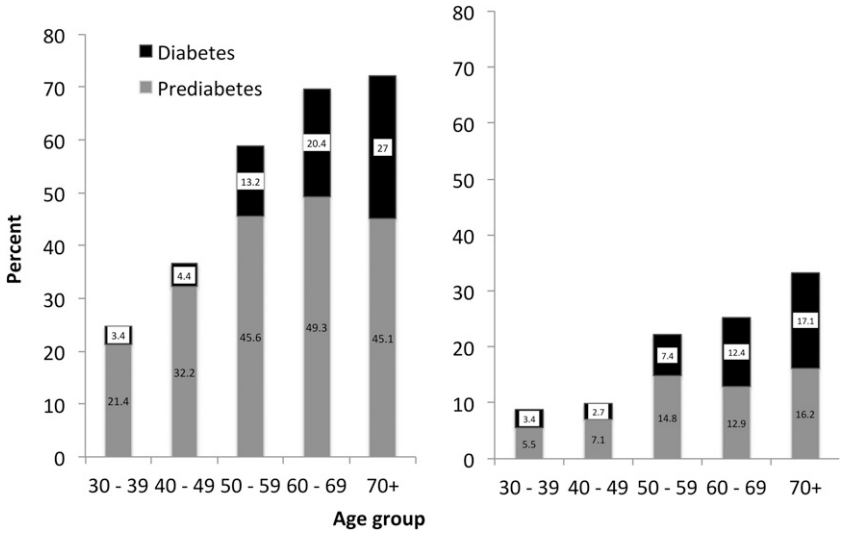

Figure 1—Prevalence of diabetes and prediabetes by age group on the basis of HbA_{1c} (left panel) and FPG (right panel).

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Received 24 March 2016 and accepted 2 April 2016.

classified as having the same diagnosis by FPG (sensitivity 54%, specificity 99%). Among 535 individuals classified as having prediabetes by HbA_{1c}, the FPG test provided a similar diagnosis for only 76 (sensitivity 14.2%, specificity 95%). Overall, the weighed κ statistic was 0.5 (95% CI 0.45–0.54).

Our findings demonstrate a rapid increase in the prevalence of diabetes in Vietnam. In 2004, a population-based study using FPG testing found that 3.8% of the population of Ho Chi Minh City had diabetes (1). This prevalence was increased to 11% in 2010 (2). In this study, we observed that within approximately 10 years, the prevalence of diabetes in this city has increased by more than threefold. The study also raises a disturbing aspect: prediabetes. We note that 40% of the adult individuals had prediabetes (on the basis of HbA_{1c} definition), which means that more than half (52%) of the population had either diabetes or prediabetes, and this will be a significant burden to society. Our data also suggest that FPG testing can miss a substantial proportion of diabetes and prediabetes detected by the HbA_{1c} test, increasing the eventual cost and burden to society of missed diabetes and its multisystem complications.

Acknowledgments. The authors sincerely thank Tran Thi Ngoc Trang and Pham Ba Lam for coordinating the recruitment of participants. The authors also thank the doctors and medical students of the Pham Ngoc Thach University of Medicine, Ho Chi Minh City, Vietnam, for the data collection and clinical measurements.

Funding. This research is funded by Foundation for Science and Technology Development of Ton Duc Thang University (FOSTECT, http://fostect.tdt.edu.vn) grant number FOSTECT.2014.BR.09 and by a Department of Science and Technology of Ho Chi Minh City grant. L.T.H.-P. and T.V.N. are the guarantors of this work and, as such, had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Duality of Interest. No potential conflicts of interest relevant to this article were reported.

Author contributions. L.T.H.-P., T.T.D., and T.V.N. performed the experiments and data collection. L.T.H.-P. and T.V.N. conceived of and designed the experiments and analyzed the data. L.T.H.-P., L.V.C., and T.V.N. wrote the paper and interpreted the data.

References

1. Duc Son LN, Kusama K, Hung NT, et al. Prevalence and risk factors for diabetes in Ho Chi Minh City, Vietnam. Diabet Med 2004;21:371–376

2. Ta MT, Nguyen KT, Nguyen ND, Campbell LV, Nguyen TV. Identification of undiagnosed type 2 diabetes by systolic blood pressure and waist-to-hip ratio. Diabetologia 2010;53:2139–2146