Brief Communication

Obesity is the Most Important Factor for Gender Inequality in Type 2 Diabetes Incidence in an Iranian Population

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Abstract

Background: The results of Shahroud Eye Cohort Study (ShECS) showed a high 5-year incidence of diabetes mellitus with female predominance in 40–64 years old Iranian population. The aim of this report was to decompose the observed sex differences in the incidence of diabetes. **Methods:** Sex-specific incidence rate of diabetes was calculated between the two phases of ShECS (2009–2014). The gap decomposition was done by the twofold Blinder–Oaxaca decomposition model. **Results:** The results showed that from the total gap (11.19%–15.55% = −4.36%) between the two sexes, 3.46% which forms 79.4% of the total gap is related to the difference in obesity in both genders. In contrast to obesity, age and overweigh status had a decreasing influence on gender inequality. **Conclusions:** Obesity of Iranian women compared with men is the most important reason for an increase in the incidence of diabetes in women.

Keywords: *Diabetes mellitus, incidence rate, Iran, Blinder–Oaxaca decomposition, Obesity*

Introduction

Ebrahimi *et al*.[1] in 2016 reported a high 5-year incidence of diabetes and its risk factors in 40–64 years old Iranian population. They emphasized that immediate interventions be implemented to prevent and control the increasing trend of diabetes in Iran. The 5-year incidence of diabetes was 11.19% [95% confidence interval (CI): 9.70–12.68] in men, 15.55% (95% CI: 14.10–17.0) in women, and it was significantly higher in women than men (Risk ratio = 1.39, 95% CI: 1.18–1.64). Some studies have reported no significant difference in the incidence of diabetes in the two sexes,[2,3] but noticing the different risk factors for diabetes for each sex, the report of sex-specific diabetes incidence rate was recommended.[4] In Ebrahimi *et al*.'s study,[1] of eight included primary predictors of diabetes in a log-binomial regression model, age, hypertension, and body mass index (BMI) were associated with increased risk of diabetes. This result indicates a sex-independent role for the mentioned risk factors. Due to the lack of a causal role of sex on increasing the risk of diabetes, and independence of the main risk factors' effects from sex, the interpretation of the results is that the reason for the increase in the diabetes incidence in women is the effect of age, blood pressure, and BMI (the confounding role of these factors in relation to sex and diabetes). Now, the major question is the role of each of these factors in the difference observed in the incidence of diabetes among Iranian men and women. The aim of this report was to decompose the observed sex differences in the incidence of diabetes to explain how much of the gap is due to differences in the predictors' level and how much is due to coefficients of model using Blinder–Oaxaca decomposition.[5]

Methods

To answer the research question, data from Shahroud Eye Cohort Study (ShECS) were used. ShECS was conducted in two phases in 2009 and 2014. The details for estimating the 5-year incidence of diabetes mellitus are presented in Ebrahimi's study for both the sexes.[1] However, we describe the methodology of this study concisely. In this study, using stratified cluster sampling method, 5190 middle-aged persons were randomly selected from the city of Shahroud in the first phase of the study in 2009. After explaining the objectives of the study and obtaining informed consent, all participants were invited for an ophthalmology examination and medical history questioning.

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In the second phase of the study, 4737 people (91.3%) participated and the 5-year incidence of diabetes was calculated in the nondiabetic persons. Participants with fasting blood sugar ≥126 mg/dL and/or those with hemoglobin A1C ≥6.5% and/or using medications for diabetes were diagnosed as patients with diabetes.[6]

In this report, the decomposition of the gap was done by the twofold Blinder–Oaxaca decomposition model. In a twofold method, the difference in incidence of diabetes in the two groups of women and men, regardless of the interaction component, is decomposed.[5] As shown in the following formula,[5,7] the sex difference in the incidence of diabetes is divided into two parts. The "explained" values in the model are related to the cross-sex difference in the incidence of diabetes in relation to the level of explanatory variables, and "unexplained" values indicate the differential magnitudes of model coefficients (but may also result from the influence of unobserved predictors) in both the sexes. The difference in the incidence of diabetes between men and women is weighted in terms of explanatory variables (explained values) using reference coefficients ($\hat{\beta}_R$). In this method, referential coefficients are obtained using the regression model of explanatory variables and the outcome is estimated for the whole population.[5]

$$\hat{Y} = \underbrace{(\overline{X}_M - \overline{X}_F)'\hat{\beta}_R}_{Explained} + \underbrace{\underbrace{\overline{X}'_M\left(\hat{\beta}_M - \hat{\beta}_R\right)}_{Unexplained\ for\ Males} + \underbrace{\overline{X}'_F\left(\hat{\beta}_R - \hat{\beta}_F\right)}_{Unexplained\ for\ Females}}_{Unexplained}$$

Results

According to the results presented in Table 1, it can be concluded that the significant contribution of inequality in the incidence of diabetes in the two sexes is due to the observed variables, rather than the difference in the effect of these variables. Among the three major risk factors for the occurrence of diabetes in both the sexes, BMI has the greatest role in inequality of incidence in both the sexes. The results showed that from the total gap between the two sexes (4.36%), 3.46%, which forms 79.4% of the total gap, is related to the difference in obesity in both the genders. In contrast to relationship between obesity and inequality, age and overweigh status had a decreasing influence on gender inequality. This is due to cross-sex difference in age and BMI distributions. The variables of hypertension and prehypertension have no significant role in the observed inequality in the two groups.

Discussion

Considering the role of obesity as a risk factor for diabetes,[8,9] the results of this study showed that obesity of Iranian women compared with men is the most important reason for an increase in the incidence of diabetes in women. The prevalence of obesity in Iranian women is significantly higher than that in men.[10] Given the high prevalence of obesity in the Eastern Mediterranean region, according to the World Health Organization report, obesity in Iranian women is higher than the regional average.[11] Weight loss in men and women can be a major contributor to reducing the risk of diabetes and other noncommunicable diseases. Moreover, weight loss interventions in Iranian women can have a significant role in reducing the incidence of diabetes in this group. Unlike the role of obesity on inequality, overweight in males is predominant and decreases the gap between genders.

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Table 1: Decomposition of the gap in diabetes incidence between males and females

Diabetes incidence rate			Rate	95% CI	*P*
Incidence rate in males (%)			11.19	9.69, 12.69	<0.001
Incidence rate in females (%)			15.55	14.05, 17.05	<0.001
Difference			−4.36	−6.49, −2.24	<0.001
Explained (total)			−2.63	−3.49, −1.77	<0.001
Predictors	**Explained**		**Unexplained (male)**		**Unexplained (female)**	
	Rate	**95% CI**	**Rate**	**95% CI**	**Rate**	**95% CI**
Age	0.36*	0.11, 0.62	−4.09	−14.8, 6.8	−2.92	−10.7, 4.8
BMI (kg/m^2)						
<25	Reference					
25-29.9	0.37*	0.13, 0.60	0.27	−0.65, 1.19	0.31	−0.61, 1.24
≥30	−3.46*	−4.32, −2.60	0.13	−0.59, 0.85	0.30	−0.76, 1.36
Blood pressure						
Normal	Reference					
Hypertension	−0.03	−0.19, 0.13	0.12	−1.06, 1.30	0.13	−0.62, 0.88
Prehypertension	0.13	−0.06, 0.31	−0.04	−1.11, 1.03	−0.01	−0.61, 0.59
Intercept	0	0	3.63	−5.9, 16.6	0.46	−9.3, 6.7

CI: Confidence interval; BMI: Body mass index. *Significant at level of 0.05

Conflicts of interest

There are no conflicts of interest.

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