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Predictors of diabetes risk perception among college students

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Abstract

Objective: To explore the diabetes knowledge and future disease risk perception of college students.

Participants: 697 college students were purposefully recruited at a large state university and completed an online survey.

Methods: Diabetes knowledge, future disease risk perception, lifestyle, and demographic factors were assessed.

Results: The majority of students (56%) reported a family history of diabetes but perceived their diabetes risk as low/moderate (90%). Logistic regression indicated higher knowledge (OR, 1.07; 95% CI, 1.01–1.13), age (OR, 1.08; 95% CI, 1.00–1.16), bodymassindex (BMI) (OR, 4.90; 95% CI, 2.33–10.30) and family history of diabetes (OR, 4.30; 95% CI, 1.97–9.40) increased perception of future diabetes risk. Those who self-rated their health as good/excellent and read food labels regularly/often had lower perceived future risk of diabetes.

Conclusions: Results highlight the importance of educating college students on diabetes risk factors as well as primary/secondary prevention for reducing diabetes incidence in this age group.

Keywords

Diabetes knowledge; college students; type 2 diabetes mellitus; risk factors; perceived risk

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Conflict of interest disclosure

The authors have no conflict of interest to declare for this study.

Data availability statement

The data that support the findings of this study are openly available in Harvard Dataverse at https://doi.org/10.7910/DVN/IL48NT.

Introduction

In the United States (U.S.), an estimated 30.3 million individuals (9.4% of the population) have diabetes.[1] Diabetes is the seventh leading cause of death with total healthcare costs equaling $327 billion in 2017.[2] The burden of diabetes is especially high in West Virginia (WV), the only state which is entiet alrely situated in the Appalachian region. According to the American Diabetes Association's 2020 statistics, the prevalence of type 2 diabetes mellitus (T2DM) in WV is 15.0%, and it is the second-highest in the nation.[3,4] Diabetes is often associated with comorbidities such as obesity, cardiovascular disease, and hypertension.[5] Although the onset of diabetes was generally at middle age, new data shows young people have experienced an increase in T2DM diagnosis.[6,7] Therefore, diabetes is the ninth leading cause of death among 25 to 44 years old (2018), and prevalence rates among 18- to 44-year-olds have increased throughout the last two decades.[1,8] In the U.S., during 1999–2002, the age-adjusted prevalence of diabetes was 9.5%, which increased to 12% during 2013–2016.[1] T2DM is caused due to insulin resistance in the body when the cell does not respond to the insulin secreted by the pancreas leading to increased blood glucose level. The consequent increase of blood glucose level produces pre-diabetes, which, if left untreated, eventually leads to the onset of T2DM.[9] Treatment of T2DM includes not only clinical treatment, i.e., oral diabetic drugs and insulin, but also self-management by the individual. Major components of diabetes management include healthy eating, physical activity, medication adherence, stress management as well as routine doctor's appointments for disease management of other associated comorbid health issues.[9]

Many common chronic diseases, such as diabetes, are influenced by health behaviors.[10] Young adults, 18 to 24 years of age, report unhealthy lifestyle behaviors that are associated with chronic diseases, e.g., poor diet, physical inactivity, substance use.[11] The National College Health Assessment (2019) of 38,679 U.S. college students showed 39% were overweight or obese, based upon self-reported height and weight.[12] In addition, 55.4% reported insufficient or no moderate physical activity, 75.5% lacked vigorous physical activity, 97.3% did not meet the recommended intake of five servings of fruits, and 94.3% reported not consuming five servings of vegetables per day.[12] Given these high rates of unhealthy lifestyle behaviors, young adults may be at greater risk of T2DM than previous generations.

Furthermore, the transition of high school to college is known to be challenging.[13] In addition to the coursework, adjustment of noncurricular adjustments (e.g., peer influence, parental expectations, etc.), increase in binge drinking and smoking have also been noted as regular, habitual behaviors.[14] During this formative stage, developing a healthy lifestyle is based on their early life experience as well as the education that they receive from home and school.[15] By exploring the new habits as well as by social influence, i.e., family and peers, young adults develop self-identity and self-awareness that contribute to their health behaviors.[13] An unhealthy lifestyle in this stage of life is associated with weight gain, which is associated with diabetes and other comorbidities later in life.[13]

Gender and racial/ethnic differences in health behaviors among college students have also been noted.[16–18] Rehman et al found that self-reported health behaviors (such as the

tendency to avoid fatty foods and intention to lose weight) were more prevalent in female students than male students. They also found males perceived health status more positively and rate it as excellent or very good as compared to their female counterparts.[16] However, studies are inconsistent on male students' adoption of risky health behaviors.[17,18] Dawson reported a higher rate of adoption[17], which conflicts with Olfert and her colleagues that noted male students exhibit less risky health behaviors.[17,18] However, males reported higher levels of physical activity and lower stress than female students.[18]

The health belief model (HBM) posits that a person's health behavior depends on his/her perceived susceptibility, severity, benefits, and barriers to reducing the risk of a disease, as well as self-efficacy, knowledge, and experience.[19,20] Studies in other countries have shown that students do not possess adequate knowledge of diabetes.[21–24] In the US, several studies have examined the perception of chronic disease and lifestyle factors (e.g. diet and physical activity) among college students[15,21,23,25–27], yet few have investigated diabetes knowledge and future risk perception, a major component of most health behavior theories. Since many young adults have shown misperceptions and inaccurate knowledge of chronic diseases[28], knowledge of diabetes, its risk factors as well as future disease risk perception are crucial to embracing healthy lifestyle modifications recommended in the primary prevention of diabetes.[29] The objective of this research was to determine diabetes knowledge and future disease risk perception among college students in a large public university in West Virginia, a state entirely within the Appalachian region. Since differences in health risk factors are noted between college men and women, gender differences were also examined.

Methods

Design

A cross-sectional survey was conducted assessing diabetes knowledge of risk factors, symptoms, and treatment/complications. The study was approved by the West Virginia University (WVU) Institutional Review Board (IRB).

Participants

A purposive sample of college students (N=697) was recruited, during April and May 2018, from the enrolled undergraduate and graduate students of WVU, which is the largest land-grant institution in WV. Eligible students were as follows: age 18 years and older, enrolled part-time or full-time, and able to voluntarily complete an online survey.

Data collection

An online survey was developed and conducted using the Research Electronic Data Capture (REDCap) hosted at WVU.[30,31] A Uniform Resource Locator (URL) was created for the participants to access the online survey. An invitation to the survey link and a cover letter describing the purpose of the study was sent to all WVU students via email. Flyers with a scannable QR (Quick Response) code to the survey link were also posted on the bulletin boards in various academic buildings. Additionally, the researchers went to large classrooms to invite participation, answered any questions, and distributed flyers with the QR code link to the survey.

Measures

Demographics—Demographic information included age, gender, ethnicity, state or residency, height, and weight. Body mass index (BMI) was calculated using self-reported height and weight and then categorized into underweight, normal, overweight, and obese.[32]

Family history of diabetes—Family health history is an important risk factor for developing diabetes in the future. Hence, participants were asked whether they had a family history of diabetes (grandparents, uncle, aunt, parents, or siblings). The response was coded as 1=Yes, 0=No.[33] A "don't know" response option was not included to force participants to best guess their family history. Prior research indicates that when respondents are asked to guess, they are able to provide correct answers to factual questions more frequently than if they were just choosing randomly.[34] When people really do not know, the best guess will still be more beneficial than a "don't know" response.

Diabetes knowledge—The diabetes knowledge survey was developed by two medical/public health professional experts. The first author is a medical doctor with a focus on public health and the last author is a diabetes disparities expert with a focus on epidemiological and intervention studies. A literature review showed no validated surveys on the current topic that could be used for this study. Therefore, available surveys were modified, and additional questions were added for a comprehensive assessment of diabetes knowledge risk perception.[22,35–39] The survey was reviewed by a public health researcher and suggestions were incorporated for content validity.

Diabetes knowledge was assessed by 23 questions that focused on general knowledge of diabetes, risk factors, symptoms, diagnosis, and treatment, complications, and prevention of T2DM. A scoring system was developed where each correct response received one point, and incorrect/no response received zero. Questions with multiple responses (e.g., knowledge of T2DM symptoms, complications, and prevention approaches) were coded similarly. The questions were summed for a total composite diabetes knowledge score (range 0– 40) with a higher score indicating higher knowledge of diabetes. Cronbach's alpha (α) of the diabetes knowledge scale was 0.861, indicating good reliability.

Health behavior—Questions related to participants' health behavior included the use of tobacco products (1=Yes, 0=No), consumption of alcohol (1=Not at all, 2=Sometimes, 3=Regularly), exercise frequency (1=Less than once/week, 2=1–2 Times/per week, 3=2–4 Times/week, 4=5≥Times/week), reading food labels (1=Never, 2=Sometimes, 3=Often, 4=Always), self-rated physical health (1=Poor, 2=Fair, 3=Good, 4=Very good, 5=Excellent), and perceived future risk of developing diabetes (1=No risk to 5=Extremely high risk).

Data analysis

Simple descriptive statistics were computed to provide basic information about the participants. Means and standard deviations were calculated for continuous variables, and percentages were calculated for categorical variables. Univariate one-way analysis of variance (ANOVA) was used to compare gender differences in the study variables, and the Chi-square test was used for categorical variables to determine association. Logistic

regression assessed perceived future risk of developing diabetes (dependent variable; recategorized as no/low/moderate risk versus high/extremely high risk). Continuous predictor variables included diabetes knowledge score and age. Categorical predictor variables were gender, BMI, family history of diabetes, self-rated physical health, exercise frequency, and food label reading behavior. Reading food labels, self-rated physical health, and perceived future risk of diabetes were dichotomized due to the limited number of responses in some categories. Participants who reported having either type 1 DM (T1DM) or T2DM (3.3%) were removed from the logistic regression analysis. The significance level of 0.05 was used for all analyses. Data were analyzed with IBM SPSS Statistics for Windows, Version 25.0.[40]

Results

Demographics

A total of 702 students completed the online survey. Incomplete responses were discarded (n=5) with a final sample of 697 complete surveys used for data analyses. Most of the participants were females (75.8%) and Non-Hispanic whites (84.5%). The mean age and BMI were 21.91 years (SD 4.48) and 24.90 (SD 4.96), respectively. Self-reported weight for height showed that 3.9% of students were underweight, 54.4% had normal BMI, 28.0% were overweight, and 13.7% were obese. More than half of the participants (56.0%) self-reported they had a family history of diabetes. Very few participants (3.3%) self-reported having either T1DM or T2DM.

Health behaviors

Approximately one-third (34.1%) of the participants reported they engaged in at least 30 minutes of physical activity 1–2 times per week, and 33.1% reported physical activity of 3–4 times per week. Only 13.9% had the recommended level of physical activity of 5 or more times per week (13.9%). Approximately 43% of the students reported reading food labels often or always, and 57% never or sometimes read them. One-fifth (21%) of students rated their physical health as poor or fair, and 79.4% rated it as good, very good, or excellent. In terms of health-risk behavior, more than two-thirds consumed alcohol sometimes or regularly (76.4%) and 14.5% used tobacco products.

Diabetes knowledge and risk perception

The mean diabetes knowledge score of the participants was 27.60 (SD 6.91; range 0– 40), indicating a moderate level of knowledge regarding the disease and its associated risk factors & complications. Approximately 91% of participants perceived no, low, or moderate risk of developing diabetes in the future, and only 9% perceived their risk as high or extremely high. Participants with a family history of diabetes were significantly more likely to perceive their future risk to be high or extremely high (14.5%) than those with no family history (3.0%; $p<.001$).

Gender difference in health behavior, diabetes knowledge, and risk perception

Gender differences in study variables are shown in Table 1. The mean diabetes knowledge score for male and female students was 26.51 (SD 7.21) and 27.97 (SD6.78), respectively.

Females had significantly higher diabetes knowledge (p=.017) but were more likely to be overweight and obese as compared to their male peers (p=.005). Interestingly, no significant differences were noted in the perceived future risk of diabetes as well as alcohol consumption between male and female students.

Predictors of perceived future risk

To determine the factors which contribute to the students' perception of developing diabetes in the future (Table 2), we used logistic regression to predict students' perceived future risk. Prior to the multivariate analysis, perceived risk was dichotomized as no, low, or moderate risk and high/extremely high risk. Predictor variables included demographic variables, diabetes knowledge, and lifestyle behaviors. Results showed the following variables as significant predictors of perceived future risk: diabetes knowledge, BMI, family history of diabetes, self-rated health, and food label reading behavior. Students who perceived their risk to be high or extremely high had higher diabetes knowledge (includes risk factors, complications, symptoms, and treatment; OR, 1.07; 95% CI, 1.01–1.13), were overweight/obese (OR, 4.90; 95% CI, 2.33–10.30) and had a family history of diabetes (OR, 4.30; 95% CI, 1.97–9.40). Interestingly, students who self-rated their health as good, very good or excellent (OR, .38; 95% CI, .19–.74) and read food labels on a regular basis (often/always) (OR, .40; 95% CI, .18–.89) perceived lower risk of developing diabetes in the future. Similar to the bivariate analysis, no gender difference was noted in risk perceptions while controlling for demographic and lifestyle factors in the model. Furthermore, physical activity was not associated with future diabetes risk perception.

Discussion

Our results highlight that college students have misperceptions of diabetes risk despite the presence of known risk factors such as family history, overweight/obesity status, and a sedentary lifestyle. Prior research shows students' misperceptions can be the result of limited knowledge of diabetes risk factors and concurs with our findings.[28,41] In addition, studies indicate students have false beliefs about developing chronic conditions.[28,41] For example, individuals can lack knowledge of specific foods that affect glycemic load.[38,42] Although females were similar to males in their risk perceptions, they had higher diabetes knowledge, which concurs with research by Xu et al and, Al-Mahrooqi et al that showed female students possess a higher knowledge of diabetes than their male counterparts.[22,37]

College students who are at increased risk for T2DM (e.g., overweight or obese, have unhealthy lifestyle behaviors or a family history of diabetes) could benefit from diabetes education. Family history of diabetes is an important risk factor and reflects the genetic predisposition of developing diabetes in the future. In this study, more than 50% of the participants reported diabetes in first-or second-degree relatives. Hence, it was not surprising that students with a family history of diabetes perceived higher risk of developing diabetes. This is supported by prior literature in young adults.[43,44] Although diabetes is not prevalent in college students, 3.3% of the participants reported they had either T1DM or T2DM. However, T2DM can be prevented in this population.[5,45,46]

With diabetes being a major disease burden for both WV and the U.S.[1], health education programs, focused on primary and secondary prevention to modify health behaviors, can help prevent or delay the early onset of diabetes.[47] Hence, comprehensive approaches to health education for students on college campuses can promote a healthy diet, engagement in recommended levels of physical activity for maintaining or managing weight and participation in annual diabetes screenings. More specifically, diabetes education can improve diabetes knowledge and awareness to reduce modifiable risk factors and prevent future complications, which can have effects on every organ system of the body.[48] Furthermore, diabetes education for college students can be at a higher health literacy level to include the pathophysiology, disease progression from normoglycemic, pre-diabetes and diabetes status, and complexity of this metabolic disease, with an emphasis on the importance of primary and secondary prevention and quality of life.

Young adulthood is also the time for the onset of health-promoting or health defeating behaviors. Most of the participants did not meet the weekly physical activity recommendations (86.0%) and were overweight (28.0%) or obese (13.7%), indicating a potential risk for early onset of T2DM. Since behavioral patterns and knowledge established during young adulthood can influence the risk of developing chronic disease later in life[49,50], health education academic programs at this stage can target chronic disease prevention as a way to prevent early onset of diabetes. Also, college students knowledge of diabetes and future risk perception might change later in their life, identifying strategies and outcome indicators for health behaviors can lay the foundation as they become older.

HBM is widely used to measure health beliefs and behaviors.[51,52] The perceived susceptibility, severity, benefits, and barriers are four main components of the HBM. For example, college students who are at increased risk due to a family history of T2DM, unhealthy behaviors such as poor dietary habit and sedentary lifestyle and higher BMI can be educated about the risk factors and complications of diabetes, understand the significance of the disease burden and make sustainable lifestyle changes (self-efficacy).[53] As reported in our findings, future diabetes risk was associated with not only higher BMI and having a genetic predisposition but also nutrition awareness and label reading behavior. According to HBM, the perceived severity of a disease is a crucial factor in the adoption of healthy behaviors for primary prevention.[54,55] Students who perceive T2DM susceptibility might be compelled to identify unhealthy lifestyles (perceived barriers) for behavior modification to reduce or maintain a normal BMI status as well as possible solutions for poor dietary habits such as reading food label for improving purchasing decisions and what they eat (perceived benefits) in preventing T2DM. Identification of barriers and benefits of a healthy lifestyle to prevent chronic diseases can trigger the decision-making process of young college students and motivate them (cue to action) to address their risk. Moreover, prior literature indicate that college students who adopt healthy lifestyle behaviors have better academic performance.[56,57]

In our study, 79.5% of the students self-rated their health status as very good to excellent. Furthermore, these participants also perceived a lower risk of developing diabetes in the future. Larsman et al noted in a literature review that young college students have a lower perceived risk of developing disease due to optimism bias.[58] The authors proposed young

adults to balance the risk perception, disease knowledge, self-efficacy and cost-benefit of health behavior changes and encourage them to take responsibility of their long term health.[58] Since diabetes screening is currently opportunistic and heavily reliant on risk perception, our results highlight a greater understanding and research into preventive health for college students.[59]

Although our study examined diabetes knowledge of the college students and their future risk perception, yet it is not without limitation. First, the cross-sectional design did not allow for causal inference. Second, the majority of respondents were white females (79%), which is more than the distribution of the total student population (50% females) limiting generalizability.[60] Additionally, responses were self-reported, especially on height, weight, and family history questions, which could have a recall or social desirability bias. There is also the possibility that response bias was present, and respondents could have selected responses at random without following instructions correctly due to the nature of an online survey. However, the large sample size minimizes such outliers. As with all surveys, definitions and items can be open to interpretation. Future research should use random representative samples of college and non-college students to assess diabetes knowledge and perceived future risk of T2DM among young adults. Further, closed questions and open-ended questions can provide a better understanding of how to move young adults from preparedness to take responsibility for future prevention. Longitudinal assessments of students' perceived and actual risk for diabetes will also be vital to disease prevention.

Conclusion

Our findings highlight moderate level of diabetes knowledge among college students with misperceptions of future risk based on self-reported good health. Risk perceptions of college students was based upon a variety of factors including actual health behavior, knowledge of the disease and genetic predisposition. However, education to improve knowledge of risk factors may be necessary but not sufficient to change health behavior in this population. Hence, diabetes prevention education must be tailored to address misperceptions and highlight strategies and opportunities available and affordable for all students. Moreover, health education on chronic diseases, linking healthy lifestyle behaviors to primary prevention as well as training on how to engage in healthy lifestyle behaviors can be beneficial. Colleges offer various health education programs on nutrition, healthy eating, exercise.[61–64] Hence, targeted diabetes prevention interventions and social media campaigns can improve the knowledge of diabetes, promote healthy behavior change and, therefore, help combat the increasing rates of diabetes in college students.

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References

1. Center for Disease Control and Prevention. National Diabetes Statistics Report, 2020. 2020. https://www.cdc.gov/diabetes/pdfs/data/statistics/national-diabetes-statistics-report.pdf.
2. American Diabetes Association. Economic costs of diabetes in the U.S. in 2017. Diabetes Care. 2018;41(5):917. doi:10.2337/dci18-0007. [PubMed: 29567642]
3. West Virginia Department of Health and Human Resources. Fast Facts. https://dhhr.wv.gov/hpcd/data_reports/Pages/Fast-Facts.aspx.
4. American Diabetes Association. The Burden of Diabetes in West Virginia. American Diabetes Association. 2020. https://www.diabetes.org/resources/statistics/statistics-by-state.
5. Center for Disease Control and Prevention. About Diabetes. Center for Disease Control and Prevention. 2020. https://www.cdc.gov/diabetes/basics/diabetes.html.
6. Cullen KW, Buzek BB. Knowledge about type 2 diabetes risk and prevention of African-American and Hispanic adults and adolescents with family history of type 2 diabetes. Diabetes Educ. 2009;35(5):836–842. doi:10.1177/0145721709341851. [PubMed: 19696204]
7. Lascar N, Brown J, Pattison H, Barnett AH, Bailey CJ, Bellary S. Type 2 diabetes in adolescents and young adults. Lancet Diabetes Endocrinol. 2018;6(1):69–80. doi:10.1016/S2213-8587(17)30186-9. [PubMed: 28847479]
8. Center for Disease Control and Prevention. National Diabetes Statistics Report, 2017. 2017. https://www.cdc.gov/media/releases/2017/p0718-diabetes-report.html.
9. Centers for Disease Control and Prevention. Type 2 Diabetes. Centers for Disease Control and Prevention. Updated 2020-04-20T06:20:44Z. https://www.cdc.gov/diabetes/basics/type2.html.
10. Ohinmaa A, Schopflocher D, Jacobs P, et al. A population-based analysis of health behaviours, chronic diseases and associated costs. Chronic Dis Can. 2006;27(1):17–24. [PubMed: 16672136]
11. Olson JS, Hummer RA, Harris KM. Gender and Health behavior clustering among U.S. young adults. Biodemography Soc Biol. 2017;63(1):3–20. doi:10.1080/19485565.2016.1262238. [PubMed: 28287308]
12. American College Health Association. National College Health Assessment II: Reference Group Report Fall 2019. 2019. https://www.acha.org/documents/ncha/NCHA-III_FALL_2019_REFERENCE_GROUP_DATA_REPORT.pdf.
13. Nelson MC, Story M, Larson NI, Neumark-Sztainer D, Lytle LA. Emerging adulthood and college-aged youth: an overlooked age for weight-related behavior change. Obesity (Silver Spring). 2008; 16(10):2205–2211. doi:10.1038/oby.2008.365. [PubMed: 18719665]
14. Kwan MY, Cairney J, Faulkner GE, Pullenayegum EE. Physical activity and other health-risk behaviors during the transition into early adulthood: a longitudinal cohort study. Am J Prevente Med. 2012;42(1):14–20. doi:10.1016/j.amepre.2011.08.026.
15. Mongiello LL, Freudenberg N, Jones H, Spark A. Many College Students Underestimate Diabetes Risk. J Allied Health. Summer 2016;45(2):81–86. [PubMed: 27262464]
16. Rehman R, Zafar A, Mohib A, Baig M. A Gender-based Comparison in Health Behaviors and State of Happiness among University Students. Cureus. 2018;10(3):e2342. doi:10.7759/cureus.2342. [PubMed: 29796354]
17. Dawson KA, Schneider MA, Fletcher PC, Bryden PJ. Examining gender differences in the health behaviors of Canadian university students:. research-article. J R Soc Promotion Health. 2007;127(1): 38–44. doi:10.1177/1466424007073205.
18. Olfert MD, Barr ML, Charlier CC, Greene GW, Zhou W, Colby SE. Sex Differences in Lifestyle Behaviors among U.S. College Freshmen. IJERPH. 2019;16(3):482. doi:10.3390/ijerph16030482.
19. Boston University School of Public Health. The Health Belief Model. Boston University School of Public Health,. 2018. http://sphweb.bumc.bu.edu/otlt/MPH-Modules/SB/BehavioralChangeTheories/BehavioralChangeTheories2.html.
20. Communication Theory. Health Belief Model. Updated 2016-06-06. 2020. https://www.communicationtheory.org/health-belief-model/.

21. Al-Mutairi RL, Bawazir AA, Ahmed AE, Jradi H. Health Beliefs Related to Diabetes Mellitus Prevention among Adolescents in Saudi Arabia. Sultan Qaboos Univ Med J. 2015;15(3):e398–e404. doi:10.18295/squmj.2015.15.03.015. [PubMed: 26355752]
22. Al-Mahrooqi B, Al-Hadhrami R, Al-Amri A, et al. Self-reported knowledge of diabetes among high school students in Al-Amerat and Quriyat, Muscat Governate, Oman. Sultan Qaboos Univ Med J. 2013;13(3):392–398. doi:10.12816/0003261. [PubMed: 23984024]
23. Khan N, Gomathi KG, Shehnaz SI, Muttappallymyalil J. Diabetes mellitus-related knowledge among university students in Ajman, United Arab Emirates. Sultan Qaboos Univ Med J. 2012;12(3): 306–314. doi:10.12816/0003144. [PubMed: 22912923]
24. Lorga T, Aung MN, Naunboonruang P, Junlapeeya P, Payaprom A. Knowledge of communicable and noncommunicable diseases among Karen ethnic high school students in rural Thasongyang, the far northwest of Thailand. Int J Gen Med. 2013;6:519–526. doi:10.2147/ijgm.s44902. [PubMed: 23843701]
25. Amuta AO, Barry AE, J. McKyer EL. Risk perceptions for developing type 2 diabetes among overweight and obese adolescents with and without a family history of type 2 diabetes. Am J Health Behav. 2015;39(6):786–793. doi:10.5993/AJHB.39.6.6. [PubMed: 26450546]
26. Kharono B, Nabisere R, Kiddu Persis N, Nakakeeto J, Openy A, Bakeera Kitaka S. Knowledge, Attitudes, and Perceived Risks Related to Diabetes Mellitus Among University Students in Uganda: A Cross-Sectional Study. East Afr Health Res J. 2017;1(2):105–112. [PubMed: 29250612]
27. Mansell K, Mansell H, Neubeker W, Drake H. Students' perceptions of and amount of diabetes education in Canadian schools of pharmacy. Curr Pharm Teach Learn. 2017;9(3):376–382. doi: 10.1016/j.cptl.2017.02.003. [PubMed: 29233274]
28. Collins KM, Dantico M, Shearer NB, Mossman KL. Heart disease awareness among college students. J Community Health. 2004;29(5):405–420. doi:10.1023/b:johe.0000038655.19448.b2. [PubMed: 15471422]
29. Center for Disease Control and Prevention. Working Together to Manage Diabetes: A Guide for Pharmacy, Podiatry, Optometry, and Dentistry: 12–17. January 2014. 2017.
30. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)-a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform. 2009;42(2): 377–381. doi:10.1016/j.jbi.2008.08.010. [PubMed: 18929686]
31. Vanderbilt University. About REDCap. Vanderbilt University 2019. https://projectredcap.org/about/.
32. Center for Disease Control and Prevention. Body Mass Index (BMI). 2018. https://www.cdc.gov/healthyweight/assessing/bmi/.
33. Lindström J, Tuomilehto J. The Diabetes Risk score: a practical tool to predict type 2 diabetes risk. Diabetes Care. 2003;26(3): 725–731. 2003-03-01 00:00:00 doi:10.2337/diacare.26.3.725. [PubMed: 12610029]
34. Mondak JJ, Davis BC. Asked and answered: knowledge levels when we will not take "don't know" for an answer. Polit Behav. 2001;23(3):199–224. doi:10.1023/A:1015015227594.
35. Mohan V, Kaur T, Deepa M, et al. Knowledge and awareness of diabetes in urban and rural india: the indian council of medical research india diabetes study (Phase I): Indian Council of Medical Research India Diabetes 4. Indian J Endocr Metab. 2014; 18(3):379–385. doi:10.4103/2230-8210.131191.
36. Ubangha LO, Ubangha OT, Abiola AO. Diabetes mellitus: Identifying the knowledge gaps and risk factors among adolescents attending a public school in Lagos State. J. Clin. Sci 2016;13:193–198.
37. Xu Y, Zhang D, Liu K, Guo Y, Yang Y. Self-reported knowledge on diabetes and its related factors among Chinese college students: a cross-sectional study. BMJ Open. 2016;6(9):e011963doi: 10.1136/bmjopen-2016-011963.
38. Yahia N, Brown C, Rapley M, Chung M. Assessment of college students' awareness and knowledge about conditions relevant to metabolic syndrome. Diabetol Metab Syndr. 2014;6(1):111. doi: 10.1186/1758-5996-6-111. [PubMed: 25360161]

39. American Diabetes Association. Type 2 Diabetes Risk Test. American Diabetes Association. 2019. http://www.diabetes.org/assets/pdfs/at-risk/ada-risk-test-generic.pdf.
40. Version 25. IBM SPSS Statistics for Windows. IBM Corp; 2015.
41. Mongiello LL, Freudenberg N, Jones H. Diabetes risk factor knowledge varies among multiracial college students. J Immigr Minor Health. 2016;18(5):971–978. doi:10.1007/s10903-015-0250-9. [PubMed: 26169506]
42. Al P, S W, M R, S S. An interprofessional diabetes experience to improve pharmacy and nursing students' competency in collaborative practice. Am Jf Pharmaceutical Educ. 2013;77(9):197. doi:10.5688/ajpe779197.
43. Ponder M, Lee J, Green J, Richards M. Family history and perceived vulnerability to some common diseases: a study of young people and their parents. 1996. doi:10.1136/jmg.33.6.485.
44. Dickerson JB, Smith ML, Sosa E, McKyer EL, Ory MG. Perceived Risk of Developing Diabetes in Early Adulthood: Beliefs about Inherited and Behavioral Risk Factors across the Life Course:. research-article. 2011. doi:10.1177/1359105311412840.
45. Reyes-Velázquez W, Hoffman EW. Toward Reducing the Diabetes Pandemic: College Students' Perspectives of Type 2 Diabetes. 2011. doi:10.2337/diaspect.24.3.161.
46. American Diabetes Association. Preventing Type 2 Diabetes in Children and Teens. Diabetes Spectr. 2005;18(4):249–250. doi:10.2337/diaspect.18.4.249.
47. San Diego ERN, Merz EL. Diabetes knowledge, fatalism and type 2 diabetes-preventive behavior in an ethnically diverse sample of college students. J Am Coll Health. 2020;1–10. doi:10.1080/07448481.2020.1751175.
48. Bailes BK. Diabetes mellitus and its chronic complications. AORN J. 2002;76(2):266–276. 278–82; quiz 283–286. doi:10.1016/s0001-2092(06)61065-x. [PubMed: 12194653]
49. ODPHP. Healthy People 2020: Adolescent Health. Office of Disease Prevention and Health Promotion. Updated January 01, 2020. Accessed January 2, 2019. https://www.healthypeople.gov/2020/topics-objectives/topic/Adolescent-Health.
50. National Research Council, Institute of Medicine. Adolescent Health Services: Missing Opportunities. The National Academies Press; 2009. p. 366.
51. Green EC, Murphy E Health Belief Model. In: Cockerham WC, Dingwall R, Quah S, eds. The Wiley Blackwell Encyclopedia of Health, Illness, Behavior, and Society. 2014. doi:10.1002/9781118410868.wbehibs410
52. Rew L Adolescent Health: A Multidisciplinary Approach to Theory, Research, and Intervention. Health Belief and Health-Promotion Models. Washington, DC: SAGE Publications, Inc.; 2005.
53. Boston University School of Public Health. The Health Belief Model. 2020. http://sphweb.bumc.bu.edu/otlt/MPH-Modules/SB/BehavioralChangeTheories/BehavioralChangeTheories2.html.
54. Antwi J, Lavin R, Sullivan S, Bellavia M. Perception of and risk factors for type 2 diabetes among students attending an upstate New York college: a pilot study. Diabetol Metab Syndr. 2020; 12(1):1–8. doi:10.1186/s13098-020-00535-1. [PubMed: 31921358]
55. Orji R, Vassileva J, Mandryk R. Towards an Effective Health Interventions Design: An Extension of the Health Belief Model. Online J Public Health Inform. 2012;4(3):e9.
56. Matingwina T. Health, Academic Achievement and School-Based Interventions. In Health and Academic Achievement. 2018; chap Chapter 9. London: IntechOpen.
57. Murray NG, Low BJ, Hollis C, Cross AW, Davis SM. Coordinated School Health Programs and Academic Achievement: A Systematic Review of the Literature. J Sch Health. 2007;77(9): 589–600. doi:10.1111/j.1746-1561.2007.00238.x. [PubMed: 17970862]
58. Larsman P, Eklöf M, Törner M. Adolescents' risk perceptions in relation to risk behavior with long-term health consequences; antecedents and outcomes: A literature review. Saf Sci. 2012; 50(9):1740–1748. doi:10.1016/j.ssci.2012.04.009.
59. Deeks A, Lombard C, Michelmore J, Teede H. The effects of gender and age on health related behaviors. BMC Public Health. 2009;9(1):213. Jun 30 doi:10.1186/1471-2458-9-213. [PubMed: 19563685]
60. West Virginia University. Student Enrollment. 2020. https://institutionalresearch.wvu.edu/institutional-research/statistical-information/student-information/student-enrollment-fall.

61. West Virginia University. Well WVU: Programs. West Virginia University. Accessed January 01, 2019. https://well.wvu.edu/programs.

62. West Virginia University. Well WVU: Healthy Eating. West Virginia University. Accessed January 01, 2019. https://well.wvu.edu/resources/nutrition/healthy-eating.

63. West Virginia University. Well WVU: Exercise. West Virginia University. Accessed January 01, 2019. https://well.wvu.edu/programs/wellbeing/exercise.

64. White JL. Wellness wednesdays: health promotion and service learning on campus. J. Nurs Educ 2020;38(2):69–71. doi:10.3928/0148-4834-19990201-06.

Table 1.

Demographic and study variables by gender.

Variable	# Participants (%)		*P*
	Male	**Female**	
Age, mean (SD)	23.15 (5.7)	21.52 (3.92)	.001**
Diabetes knowledge score, mean, (SD)	26.51 (7.21)	27.97 (6.78)	.017*
Perceived risk of diabetes			.874
No or low to moderate risk	152 (90.5)	471 (90.1)	
High or extremely high risk	16 (9.5)	52 (9.9)	
Knowledge of level of normal fasting blood glucose[a]			. 936
<126mg/dl, <140mg/dl, <200mg/dl	105 (65.2)	337 (65.6)	
<100mg/dl	56 (34.8)	177 (34.4)	
BMI[b]			.016**
Underweight	3 (1.8)	23 (4.5)	
Normal	77 (47.2)	288 (56.7)	
Overweight	60 (36.8)	128 (25.2)	
Obese	23 (14.1)	69 (13.6)	
History of diabetes			.001**
Yes	12 (7.1)	10 (1.9)	
No	156 (92.9)	513 (98.1)	
Family history of diabetes[c]			.325
Yes	99 (59.3)	289 (54.9)	
No	68 (40.7)	237 (45.1)	
Physical health[d]			.843
Poor and fair	33 (19.8)	109 (20.8)	
Good,	79 (47.3)	249 (47.4)	
Very good	44 (26.3)	142 (27.0)	
Excellent	11 (6.6)	25 (4.8)	
Exercise frequency[e]			.650

Variable	# Participants (%)		*P*
	Male	Female	
<once/week	34 (20.2)	95 (18.1)	
1–2 times/week	51 (30.4)	186 (35.4)	
3–4 times/week	57 (33.9)	174 (33.1)	
5 or more times/week	26 (15.5)	71 (13.5)	
Read food label[f]			.639
Never/sometimes	98 (58.3)	296 (56.3)	
Often/always	70 (41.7)	230 (43.7)	
Use of tobacco products[g]			.013*
Yes	34 (20.4)	66 (12.6)	
No	133 (79.6)	459 (87.4)	
Alcohol consumption[h]			.054
Yes	119 (70.8)	410 (78.1)	
No	49 (29.2)	115 (21.9)	

Note.

*$P<.05$;

**P<.01.

[a]Percent of participants for knowledge on level of normal fasting blood glucose is a categorical variable where 0= <126mg/dl, <140mg/dl, <200mg/dl, 1= <100 mg/dl.

[b]Percent of participants for BMI categorized as underweight, normal, overweight, or obese.

[c]Percent of participants for family history of diabetes which is a categorical variable computed from reported diabetes among family members where 0= no family history and 1= family history.

[d]Percent of participants for physical health which is a categorical variable computed from self-reported rating of the participant's own health where 1= poor, 2= fair, 3= good, 4= very good and, 5= excellent.

[e]Percent of participants for exercise frequency which is a categorical variable computed from self-reported frequency of physical exercise at least 30 minutes per day where 1= <once per week, 2=1–2 times/week, 3=3–4 times/week, 5=5 or more times/week.

[f]Percent of participants for reading a food label which is a categorical variable computed from how often the participant reads food labels to identify nutrients in packaged foods where 0= never or sometimes, 1= often or always.

[g]Percent of participants for use of tobacco products which is a categorical variable computed from self-reported information on whether the student uses any tobacco product where 0= no, 1= yes.

[h]Percent of participants for consumption of alcohol which is a categorical variable computed from self-reported information on whether the student consumes alcohol where 0= no, 1= yes.

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Table 2.

Logistic regression model for predicting perceived diabetes risk.

Covariates	*P*	OR [95% CI]
Diabetes knowledge score	.015*	1.07 [1.01, 1.13]
BMI (overweight or obese)	.001**	4.90 [2.33, 10.30]
Age	.039*	1.08 [1.00, 1.16]
Sex (male)	.07	.48 [.22, 1.06]
Family history of diabetes	.001**	4.30 [1.97, 9.40]
Physical health (good, very good or excellent)	.005**	.38 [.19, .74]
Exercise frequency (1–2 times/week)	.083	3.38 [.85, 13.38]
Exercise frequency (3–4 times/week)	.565	1.48 [.39, 5.70]
Exercise frequency (5 or more times/week)	.731	1.27 [.33, 4.98]
Read food label (often or always)	.024*	.40 [.18, .89]

Note. OR=Odds ratio, CI=Confidence interval,

*$P<.05$;

**P<.01.