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Publication Date
2022-03-01

DOI
10.1016/j.hrtlng.2021.11.007

Peer reviewed

HHS Public Access

Author manuscript

Heart Lung. Author manuscript; available in PMC 2022 November 19.

Published in final edited form as:

Heart Lung. 2022 ; 52: 42–47. doi:10.1016/j.hrtlng.2021.11.007.

Perceived Heart Attack Likelihood in Adults with a High Diabetes Risk

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Abstract

Background: Heart disease is the leading cause of death for women and men in the United States. Yet, little is known about the motivation for care-seeking behavior for heart attack and the perception of self-risk of a heart attack in individuals, especially those at high risk for developing type 2 diabetes.

Objectives: This study aimed to describe knowledge and awareness of heart attacks and perceived risk for future heart attacks and evaluate factors associated with a low perceived risk of a heart attack in adults with a high risk for type 2 diabetes.

Methods: In this secondary data, cross-sectional study, the screening/baseline data of 80 adults participating in the mobile phone-based diabetes prevention program trial were analyzed. Validated measures assessed knowledge, self-efficacy, and heart attack risk perception were used. Logistic regressions were performed.

Results: The mean (standard deviation) age of participants was 55.4 (9.0) years. 32.5% of the sample failed to identify any heart attack symptoms. Half of the sample did not perceive their risk of having a heart attack in their lifetime. Older age, lower body mass index, not having a family history of heart attack, and current smokers were significantly associated with a lower perceived risk of heart attack ($P < .05$).

Conclusions: Healthcare providers need to assess the discrepancies between the individual's risk perception and the presence of actual risk factors of a heart attack in adults with a high risk for type 2 diabetes.

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[†]The current study was a secondary data analysis of the parent study "Mobile phone-based diabetes prevention program (mDPP) trial" by Dr. Yoshimi Fukuoka. The parent study was supported by the UCSF Diabetes Family Fund for Innovative Patient Care-Education and Scientific Discovery Award, K23 Award (NR011454), and the UCSF Clinical and Translational Science Institute (CTSI) as part of the Clinical and Translational Science Award program funded by the National Center for Advancing Translational Sciences (UL1 TR000004) at the NIH. The current study was funded by a grant (K24NR015812) from the National Institute of Nursing Research. The study sponsors had no role in the study design; collection, analysis, or interpretation of data; writing the report; or the decision to submit the report for publication.

Declaration of Competing Interest

None.

Keywords

acute coronary syndrome; cardiovascular diseases; risk perception; diabetes mellitus type 2; prevention; weight loss

Introduction

Heart disease continues to be the leading cause of death in both women and men in the United States.[1] Type 2 diabetes and obesity are major risk factors for heart disease. The incidence of type 2 diabetes has increased at an alarming rate. In 2020, 10.5% and 34.5% of adults in the United States had diabetes or prediabetes, respectively.[2] Over the past 20 years, the number of adults diagnosed with diabetes has more than doubled. The dramatic increase in the prevalence of diabetes and prediabetes can be explained mainly by the obesity epidemic. The prevalence of obesity among adults in the United States increased from 30.5% in 2000 to 42.4% in 2018.[3]

Approximately one in four adults who presented with acute coronary syndrome (ACS; i.e., heart attack) to a hospital had a history of diabetes.[4] Early access to effective reperfusion treatment reduces mortality and morbidity in individuals who experience ACS.[5–10] However, individuals with type 2 diabetes tend to delay seeking care (i.e., prehospital delay) during an ACS episode and are therefore more likely to experience adverse outcomes or death as a result of ACS than those without diabetes.[4] Despite significant advancements in reperfusion treatment for ACS, prehospital delay is the primary reason limiting access to this effective therapy.[11] Thus, to reduce prehospital delay time between ACS onset and hospital arrival, it is necessary for individuals to have some knowledge of ACS symptoms and risk factors (such as obesity and type 2 diabetes), and to take prompt action to seek care (such as calling 911).

However, prehospital delay times have remained unchanged over the past 20 years.[12] Previous studies have demonstrated that knowledge alone is insufficient to promote prompt care-seeking behavior during an ACS episode.[13,14] Self-efficacy for prompt recognition of and response to ACS symptoms and perceived heart attack risk play a vital role in reducing prehospital delay. However, little is known about the motivation for care-seeking behavior for ACS and the perception of self-risk of ACS in individuals who are at high risk for developing type 2 diabetes. This study aimed to describe knowledge and awareness of heart attacks and treatment and perceived risk for future heart attacks, and to evaluate factors associated with a low perceived risk of a heart attack in adults at high risk for type 2 diabetes.

Methods

Design and Sample

We analyzed the screening and baseline, cross-sectional data regarding knowledge of heart disease, heart attack awareness, and perceived risk of heart attack in 80 adults who participated in the Mobile Phone Diabetes Prevention Program (mDPP) trial, a randomized controlled trial comprising two groups designed to evaluate the potential efficacy of a

mobile phone-delivered weight loss and diabetes prevention program in adults at high risk for type 2 diabetes. A detailed description of this trial has previously been given.[15] The study protocol was approved by the University of California, San Francisco Committee on Human Research. All participants provided written informed consent. Participants in the San Francisco Bay Area were mainly recruited from primary care clinics by posting flyers about the study and via media and online advertising. Trained research staff assessed participants' initial eligibility criteria by telephone based on their self-reported information. The initial eligibility criteria assessed by phone were as follows: age greater than or equal to 35 years, body mass index (BMI) greater than or equal to 25 kg/m^2 (greater than or equal to 23 kg/m^2 for Asian-Pacific Islanders) based on self-reported weight and height, no diagnosis of type 1 or type 2 diabetes, high risk for diabetes (American Diabetes Association [ADA] Diabetes Risk Score greater than or equal to 5 points), being an English speaker, and not having a medical condition or other physical problems necessitating special attention in an exercise and/or diet program, and being physically inactive at work or during leisure time as assessed by the Stanford Brief Activity Survey.[16,17] The participants who met all initial eligibility criteria were invited for the screening and baseline visit.

Measures

Outcome measures—Three previously published scales were used in this study to assess heart attack knowledge, self-efficacy for recognizing and responding to heart attack symptoms, and the perceived risk of a future heart attack.[13,18,19] Knowledge of heart attack and self-perceived risk for ACS[18] were assessed using a modified version of the Knowledge Scale and Self-Perceived Risk Scale previously validated in diverse samples.[20,21] Knowledge of heart attack was measured using six statements adapted from the Heart Attack Knowledge Scale[18] with "true," "false," or "unknown" answer choices (four items required "false" responses and two required "true" responses). Examples included "Hospitals have drugs that reduce the damage done when a heart attack occurs," "Breast cancer is the most common cause of death in women in the United States" (for the female sample), and "Lung cancer is the most common cause of death in men in the United States" (for the male sample). Only correct answers received a point. The total knowledge score ranged from 0 = *minimally knowledgeable* to 6 = *highly knowledgeable*.

In the present study, self-efficacy for recognizing heart attack symptoms and seeking health care was assessed by means of four questions modified from the ACS Response Index.[19] The modified scale comprised two items that tested symptom recognition and two items that assessed confidence in seeking medical attention for a heart attack. These four items were measured using a 4-point Likert-type scale ranging from 1 = *not sure* to 4 = *very sure*, and overall self-efficacy was calculated by summing the scores for all four items, with scores ranging from 4 = low self-efficacy to 16 = high self-efficacy.

Perceived risk of a future cardiac event was measured by two questions: "Compared with other women/men your age, how likely do you think it is that you could have a heart attack in the next five years?" and "Compared with other women/men your age, how likely do you think it is that you could have a heart attack in your life-time?"[18] Participants' responses

were rated on a 5-point Likert-type scale ranging from 1 = *much less likely* to 5 = *much more likely*.

Lastly, we used an open-ended question to assess participants' knowledge of the signs and symptoms of heart attack for women or for men. The phrasing of the question was in concordance with the participants' sex. In particular, two questions were phrased slightly differently by gender (i.e., "Breast cancer/Lung cancer is the number one cause of death in women/men," "Caucasian women/men face a greater threat from heart disease than other women/men of other races"). Participants were encouraged to list as many signs and symptoms of heart attack as possible.

Other Measures—Sociodemographic information and self-reported cardiovascular disease risk factors were collected from participants at the screening and baseline visit. Men were assessed for a history of early family heart attack by asking, "Has your father or brother had a heart attack before the age of 55?" Women were asked, "Has your mother or sister had a heart attack before the age of 65?" Three responses were possible, "yes," "no," or "do not know." The American Diabetes Association Type 2 Diabetes Risk Test was used to assess participants' risk of being prediabetic and thus at high risk for type 2 diabetes.[22] Possible total scores ranged from 0 to 11 points, with higher scores indicating greater risks. Those with a total score equal to or greater than 5 points were at greater risk of being prediabetic. Trained research staff measured glycated hemoglobin (HbA1c) using a point-of-care (POC) test kit (Bayer's A1CNow + ®) in the research office. The Stanford Brief Activity Survey assessed participants' daily physical activity intensity levels during the past year.[16,17] It consists of five categories: inactive, light activity, moderate activity, hard activity, and very hard activity.

In addition, trained research staff measured participants' weight using a Tanita WB-110 digital electronic scale (Tanita Corporation of America, Inc., Arlington Heights, IL, USA) and height using a standard stadiometer in the research office. Each participant's BMI was calculated using these measurements.

Data Analysis

Descriptive statistics were used to describe participants' sociodemographic characteristics, cardiovascular risk, physical activity, heart attack knowledge, self-efficacy, and risk perception. For logistic regressions, we dichotomized heart attack risk perception responses into two categories (lower/same risk versus higher risk perception). Univariate logistic regression analyses were performed to estimate the associations between each independent variable and heart attack risk perception. We then conducted a multivariate logistic regression analysis to investigate the roles of sociodemographic factors, cardiovascular risk factors, and physical activity on heart attack risk perception. Statistical significance was set at $P < .05$. All analyses were performed using SPSS (version 21.0; IBM, Chicago, IL, USA).

Results

Sample Characteristics

Table 1 presents the sociodemographic characteristics and cardiovascular risks of the study participants. The mean age was 55.4 [standard deviation (SD) = 9.0)] years, 71.3% were women, 76.3% had a bachelor's or graduate degree, 52.5% were married or cohabitating, 57.5% were employed, and 51.2% self-identified as belonging to a racial/ethnic minority group. In addition, 66.3% of the participants reported that they had participated in a diet program in the past. The average rating of their own general health status was 4.8 (SD = 1.1) on a scale of 1 = *poor health* to 7 = *best health*. The mean American Diabetes Association Diabetes Risk Test score was 6.0 (SD = 1.3) points, the mean HbA1c was 5.4 (SD = 0.5)% with a range between 4.3% to 7.1%, and the mean BMI was 33.4(SD = 6.0) kg//m^2. A total of 21.3% reported having a family history of an early heart attack.

Description of Heart Attack Knowledge, Self-efficacy, and Perceived Risk for a Future Heart Attack

Table 2a summarizes the average total scores of heart attack knowledge and the percentage of correct answers for each question. The total mean score of heart attack knowledge among the 80 participants was 4.2 (SD = 1.4), meaning that 4.2 out of the 6 questions were correctly answered. The mean total score did not differ between men and women, M = 4.1 (SD = 1.5) versus M = 4.4 (SD = 1.1), respectively; $P = .452$. Table 2b. presents the average total scores of self-efficacy for recognizing and responding to heart attack symptoms, M = 9.7 (SD = 3.3). Table 2c. summarizes the perceived risk of future heart attack (i.e., in the next five years and in their lifetime). Despite their risks, 28.8% and 25.0% of the sample reported that they were somewhat or less likely than others who were of their same age and sex to have a heart attack in the next five years and in their lifetime, respectively, while 28.8% and 25.0% of the sample reported that their likelihood was the same in the next five years and in their lifetime, respectively. No sex difference was observed in these responses ($P = .466$). A striking finding was that 32.5% of the study participants did not list any heart attack symptoms. Of the remaining participants, only 62.5% listed chest, arm, shoulder, and/or jaw pain or tightness/discomfort as symptoms of a heart attack.

Low Perceived Risk of Developing a Heart Attack

Table 3 presents the results of the univariate logistic regression analyses and multivariate logistic regression analysis predicting a low perceived risk of a heart attack. The four statistically significant predictors in the multivariate logistic regression were as follows: (1) age (adjusted odds ratio [AOR] = 1.119; 95% CI, 1.031-1.215; $P = .007$), (2) smoking (AOR = 11.773; 95% CI, 1.041-133.103; $P = .046$), (3) BMI (AOR = .893; 95% CI, .806-.991; $P = .032$), and (4) family history of heart attack (AOR = .228; 95% CI, .057-.912; $P = .037$).

Discussion

In this study, we evaluated the knowledge, awareness, and perceived heart attack risk among participants at high-risk for type 2 diabetes. Despite their significant risks, half of the total number of participants underestimated the risk of having a heart attack during their

lifetime. Furthermore, approximately one in three participants could not list any heart attack symptoms and believed that breast or lung cancer was the leading cause of death for women and men, respectively. Compared to the findings in other large studies,[23,24] the high-risk sample in the present study had less knowledge and awareness regarding heart attacks than the general public. These findings raise several concerns.

According to the 2017 National Health Interview Survey in the United States, approximately 94% of the sample could report at least one heart attack symptom, while half of the sample could list five common heart attack symptoms.[23] Another survey by the American Heart Association reported that 16.5% of women believed that breast cancer was the leading cause of death for them.[24] Over the past two decades, several awareness campaigns designed to educate the public about heart disease in women have been conducted (e.g., Go Red for Women, The Heart Truth).[25,26] However, despite these campaigns, recent reports have shown that public heart attack awareness has declined in the past 10 years. A potential explanation is that individuals with multiple heart attack risk factors may unconsciously avoid information related to heart attacks. The tendency to avoid health information is closely related to emotional factors such as anxiety and fear, as well as to cognitive factors such as self-efficacy. According to the Extended Parallel Processing Model, information avoidance is likely to occur when individuals have a high level of fear regarding health threats (e.g., experiencing a heart attack,) but do not believe they can control the threats themselves (i.e., low efficacy).[27,28] The high-risk participants in the present study may have avoided heart attack-related information as a result of high level of fear and low level of efficacy.

The finding in the present study that older age and current smoking status are associated with a lower perceived risk of heart attack is counterintuitive. This finding can be explained in terms of a bias known as comparative optimism. Consistent with previous studies, older individuals were more likely to underestimate their own heart attack risk.[29–31] Age is a non-modifiable risk factor for ACS. The reported average age for a first heart attack was approximately 66 years for men and 72 years for women in the United States.[32] However, older adults may not be aware of these facts and underestimate their own risks. Regarding smoking status, previous research suggests that smokers can exhibit comparative optimism bias that minimizes their perceived risk of developing heart disease. For example, in one study, smokers exhibited more optimistic perceptions regarding their heart attack risk than non-smokers.[33,34]

The important role of BMI and family history in heart attack risk perception has been reported in previous studies[35,36] which have shown that a lower BMI or absence of family history of heart attack is related to lower heart attack risk perception. This is consistent with the current study’s findings, which suggest that BMI is a consistent factor associated with a high perceived risk for future heart attack. This consistency might be explained by the effect of public and media campaigns to halt the growing epidemic of obesity in the United States. In addition, previous research has shown that individuals with a family history of heart disease experience stress in managing this illness.[37]

Previous studies have reported mixed results on the association between knowledge of heart attack and sex. In one study,[18] women were found more likely to possess accurate knowledge about heart disease compared to men, whereas no differences in knowledge between men and women were observed in other studies.[21,38] Meanwhile, previous research found that men had higher self-efficacy than women.[21] In the current study, the non-significant relationship between perceived heart attack risk and sex was consistent with the results of previous studies.[21,39]

Finally, several limitations must be considered when interpreting the present study's findings. First, only participants who were overweight or obese and who were at high risk for type 2 diabetes were recruited, all of whom were highly motivated to lose weight to avoid having the disease. Without participants with a low risk for type 2 diabetes in this study, the results may not be generalizable to populations where these conditions are absent. Second, the participants' risk factor data were assessed by self-report, which may have resulted in the underreporting of their risks. Lastly, the sample size was relatively small, resulting in the considerable variability in some results. For instance, the number of current smokers was very small. Although aging is a significant predictor for type 2 diabetes and ACS, the mean age of the sample was relatively low (55 years old). Thus, the results should be interpreted with caution, and the replication of the study's findings in a large high-risk sample is warranted.

Implications for practice

The findings of this study suggest that healthcare providers need to assess the discrepancies and concordance between the individual's risk perception and presence of actual risk factors of a heart attack in adults with a high risk for type 2 diabetes. In particular, aging increases the risk of ACS and type 2 diabetes, but the perceived risk of a heart attack in relation to age has an opposite association. Given the rapidly growing aging population, low self-perceived risk of a heart attack in this population may need to be addressed through education programs in clinical settings.

Conclusion

This study demonstrated that adults with overweight/obesity at high risk for developing type 2 diabetes underestimate their risk of heart attack, as evidenced by one in three study participants being unable to list any heart attack symptoms. These findings highlight the importance of assessing the risk perceptions of adults at high risk for developing type 2 diabetes before encouraging lifestyle modifications or educating about heart attack symptoms and prompt care-seeking during a heart attack. Finally, the study's findings will need to be confirmed with a large study including nationally representative, diverse samples of American adults with a wide range of type 2 diabetes risks.

Abbreviations:

ACS	Acute coronary syndrome
BMI	body mass index

SD	standard deviation
CI	confidence interval
OR	odds ratio

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Table 1

Clinical and demographic characteristics of the sample (N = 80)

Sociodemographics		**Mean (SD) or %(n) [Range]**
Age (years)	-	55.4 ± 9.0 [36-76]
Sex	Men	28.8 (23)
	Women	71.3 (57)
Education	Completed high school	1.3 (1)
	Some college education	22.5 (18)
	Completed college or graduate school	76.3 (61)
Marital status	Married/cohabitating	52.5 (42)
	Never married/ divorced/widowed	47.6 (38)
Employment	Employed for paid	57.5 (46)
	Unemployed/home maker/retired/disabled/other	42.5 (34)
Ethnicity	White	48.8 (39)
	Asian	20.0 (16)
	African American	8.8 (7)
	Hispanic	12.5 (10)
	Multiracial	10.0 (8)
Past diet program	Yes	66.3 (53)
How would you rate your general health status?		4.8 (1.1) [2-7]
American Diabetes Association Diabetes Risk Score		6.0 (1.3) [3-9]
Glycated hemoglobin (HbA1c) *a)*		5.4 (0.5) [4.3-7.1]
Cardiovascular risk factors		
Current smoker	Yes	6.3 (5)
Body Mass Index kg/m^2		33.4 (6.0) [24.4-54.1]
Told I have high blood pressure	Yes	46.3 (37)
	No	52.5 (42)
	Don’t know	1.3 (1)
Told I have high total cholesterol	Yes	41.3 (33)
	No	40.0 (32)
	Don’t know	18.8 (15)

Sociodemographics		Mean (SD) or %(n) [Range]
Has your mother, sister, father, or brother had a heart attack?	Yes	21.3 (17)
Physical activity		
Stanford Brief Activity Survey (Activity intensity categories)	Inactive	21.3 (17)
	Light	75.0 (60)
	Moderate	3.8 (3)
	Hard	0.0 (0)
	Very hard	1.0 (0)

[a)]Measured by a point-of-care (POC) test kit (Bayer's A1CNow + ®) in the research office

Table 2

Heart attack knowledge, self-efficacy, and heart attack risk perception

Table 2.a. Total mean score and percent of correct answer of heart attack knowledge

	Total (N = 80)	Women (n = 57)	Men (n = 23)
Total mean score[a] (SD, median, range)	**4.2 (1.4, 4.0, 0-6)**	**4.1 (1.5, 4.0, 0-6)**	**4.4 (1.1, 4.0, 2-6)**
Questions			
1. Breast cancer/Lung cancer is the number one cause of death in women/men (correct response: false)			
Correct % (n)	62.5 (50)	61.4 (35)	65.2 (15)
2. Almost all heart attacks in women/men occur in people older than 65 years (correct response: false)			
Correct % (n)	72.5 (58)	68.4 (39)	82.6 (19)
3. The symptoms of heart attack are always sudden & severe (correct response: false)			
Correct % (n)	90.0 (72)	91.2 (52)	87.0 (20)
4. Caucasian women/men face greater threat from heart disease than other women/men of other races (correct response: false)			
Correct % (n)	66.3 (53)	64.9 (37)	69.6 (16)
5. The symptoms of heart attack can be mild, take days to develop (correct response: true)			
Correct % (n)	75.0 (60)	75.4 (43)	73.9 (17)
6. Hospitals have drugs that reduce the damage done when a heart attack occurs (correct response: true)			
Correct % (n)	53.8 (43)	50.9 (29)	62.5 (14)

Table 2.b. Mean score of self-efficacy for recognizing and responding to heart attack symptoms

	Total (N = 80)	Women (n = 57)	Men (n = 23)
Total mean score[b] (SD, median, range)	**9.7 (3.3, 10.0, 4-16)**	**9.6 (3.4, 10.0, 4-16)**	**9.7 (3.0, 9.0, 4-15)**
Questions			
1. How sure are you that you could recognize the signs and symptoms of a heart attack yourself			
Mean score[c] (SD)	2.2 (0.9)	2.2 (1.0)	2.2 (0.9)
2. How sure are you that you could tell difference between the signs or symptoms of a heart attack and other medical problems?			
Mean score[c] (SD)	2.0 (0.9)	2.1 (1.0)	1.9 (0.8)
3. How sure are you that you could call an ambulance or dial 911 if you thought you were having a heart attack?			
Mean score[c] (SD)	2.7 (1.1)	2.6 (1.1)	2.7 (1.1)

Table 2.a. Total mean score and percent of correct answer of heart attack knowledge			
	Total (N = 80)	**Women (n = 57)**	**Men (n = 23)**
4. How sure are you that you could get to an emergency room within 60 minutes after onset of your symptoms?			
Mean score[c] (SD)	2.8 (1.0)	2.8 (1.1)	3.0 (0.8)

Table 2.c. Responses to the perceived risk of heart attack			
	Total (N = 80)	**Women (n = 57)**	**Men (n = 23)**
Questions			
Compared to other women/men your age, how likely do you think it is that you could have a heart attack in the next 5 years?			
Much less/somewhat less likely % (n)	28.8 (23)	26.3 (15)	34.8 (8)
About the same % (n)	28.8 (23)	24.6 (14)	39.1 (9)
Somewhat more/much more likely % (n)	42.4 (34)	49.1 (28)	26.1 (6)
Compared to other women/men your age, how likely do you think it is that you could have a heart attack in your lifetime?			
Much less/somewhat less likely % (n)	25.0 (20)	22.8 (13)	30.4 (7)
About the same % (n)	25.0 (20)	22.8 (13)	30.4 (7)
Somewhat more/much more likely % (n)	50.0 (40)	54.4 (31)	39.1 (9)

[a]Possible total score ranges from 0 (low knowledge) to 6 (high knowledge). “Don’t know” and wrong answers were coded as incorrect (0).

[b]Possible total score ranges from 4 (low self-efficacy) to 16 (high self-efficacy)

[c]Possible each score ranges from 1 (not sure) to 4 (very sure)

Table 3

Predicting a lower perceived risk of heart attack (N = 80)

	Unadjusted			Adjusted[a]		
	OR	**95% CI**	***p*-value**	**OR**	**95% CI**	***p*-value**
Female	.539	.201 to 1.446	.220	.601	.173 to 2.083	.422
Age (years)	1.069	1.013 to 1.130	.016	1.119	1.031 to 1.215	.007
Completed college or graduate school	1.148	.409 to 3.219	.793	1.856	.459 to 7.515	.386
Non-White	.740	.307 to 1.783	.503	.536	.170 to 1.689	.287
Smoking	1.541	.243 to 9.754	.646	11.773	1.041 to 133.103	.046
BMI (kg/m^2)	.883	.807 to .966	.006	.893	.806 to .991	.032
High blood pressure	.904	.375 to 2.179	.823	.309	.085 to 1.129	.076
High cholesterol (> 200mg/dl)	.733	.300 to 1.791	.496	.309	.090 to 1.054	.061
Family history of heart attack	.333	.105 to 1.059	.062	.228	.057 to .912	.037
Little or moderately active	.333	.105 to 1.059	.062	.329	.076 to 1.419	.136

Abbreviations: BMI = body mass index; CI = confidence interval; OR = odds ratio.

[a]All variables were included in the multivariate logistic regression model.