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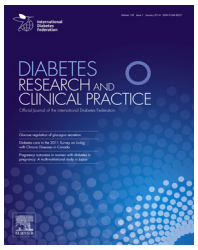

Family history and body mass index predict perceived risks of diabetes and heart attack among community-dwelling Caucasian, Filipino, Korean, and Latino Americans—DiLH Survey

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ABSTRACT

Aim: The purpose of the study was to explore the perceived risk for diabetes and heart attack and associated health status of Caucasian, Filipino, Korean, and Latino Americans without diabetes.

Methods: A cross-sectional survey was conducted with 904 urban adults (mean age 44.3 ± 16.1 years; 64.3% female) in English, Spanish or Korean between August and December 2013.

Results: Perceived risk for developing diabetes was indicated by 46.5% ($n = 421$), and 14.3% ($n = 129$) perceived themselves to be at risk for having a heart attack in their lifetime. Significant predictors of pessimistic diabetes risk perceptions: Filipino (adjusted odds ratio [AOR] = 1.7; 95% CI: 1.04–2.86) and Korean (AOR = 2.4; 1.33–4.48) ethnicity, family history of diabetes (AOR = 1.4; 1.00–1.84), female gender (AOR = 1.4; 1.04–1.96), high cholesterol (AOR= 1.6; 1.09–2.37) and higher body mass index (BMI) (AOR = 1.1; 1.08–1.15). Predictors of pessimistic heart attack risk perceptions were family history of an early heart attack (AOR = 2.9; 1.69–5.02), high blood pressure (AOR = 2.4; 1.45–3.84), and higher BMI (AOR = 1.1; 1.04–1.12) after controlling for socio-demographic factors. Older age, physical inactivity, smoking, and low HDL levels were not associated with risk perceptions.

Conclusion: Multiple risk factors were predictive of greater perceived diabetes risk, whereas, only family history of heart attack, high blood pressure and increases in BMI significantly contributed to perceived risk of heart attack among ethnically diverse at risk middle-aged adults. It is important that healthcare providers address the discordance between an individual's risk perceptions and the presence of actual risk factors.

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1. Introduction

Diabetes mellitus is a growing global epidemic with serious complications [1]. Complications that include the higher morbidity and mortality rates from coronary artery disease such as heart attack [2,3] and diabetes induced microvascular complications [4]. Diabetes disproportionally affects racial and ethnic minority groups, which in turn magnify health disparities in the United States (U.S.). It is estimated that one in three U.S. adults has a prediabetic condition. Although a moderate amount of weight loss through lifestyle change prevents or delays the onset of diabetes [5], the vast majority of prediabetic individuals are not screened for prediabetes or aware of their condition [6]. Therefore, improving awareness and knowledge of this highly susceptible population is a public health priority.

Risk perception of developing diabetes and understanding its link to heart attack is considered a key concept that generally precedes screening behaviors for prediabetes and improving individual lifestyles [7–10]. To promote screening and lifestyle changes, a general public perception and understanding of diabetes risk are critical. The purpose of this paper was to explore the association between self-reported risk perception of developing diabetes or heart attack and the often overlapping risk factors for these medical conditions among a large diverse sample of English, Spanish, and Korean-speaking non-diabetic adults. To our knowledge, this was the first diabetes and heart attack comparative risk perception survey conducted in all three languages. Given the rapidly growing number of racial and ethnic minorities in the U.S who are at risk of developing diabetes, the findings from this cross-sectional survey will provide new insight for diabetes and heart attack risk screening and prevention in the future.

2. Methods

2.1. Study design and sample

In this cross-sectional survey, 1039 adults who were 18 years or older and reported no history of diabetes took the Digital Link to Health (DiLH) Survey between August and December 2013. Details of the survey design have been described previously [11–13]. The original purpose of the survey was to develop culturally tailored diabetes prevention programs using digital technologies for understudied high risk racial and ethnic groups: Filipino, Korean, and Latino Americans in the San Francisco Bay Area and San Diego. Therefore, these high risk groups were oversampled in this survey study. In this paper, 904 individuals who identified themselves as Caucasian, Filipino, Korean, or Latino were included in the analysis. Excluded from the analysis were 135 individuals who had missing data for gender ($n = 1$) or ethnicity/race ($n = 23$), or who identified as other Asian ethnicity ($n = 53$) or other race ($n = 58$). The study protocol was approved by the University of California, San Francisco Institutional Review Board prior to conducting survey.

To recruit a diverse community-dwelling sample, the English survey was independently translated into Spanish and Korean and reviewed by two bilingual staff members, and all three language-specific surveys were pilot tested twice among 10 people for each pilot.

2.2. Procedures

Participants were recruited both in person and online. In-person recruitment involved bilingual research staff attending community events and churches to pre-screen potential participants prior to providing the survey. Potential participants were asked to review a study information form and encouraged to ask any questions before filling out the survey. After obtaining verbal consent, participants completed paper versions of the survey independently. If participants had questions or preferred verbal administration, bilingual staff were available to answer specific questions or help complete the survey. If participants did not have sufficient time to complete the survey or preferred the online survey during an event, staff provided a link to the online survey. Participants were also recruited online by posting online survey links in English, Korean, and Spanish on Craigslist on a weekly basis. Participants who completed a paper-copy of the survey were offered a complimentary tote-bag and those who completed the online survey had the option of entering a $25 gift card raffle.

2.3. Measures

In the DiLH survey, risk factors for diabetes and heart attack were assessed using a modified version of the American Diabetes Association Diabetic Risk Test [14] and cardiovascular risks were modeled on the Framingham Risk Score [15–18]. Family history of early heart attack was assessed by inquiring ''Has your father or brother had a heart attack before the age of 55?'' and ''Has your mother or sister had a heart attack before age 65?''. One question assessed participant's family history of diabetes: ''Do you have a mother, father, sister or brother with diabetes?'' To assess health status, participants were asked: (1) if they had high blood pressure ($\geq$140/90 mmHg) or were taking anti-hypertension medication; (2) if their total cholesterol level was greater than 200 mg/dL or medication was needed to control their cholesterol; (3) if their high-density lipoprotein (HDL) level was less than 50 mg/dL for women or less than 40 mg/dL for men; (4) if they had smoked at least one cigarette during the last week; (5) if they had at least 150 min per week of moderate or vigorous intensity physical activity (e.g. brisk walking, running, basketball) during the last month. Body mass index (BMI) was calculated from the participants' reported weight and height. Responses to health status assessment questions were coded either as yes, no, or don't know, although participants' reports did not include actual blood pressure measures or blood lipid levels.

Diabetes comparative risk perception was assessed by ''Compared to other people of my same age and sex (gender), I am less likely than they are to get diabetes'' taken from Walker's Risk Perception Survey for Developing Diabetes (RPS-DD) [19]. The four point Likert scale responses included (1) Strongly agree, (2) Agee, (3) Disagree (4) Strongly Disagree. For analysis, this response was dichotomized into (yes/no) ''Agree/Strongly agree'' versus ''Disagree/Strongly disagree''

that I am less likely to get diabetes. To assess perceived comparative risk of heart attack, participants were asked: ''Compared to other people your age, how likely do you think it is that you could have a heart attack in your lifetime?'' [20,21]. Participants could rate the likelihood of having a heart attack in their lifetime by selecting a number from 1 to 5, with 1 = much less likely, 3 = about the same risk, and 5 = much more likely. Scores were dichotomized into lower/same risk (scores 1–3) or higher risk (scores 4–5) of heart attack.

2.4. *Data analysis*

All survey data were entered into SPSS 22.0 using a double-data entry system. Descriptive statistics were used to describe sample demographics; diabetes and heart attack risk factors, and risk perceptions. Multiple logistic regressions were performed to explore which socio-demographic and medical risk factors were associated with greater perceived risk of developing diabetes and having a heart attack in one's lifetime. For face validity, educational level, marital status, number of years living in the U.S., primary language, and survey administration mode (online or paper survey) were controlled for in the diabetes and heart attack risk perception regression models. For the diabetes regression model, family history of diabetes, gestational diabetes, high blood pressure or on medication, BMI, physical inactivity, high total cholesterol and low HDL were entered as potential predictors. Lipid values were added to the model in recognition of the interplay between hypercholesterolemia and decreased HDL cholesterol levels as major risk factors for cardiovascular disease for individuals with diabetes [22]. For the heart attack regression model, gestational diabetes was replaced by smoking status, and family history of diabetes was replaced by family history of early heart attack. Statistical significance was set at p-value $<.05$.

3. Results

3.1. *Sociodemographics*

Non-Hispanic Caucasians represented 19.0% ($n = 172$) of the sample, Filipinos 27.7% ($n = 250$), Koreans 25.9% ($n = 234$), and Latinos 27.4% ($n = 248$). Approximately 43.6% of the participants completed surveys in either in Spanish ($n = 196$) or Korean ($n = 198$) with the remaining completed in English. Table 1 shows sociodemographic and risk factors. The mean age of the participants was 44.3 (SD ± 16.1) years; 64.3% ($n = 581$) were female; 58.1% ($n = 524$) were married or cohabitating; over half (57.2%, $n = 515$) had college education and 27.4% ($n = 247$) had high school or less education. Approximately one-third of the sample (31.9%, $n = 287$) was born in the U.S. Of the 68.1% ($n = 614$) of participants born outside the U.S., 12.5% ($n = 113$) resided in the U.S. for less than 10 years while 55.6%, ($n = 501$) lived in the U.S. for 10 years or more. Less than half of the participants (44.7%, $n = 404$) reported speaking English as their primary language.

Participants reported the following health risk factors: 35.3% ($n = 317$) had a positive family history of diabetes; 11.3% ($n = 102$) had a positive family (parent or sibling) history of an

Table 1 – Demographics & self-reported diabetes & heart attack risk factors.

	N	Mean (± SD) or % (n)
Demographics		
Age (years)	896	44.3 (± 16.1)
Gender	904	
Female		64.3 (581)
Male		35.7 (323)
Years in US	901	
Born in USA		31.9 (287)
Less than 9 years		12.5 (113)
10 years or more		55.6 (501)
Education	901	
High school or less		27.4 (247)
College or some college		57.2 (515)
Graduate school		15.4 (139)
English (primary language)	904	
Yes		44.7 (404)
No		55.3 (500)
Ethnicity/race	904	
Caucasian		19.0 (172)
Latino		27.4 (248)
Filipino		27.7 (250)
Korean		25.9 (234)
Marital status	902	
Single/divorced/widowed		41.9 (378)
Married/cohabitating		58.1 (524)
Self-reported medical risk factors		
Family history of diabetes	899	
Yes		35.3 (317)
No		64.7 (582)
Family history of heart attack	904	
Yes		11.3 (102)
No		88.7 (802)
Body mass index (kg/m^2)	885	25.5 (±5.3)
Gestational diabetes	899	
Yes		6.0 (54)
No[a]		94.0 (845)
High blood pressure	903	
Yes		21.4 (193)
No		76.2 (688)
Don't know		2.4 (22)
Physical inactivity	902	
Yes		44.8 (404)
No		55.2 (498)
Smoking	900	
Yes		8.4 (76)
No		91.6 (824)
High cholesterol	902	
Yes		21.2 (191)
No		73.2 (660)
Don't know		5.7 (51)
Low high-density lipoprotein cholesterol	902	
Yes		16.1 (145)
No		59.4 (536)
Don't know		24.4 (221)
Survey	904	
Paper		72.3 (654)
Online		27.6 (250)

[a] Included men.

early heart attack; 21.4% ($n = 193$) had high blood pressure (≥140/90 mmHg); 21.2% ($n = 191$) had high cholesterol (≥200 mg/dL); and 16.1% ($n = 145$) reported low HDL (although 24.4% ($n = 221$) did not know their HDL level). A small minority (8.4%, $n = 76$) reported smoking at least one cigarette during the last week and very few women (6%, $n = 54$) experienced a pregnancy with gestational diabetes. A little over half (55.2%, $n = 498$) reported that they had 150 min of moderate to vigorous intensity physical activity per week. Three out of four participants (72.3%, $n = 654$) completed the paper survey versus 27.6% ($n = 250$) the online survey.

3.2. *Description of risk perceptions between diabetes and heart attack*

The majority of the participants (53.5%, $n = 484$) agreed or strongly agreed that they were less likely than others to develop diabetes as opposed to 46.5% ($n = 420$) who disagreed or strongly disagreed with this optimistic perception. In contrast to the diabetes risk perceptions, only 14.3% ($n = 129$) of the participants perceived that they were more likely than others to have a heart attack in their lifetime. Only 9.3% ($n = 83$) of participants perceived themselves to be at dual risk for developing diabetes and having a heart attack in their lifetime. These negative perceptions were in contrast to the 48.4% ($n = 437$) who did not perceive themselves at risk for either outcome. Mixed perceptions were reported by 37.3% ($n = 336$) who perceived themselves to be at increased risk of diabetes, but not heart attack, and 5.1% ($n = 46$) who perceived heart attack to be a threat, but not diabetes.

3.3. *Perceived risk for developing diabetes*

Table 2 summarizes the results of the multiple logistic regression predicting high perceived risk of diabetes from acknowledged diabetes risk factors (both socio-demographic and medical), controlling for education, number of years living in the US, marital status, primary language, and survey administration mode (online or paper). Five significant risk factors predicted perceived risk of diabetes: (1) female gender [adjusted odds ratio (AOR) = 1.4; 95% CI: 1.04–1.96, $p = .026$]; (2) family history of diabetes (AOR = 1.4; 1.00–1.84, $p = .048$); (3) ethnicity (overall $p = .038$), with Filipino (AOR = 1.7; 1.04–2.86, $p = .035$) and Korean Americans (AOR = 2.4; 1.33–4.48, $p = .004$) perceiving themselves at greater risk,; (4) high cholesterol (AOR = 1.6; 1.09–2.37, $p = .018$); and (5) higher BMI (AOR = 1.1; 1.08–1.15, $p \leq .001$). Age, gestational diabetes, high blood pressure, low HDL, and physical inactivity were not associated with negative diabetes risk perceptions ($p > .05$).

3.4. *Perceived risk of heart attack*

Table 3 shows the results of a multiple logistic regression predicting perceived risk of heart attack. The three significant predictors were: (1) family history of an early heart attack (AOR = 2.91.69–5.02, $p < .001$); (2) high blood pressure (AOR = 2.41.45–3.84, $p = .001$); and (3) higher BMI (AOR = 1.1; 1.04–1.12, $p < .001$). For every 1 kg/m^2 increase in BMI, the likelihood of perceiving oneself at high risk of heart attack increased by 10%. Individuals who reported high blood pressure or taking medication to control blood pressure were 2.4 times more likely than those without high blood pressure to perceive themselves at increased risk of heart attack ($p = .001$). The recognized heart attack risk factors of smoking, high cholesterol, and low HDL did not influence heart attack risk perceptions.

4. Discussion and conclusion

4.1. *Discussion*

To our knowledge, this study is the first report of perceived risk for diabetes and heart attack among community-dwelling Caucasian, Filipino, Korean, and Latino Americans without diabetes. The discordance in perceptions indicated in this survey highlights public knowledge gaps about diabetes and heart attack risk factors. Americans continue to suffer heart

Table 2 – Multiple logistic regression predicting perceived risk of developing diabetes (N = 862).

	Unadjusted odds ratio (95% CI)	*p*-Value	Adjusted odds ratio[a] (95% CI)	*p*-Value
Age	.99 (.99–1.00)	.156	.99 (.98–1.00)	.059
Female gender	1.17 (.89–1.54)	.262	1.43(1.04–1.96)	.026
Race/ethnicity				.038[b]
Caucasian	Reference	.017	Reference	
Latino	1.62 (1.09–2.40)	.017	1.78 (.99–3.20)	.055
Filipino	1.52 (1.02–2.25)	.038	1.72 (1.04–2.86)	.035
Korean	1.04 (.70–1.55)	.854	2.44 (1.33–4.48)	004
Body mass index (kg/m^2)	1.11 (1.08–1.14)	<.001	1.11 (1.08–1.15)	<.001
Gestational diabetes	1.47 (.84–2.55)	.176	1.01 (.54–1.88)	.973
Family history of diabetes	1.58 (1.20–2.08)	.001	1.36 (1.00–1.84)	.048
High blood pressure	1.47 (1.07–2.02)	.019	1.15 (.78–1.70)	.490
Physical inactivity	1.15 (.89–1.50)	.290	1.03 (.76–1.39)	.862
High cholesterol	1.50 (1.09–2.07)	.013	1.60 (1.09–2.37)	.018
Low high-density lipoprotein cholesterol	1.33 (.93–1.90)	.117	1.02 (0.68–1.53)	.925

[a] Adjusted for years living in US, education, marital status, English as primary language, survey administration mode.
[b] Overall *p*-value.

Table 3 – Multiple logistic regression predicting perceived risk of having a heart attack (N = 865).

	Unadjusted odds ratio (95% CI)	p-Value	Adjusted odds ratio[a] (95% CI)	p-Value
Age	1.01(.99–1.02)	.335	.99 (.98–1.01)	.309
Female gender	1.13 (.76–1.68)	.545	1.67 (.74–1.82)	.505
Race/ethnicity				
Caucasian	Reference	.005	Reference	.325[b]
Latino	.40 (.23–0.69)	.001	.64 (.27–1.37)	.231
Filipino	.63 (.38–1.04)	.072	.74 (.39–1.41)	.354
Korean	.48 (.28–0.82)	.007	1.09 (.48–2.48)	.836
Family history of early heart attack	3.13 (1.95–5.01)	<.001	2.92 (1.69–5.02)	<.001
Body mass index (kg/m^2)	1.08 (1.04–1.11)	<.001	1.08 (1.04–1.12)	<.001
Smoking	1.53 (.84–2.78)	.166	1.29 (.68–2.48)	.439
High blood pressure	2.78 (1.87–4.15)	<.001	2.36 (1.45–3.84)	.001
Physical inactivity	1.26 (.86–1.82)	.223	1.17 (.76–1.79)	.478
High cholesterol	1.84 (1.22–2.79)	.004	1.31 (.79–2.18)	.294
Low high-density lipoprotein cholesterol	1.82 (1.16–2.86)	.009	1.27 (.76–2.13)	.365

[a] Adjusted for years living in US, education, marital status, ethnicity, English as primary language, survey administration mode.
[b] Overall p-value.

attacks at a rate of 1 every 34 s, and 1 American dies of a coronary event every 83 s [23]. Despite these alarming statistics, only 14.3% of the survey participants perceived themselves as being more likely than others to have a heart attack in their lifetime. Moreover, Filipino Americans, the second fastest growing subgroup of Asian Americans [24], faces one of the highest incidences of coronary heart disease among all racial and ethnic groups [25], yet they did not perceive themselves at higher risk of heart attack than the other three racial and ethnic groups in this survey. On the other hand, approximately half of survey participants perceived a high risk of developing diabetes. Risk factors for diabetes and heart attack overlap significantly [26]. Yet, only 9.2% ($n = 82$) of participants perceived themselves to be at dual risk for developing diabetes and having a heart attack in their lifetime. Previous studies reported that diabetes was rarely perceived as a risk factor for heart attack among patients [27]. Thus, health care providers can assist patients in making this connection between diabetes and heart attack risk factors.

The findings also suggest that individuals with higher BMI and a family history of diabetes or early heart attack perceived themselves at greater risk for diabetes or heart attack, compared to those with lower BMI and no family history. Previous studies highlight possible factors for these heightened risk perceptions. For example, individuals with a family history of diabetes [28] or heart attack personally experienced the stress of managing these serious illnesses [29,30] as well as the wide range of their complications. Although this survey included a large diverse sample of English, Spanish or Korean speaking adults, the findings are similar to previous study results that included only English speaking samples [28,31]. The relationship between BMI and increased perceived risk of diabetes and heart attack has led to the recent broad public campaigns against the obesity epidemic in the United States. Acknowledging a family history of diabetes, heart attack, or obesity may provide an opportunity for healthcare providers to engage with patients about these conditions to promote better screening and reduce lifestyle risks [32,33].

In contrast, older age and physical inactivity, which are traditional risk factors for both diabetes and heart attack, were not associated with increased risk perception in this survey. Individuals who are age 65 years or older have a two-to four-fold increased risk of diabetes and heart attack, which accompany other known risk factors, such as hypertension, hyperlipidemia, and physical inactivity [23]. Given the rapidly growing number of older Americans [34], awareness of the potential disconnect between risk perception and actual health risks warrants further investigation to reduce the increasing burden of diabetes and heart attack in this older population.

4.2. *Strengths and limitations*

The inclusion of relatively large samples of Korean, Spanish and English-speaking adults allowed us to compare these racial and ethnic groups in relation to perceived risk of diabetes and heart attack, but several limitations of this survey study need to be acknowledged. First, risk factors were solely determined by participants' self-reports, and therefore subject to misclassification and underestimation of their prevalence. In addition, diabetes and heart attack risk perception was estimated using comparative risk questions that compare participant's personal risk estimate compared to persons of similar age and gender. Second, because this was a cross-sectional survey, causal relationships between the risk factors and perceived risk of diabetes or heart attack could not be determined. Third, the sampling of participants recruited from the San Francisco Bay Area and San Diego in California employed a non-proportional quota sampling method. Understudied racial and ethnic minority groups were intentionally over-recruited for the survey. Thus, the results from this study may not be generalizable to a more representative sample of the U.S. population.

4.3. *Clinical implications and conclusion*

The findings confirm that higher BMI and a family history of diabetes or early heart attack were related to an increased

perceived risk of diabetes and heart attack. However, age and physical activity were not associated with either risk perception, and few participants perceived a dual risk with diabetes and heart attack despite overlapping risk factors. Preventing diabetes and heart attack requires motivation and commitment to make healthy lifestyle changes, but accurate perception of their risks of diabetes and heart attack is the first step to make these lifestyle changes. Healthcare providers need to assess the discrepancies between the individual's risk perception and the presence of actual risk factors, and inform patients of the connection between diabetes and heart attack. To better meet the needs of these at-risk adults, and educate the general public, more effective and tailored communication strategies may need to be developed and tested in a racially and ethnically diverse population.

Conflict of interest statement

None of the authors have any conflict of interest by way of affiliation, financial agreement, or other involvement with any institution, company, or organization with a financial interest in the subject matter.

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