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Diabetes Knowledge: What Do College Students Know

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This study investigates students' knowledge about diabetes, with a focus on academic disciplines and gender. Data were collected from 218 students enrolled at a large public university. Descriptive statistics were employed, and factorial analysis of variance (ANOVA) were performed. The results showed that, while participants seemed to have some knowledge about diabetes, they generally lacked specific content information about the disease. Female students outperformed male students in diabetes knowledge. Rehabilitation counselor educators can offer an invaluable service by covering the topic of diabetes in their courses and curricula. They can consider incorporating specific information about diabetes that can better prepare students as rehabilitation counseling professionals and informed citizens, while ensuring that male and female students have the same level of diabetes knowledge.

Keywords: diabetes knowledge; students; gender

COLLEGE STUDENTS' KNOWLEDGE ABOUT DIABETES

Diabetes mellitus (DM), an important public health problem, refers to a group of diseases that affect how the body uses blood sugar (glucose; Lemes dos Santos et al., 2014). Diabetes can lead to excess sugar in the blood, which can result in serious health problems, including heart disease, stroke, and damage to eyes, kidneys, and nerves (Centers for Disease Control and Prevention, 2020c, 2020e; Gunasekeran et al., 2020; U.S. National Library of Medicine, 2020). Persons with diabetes are at a higher risk of getting sick from COVID-19, a current health crisis with long-term negative implications (Centers for Disease Control and Prevention, 2020c, 2020e). DM is one of the most common noncommunicable diseases and one of the leading causes of death worldwide, affecting more than 415 million individuals (Vandenbosch et al., 2018). As of 2018, nearly 34.2 million Americans

had been diagnosed with diabetes and an additional 88 million Americans were showing pre-diabetic symptoms (American Diabetes Association, 2020).

Knowledge about diabetes and related health conditions has been shown to reduce or eliminate diabetes and its corollaries (Johnston, 2017; Swanson & Maltinsky, 2019). Methods for reducing or eliminating diabetes include diabetes-related knowledge attained through educational and information-based strategies (Powers et al., 2016). In fact, education is the first step in prevention efforts for diabetes, and effective diabetes education would be a boon to society (Xu et al., 2016). Educational programs focusing on providing diabetes-related knowledge are widely recommended for prevention and management (International Diabetes Federation, 2017; Johnston, 2017). College students at universities, where educational programs have platforms for imparting knowledge in general and knowledge related to health issues such as diabetes in particular, are potential leaders in the health arena and other fields. They will in time become important players in diabetes-related health issues, whether through managing their own health or by caring for others as family members, practitioners, or legislators. Rehabilitation–education programs, among others, can be instrumental in providing such knowledge to students in health and other fields. However, whether students are knowledgeable about diabetes is unclear. The need for diabetes knowledge is crucial, given that the failure to acquire such knowledge can lead to poor actions regarding diabetes health, ultimately resulting in worse overall health and premature mortality (Centers for Disease Control and Prevention, 2020c, 2020e; Gunasekaran et al., 2020; U.S. National Library of Medicine, 2020). The purpose of this study, therefore, is to explore college students' knowledge about diabetes.

College Students and Diabetes Knowledge

The serious problem of diabetes has a devastating impact on our society. College students themselves may face tremendous diabetes-related challenges, in part because of detrimental health behaviors such as unhealthy nutrition and lack of exercise, both of which are linked to diabetes (Ortega et al., 2013; Strong et al., 2008). Such challenges can affect their personal and academic lives as well as the welfare of society and of their friends and family members.

College students' knowledge about diabetes can be invaluable in reducing or eliminating diabetes in our society. Education about diabetes offers knowledge, skills, and confidence to persons with diabetes, and is vital for preventing and managing the disease (Beverly et al., 2019; Malik et al., 2010; Strang et al., 2010) and can prepare students to work in interdisciplinary context where Biopsychosocial Model (i.e., interconnection between biology, psychology, and socio-environmental factors) is valued (CAAHEP, 2019; Council for Accreditation of Counseling and Related Educational Programs [CACREP], 2016). The importance of increasing knowledge to help reduce chronic illnesses, including diabetes, is well understood in the helping field (Adams, 2010). Students who are already in a community of higher education and science-based learning are in a position to gain vital diabetes-related knowledge.

Diabetes knowledge becomes important for students in health and nonhealth disciplines alike, whether they are citizens caring for neighbors or loved ones, health professionals working with clients with diabetes, or educators providing diabetes-related knowledge to others (Centers for Disease Control and Prevention, 2017). Such information can assist these students to address diabetes issues before (prevention) and after the disease, including those that affect their own mental health (Jaser, 2010) and academic performance (Meo et al., 2013). The students are potential future leaders; the emerging legislators, health professionals, and educators among them can use this information to help clients with diabetes issues

and provide health-related advice to inform curricula and legislation. Preservice rehabilitation counseling students may, in their future careers, be working with traditional rehabilitation counselor clients—that is, persons with disabilities seeking employment; accordingly, the students are likely eventually to see clients whose health issues, such as diabetes, are a secondary form of disability affecting their employment (Tunceli et al., 2005), mental health, and overall quality of life (Rubin, 2000). Yet preservice rehabilitation counseling students have rarely, if ever, been included in studies investigating knowledge about diabetes. Diabetes knowledge can be an invaluable asset to help them assist their clients holistically.

Academic Disciplines. Educators in health disciplines, including rehabilitation counseling educators, play an important role in educating students about health within the Biopsychosocial Model context, including issues such as interactions between diabetes and employment, and in helping meet university and accreditation standards in related Biopsychosocial Model and others related issues (CAAHEP, 2019; CACREP, 2016). However, evidence about whether students are receiving and retaining such knowledge is mixed. Research indicates that some students, including nursing students, lack knowledge in the area of DM and its management (Gerard et al., 2010; Modic et al., 2014; Tawalbeh & Gharaibeh, 2014; Yacoub et al., 2014). Studies (Ahmed et al., 2012; Gerard et al., 2010; Modic et al., 2014) have noted the need for up-to-date diabetes information. The degree to which the imparting of knowledge about diabetes differs among academic fields, such as health disciplines and nonhealth disciplines (e.g., rehabilitation counseling, business), is not clear.

Gender. Gender disparities in knowledge about diabetes may exist. Women generally are better-represented in the health fields than men, and are more likely to care for family members and others (Bloom et al., 2001; Family Caregiver Alliance, 2016); this may add to their level of diabetes knowledge. Studies, both national and international, have reported mixed results regarding gender differences in diabetes knowledge. While a significant number of studies (Al-Mahrooqi et al., 2013; Fukuoka et al., 2014; Lemes dos Santos et al., 2014; Majumder et al., 2013; Manierre, 2015) have shown that women are more knowledgeable about DM than men, other studies (Bani, 2015; Mohieldein et al., 2011) report no difference, or find that men have better knowledge about DM than women. In a study by Khan et al. (2012), women had better general knowledge of DM and its complications; there was no significant difference between the genders regarding knowledge of risk factors or symptoms. Hassanein et al. (2018), using a descriptive cross-sectional correlational design and random systematic sample, found no difference between men and women in knowledge of DM. Gender differences in knowledge can translate into gender differences in diabetes management, especially in minority populations (Brown et al., 2000; Burner et al., 2013; Chlebowy et al., 2013).

The societal changes in career and gender roles that have started to reverse the trends related to gender representation in the health fields and in caregiving responsibilities (Block et al., 2019) may affect the difference in diabetes knowledge between the genders. Yet, research on gender differences in diabetes knowledge among students is lacking.

While these studies have focused on diabetes knowledge specifically in relation to academic discipline and gender, as noted above, the studies have had mixed results. Also, these studies' samples have been restricted, with limited, if any, inclusion of preservice rehabilitation counseling students, and rehabilitation counseling educators have rarely, if ever, been the audience for information related to diabetes knowledge.

DM is a serious public health problem that afflicts millions of American with primary and secondary health issues, lessening their quality of life and even causing death. Research has shown that knowledge about diabetes disseminated through educational and information-based strategies can reduce or eliminate diabetes and its corollaries (Johnston, 2017; Powers

et al., 2016; Swanson & Maltinsky, 2019; Xu et al., 2016). However, for some groups, such as preservice rehabilitation counseling students, and regarding issues such as gender, research in this area is minimal, if it exists at all. Therefore, the purpose of this study is to investigate awareness of DM in college students. The two research questions that guided the present study were (a) What are the levels of general knowledge about DM among college students? and (b) Are the levels of general knowledge about DM different depending on each student's gender and academic major (e.g., preservice rehabilitation counseling, business, engineering)?

METHOD

Participants

The sample consisted of 218 students (of which 50.9% were female) enrolled at a large public university located in a Southwestern state. Participants ranged in age from 18 to 54 years ($m = 23.98$, $sd = 6.14$). The majority of the participants did not have disabilities ($n = 199$, 91.3%). In level of education, seniors ($n = 71$) made up the largest subgroup, followed by juniors ($n = 64$), graduate students ($n = 45$), sophomores ($n = 26$), and freshmen ($n = 10$). Ethnically, 88.5% of the participants were Hispanic, 7.3% European American, 2.3% Asian American, 0.9% African American, and 0.5% multiracial. Academic majors of participants were evenly distributed: business (33.9%), rehabilitation services (33.5%), and engineering (32.6%).

Measures

Diabetes Knowledge. The General Diabetes Knowledge Test (GDKT; Zhang et al., 2009) is a 36-item questionnaire comprising six subscales: (a) general knowledge of disability (4 items), (b) risk factors of diabetes (3 items), (c) symptoms of diabetes (6 items), (d) complications of diabetes (5 items), (e) treatment and management of diabetes (13 items), and (f) monitoring of diabetes (4 items). The participant receives one point for each "Yes" answer to a question and zero points for each "No" or "Unsure" answer to a question (which is regarded as a wrong answer). The raw score is derived from the sum of all correct responses, which is then converted to a final score between 0 and 100, according to percentage (Zhang et al., 2009). A higher score indicates a better general knowledge of diabetes. For the present study, only the first three of the six GDKT subscales were used to assess the levels of diabetes knowledge among students.

Demographic Questionnaire. Participants were asked to declare their basic background information such as age, race, gender, academic major, and level of education.

Procedure

Upon receipt of institutional review board approval for the study, members of the research team contacted faculty in the engineering, health sciences, and business colleges to request permission to administer the questionnaire to their students. Prospective participants were informed of the purpose of the study and told that participation was voluntary and would be kept anonymous. No incentive was offered. The amount of time required to complete the questionnaire was approximately 10–15 minutes.

Data Analysis

All variables were screened for missing values, outliers, and violations of statistical assumptions before data analysis, which included both descriptive and inferential statistics, was begun. Mean, standard deviation, mode, maximum, minimum, and range were used to assess the central tendency for each univariate. Chi-square tests were used to assess the sampling distribution of categorical variables (i.e., gender and academic major). A between-subjects factorial design was deemed appropriate for the study, as it contains more than one independent variable. To test for differences in general diabetes knowledge among students, a 2 (gender: male, female) \times 3 (academic major: business, engineering, rehabilitation services) factorial analysis of variance (ANOVA) was performed.

RESULTS

Table 1 displays the summary of participants' responses to the three subscales measuring diabetes knowledge. The average percentage of students who correctly answered all five items of the General Knowledge of Diabetes subscale was 64.5%. The percentages of students answering correctly for each item ranged from 46.3% for item #5 ("Diabetes is not curable") to 81.7% for item #1 ("Diabetes is a condition of high blood sugar"). On average, the percentage of students who selected "No" or "Unsure" as answers to any of the five items was 16.9% and 18.6%, respectively. The average percentage of students who correctly answered all three items of the Risk Factors of Diabetes subscale was 79.9%. The percentages of students answering correctly for each item ranged from 71.1% for item #2 ("Age above 40 years old") to 89.0% for item #1 ("Family history of diabetes"). On average, the percentage of students who selected "No" or "Unsure" as answers to any of the three items was 14.8% and 4.8%, respectively. The average percentage of students who correctly answered all six items of the Symptoms of Diabetes subscale was 62.1%. The percentages of students answering correctly for each item ranged from 47.7% for item #3 ("Weight loss despite normal appetite") to 73.9% for item #6 ("Tiredness and weakness"). On average, the percentage of students who selected "No" or "Unsure" as answers to any of the five items was 17.4% and 20.5%, respectively.

Preliminary data screening was performed to assess any violations of assumptions for ANOVA. Examination of a histogram of scores of the outcome variables suggested that the distribution was normal. Levene's test indicated no violation of the homogeneity of variance assumption. Table 2 shows that the interaction effect between academic major and gender on overall diabetes knowledge was not statistically significant: $F(2, 210) = 1.217$, $p = .298$, partial $\eta^2 = .011$. The calculated effect size was small. The main effect for academic major was also not statistically significant: $F(2, 210) = .675$, $p = .510$, partial $\eta^2 = .006$. The scores for diabetes knowledge for the three academic majors were: business ($m = 70.94$, $sd = 23.46$), engineering ($m = 67.61$, $sd = 23.89$), and rehabilitation services ($m = 62.80$, $sd = 23.31$). The main effect for gender was statistically significant: $F(1, 210) = 8.816$, $p = .003$, partial $\eta^2 = .040$. The calculated effect size was small. Female students ($m = 72.59$, $sd = 23.11$) had higher scores on overall diabetes knowledge than did male students ($m = 61.36$, $sd = 23.01$). A subsequent post hoc test was not conducted for gender because it has only two categories.

TABLE 1. Summary of Participants' Responses to the Three Subscales Measuring Diabetes Knowledge

Subscales	Yes		No		Unsure	
	N	%	N	%	N	%
<i>General Knowledge of Diabetes</i>						
1. Diabetes is a condition of high blood sugar	178	81.7	26	11.9	14	6.4
2. Type 1 diabetes is a condition of insufficient insulin	146	67.0	12	5.5	60	27.5
3. Type 2 diabetes is a condition of the body not responding to insulin	111	50.9	34	15.6	73	33.5
4. Diabetes is noncontagious	167	76.6	37	17.0	14	6.4
5. Diabetes is not curable	101	46.3	75	34.4	42	19.3
Average of five items		64.5		16.9		18.6
<i>Risk Factors of Diabetes</i>						
1. Family history of diabetes	194	89.0	15	6.9	8	3.7
2. Age above 40 years old	155	71.1	45	20.6	17	7.8
3. Obesity	174	79.8	37	17.0	6	2.8
Average of three items		79.9		14.8		4.8
<i>Symptoms of Diabetes</i>						
1. Constant feeling of thirst	138	63.3	32	14.7	48	22.0
2. Frequent urination	138	63.3	31	14.2	49	22.5
3. Weight loss despite normal appetite	104	47.7	52	23.9	62	28.4
4. Blurred vision	127	58.3	55	25.2	36	16.5
5. Slow healing of cuts and wounds	144	66.1	35	16.1	38	17.4
6. Tiredness and weakness	161	73.9	22	10.1	35	16.1
Average of six items		62.1		17.4		20.5

TABLE 2. Two-Way Analysis of Variance for Academic Major and Sex on Overall Diabetes Knowledge

Source	SS	df	MS	F	p	Partial η^2
Intercept	831,290.119	1	831,290.119	1,558.961	.000	.881
Sex	4,700.777	1	4,700.777	8.816	.003	.040
Major	719.967	2	359.983	.675	.510	.006
Sex*Major	1,298.386	2	649.193	1.217	.298	.011
Error	111,979.028	210	533.233			
Total	1,093,979.592	216				

DISCUSSION

The purpose of the present study is to investigate knowledge of DM in college students. Findings of this study shed light on levels of general diabetes knowledge among students and were partially consistent with previous research (Fitzgerald et al., 1998; Zhang et al., 2009). Analysis of responses to the General Knowledge of Diabetes subscale showed that only 46.3% of participants knew that diabetes is incurable. One plausible explanation is that more than two-thirds of the participants were majoring in a nonhealth-sciences-related field. Health education is not a graduation requirement for some disciplines, such as business and engineering. In the current study, although participants seemed to have some knowledge about diabetes, they generally lacked a refined understanding of specific content information with respect to various aspects of the disease. For example, an overwhelming majority of the participants could correctly identify common risk factors associated with diabetes, yet they did not know many symptoms exhibited by people with DM. It is worth noting that some studies (Kapongo et al., 2015; Singh et al., 2014; Wang & Volker, 2013; Yahia et al., 2014) found that students lack diabetes-related knowledge. Other studies (Kharono et al., 2017; Li et al., 2013) had contrary findings, with students having above-average levels of knowledge about diabetes.

Some studies (Edwards et al., 2014; Henry, 2015; Rushforth et al., 2016; Yacoub et al., 2014) found that students in the health fields (e.g., nurses, physician assistants, medical students) lack diabetes-related knowledge. In the current study, rehabilitation-services students had the lowest scores for overall diabetes knowledge when compared with business and engineering students, although the differences in group means were statistically insignificant. Our findings are consistent with Haroon et al.' 2016 study, in which novice preclinical Pakistani medical and dental students had little understanding of diabetes. New preservice rehabilitation counseling professionals are still in the phase in which they are acquiring such knowledge. It is worth noting that the focus of rehabilitation counseling has generally been on vocation and (recently) mental health. This may have limited those professionals' access to knowledge about diabetes.

Another significant finding is that female students outperformed male students in diabetes knowledge. This finding is in line with some studies; however, it contradicts others (Bani, 2015; Mohieldin et al., 2011) that found no difference or that males were more knowledgeable about DM than females. This may be partly due to socialization of women in many cultures, where they are told at a young age to pay attention to their diets due to the enormous pressure to keep a slender, attractive appearance (McGaughey, 2018; Perloff, 2014; Stokes et al., 2016). It is also likely that young females spend more time than young males reading popular magazines and health journals about food and nutrition and ways to prevent certain diseases and weight gain (Ferguson et al., 2014; Pompper & Koenig, 2004; Strauss et al., 2015). Moreover, it is likely that young females spend more time taking care of their health (gaining information from health providers and through other means) than men do. It seems that gender disparities in having regular visits to doctors begin to arise when people are young; Gonzalez et al. (2009) compared Latino/a students' knowledge of type 2 DM among college students who had a usual source of healthcare (meaning a regular doctor) with that of those who did not. They found that there were gender disparities in doctors' visits among the Latino/a students. These annual doctors' visits represent a potential increase in knowledge that can improve health literacy and affect health outcomes.

Another possible explanation of female students outperforming male students in diabetes knowledge is the gender-role expectations of women as caregivers (Chen et al., 2017; Warren et al., 2018), which might influence them to internalize dietary expertise for their

family members. Women's increased dietary knowledge, when compared with that of their male counterparts, is expressed through a higher quality of diet across the life span (Hiza et al., 2013). Vaccaro and Huffman (2017) show that in late adulthood (over 55 years of age), women consume a lower percentage of food with added sugar.

A few limitations should be addressed when considering the generalizability of the interpretation of these findings. The sample was recruited at a federally designated Hispanic-serving institution; as a result, most of the participants were Hispanic. As such, the results may not be applicable to a racially diverse community. Nonparticipation by prospective subjects might represent an important source of information that the researchers could not access (Pituch & Stevens, 2016).

Despite the weaknesses inherent in the study, our findings have several important implications. College students in general and preservice rehabilitation counseling professionals need knowledge about diabetes to use as a springboard to better help their future clients, themselves, and their communities. Preservice rehabilitation counseling students, generally serving traditional rehabilitation counselor clients with disabilities who are seeking employment, can be equipped with diabetes knowledge to better serve their clients who have diabetes as a secondary form of disability, which can negatively affect their employment (Tunceli et al., 2005), mental health, and overall quality of life (Rubin, 2000). Educators can make an invaluable contribution by incorporating the subject of diabetes in their courses and curricula so that students who are preservice rehabilitation counselors, as well as other students, whether in health or nonhealth fields (such as business and engineering students), can acquire essential knowledge about diabetes in order to better serve society.

Implications for Rehabilitation Counseling Education

With the incidence and prevalence of diabetes on the rise (Centers for Disease Control and Prevention, 2020d), renewed emphasis should be placed on prevention through education. Currently, programs offered through the National Diabetes Prevention Program of the Centers for Disease Control and Prevention (2011) are focused on the education of the general public (Centers for Disease Control and Prevention, 2020a), with limited focus on college students in general and preservice rehabilitation counseling professionals in particular.

Students and society could both benefit tremendously from such educational efforts. Prevention of diabetes and reducing or eliminating its consequences are possible. San Diego and Merz (2020) found that college students' positive health behaviors related to diabetes prevention were associated with increased knowledge about diabetes and perceptions of control over their personal health. A study published by Powers et al. (2006) for the American Diabetes Association showed that diabetic patients who were properly educated had a significant decrease in HbA1c and body weight, indicating improved glycemic control.

The results of the current study indicate that the students, including the preservice rehabilitation counseling professionals, lacked diabetes-related knowledge. The implications of this study matter because the prevalence of diabetes is growing, which adversely affects overall health, including the potentially increasing risk of severe illness from COVID-19 and long-term COVID-19-related issues (Centers for Disease Control and Prevention, 2020b); and students who are future leaders (e.g., health workers and legislators) need such knowledge to help combat this health problem.

To incorporate diabetes education in a program's curriculum, educators can follow guidance from the Centers for Disease Control and Prevention's National Diabetes Prevention

Program, while modifying it to meet accreditation and other standards. Also, educators can discuss the importance of health behaviors related to diabetes, as noted by Burke et al. (2014).

Inclusion of diabetes in a curriculum can be achieved in courses other than those focused on medicine when it is appropriate to do so, even broadening the scope of diabetes knowledge (e.g., adding information to existing diabetes materials in rehabilitation counseling education). Limiting diabetes knowledge to certain courses may result in minimal time spent on diabetes-related issues and a decreased potential to relate diabetes knowledge to other aspects of disability. One way to expand access to diabetes knowledge would be to incorporate it into courses in which various aspects of professional functioning and other foundational issues are covered. In these courses, diabetes would be relevant when discussing accreditation standards. It would also be appropriate when discussing the rehabilitation philosophy of holism. An instructor can talk about the possibility of vocational and mental health clients having health issues such as diabetes, and how treating the whole person, including the diabetes issues, can help in the successful employment of clients (e.g., maintaining employment and improving employment performance), while also expanding knowledge about diabetes.

Courses on subjects with close ties to diabetes, such as classes on assessment, human growth and development, and substance abuse, can also be appropriate venues in which to discuss the disease. In an assessment course, an instructor can discuss holistic assessment, which includes diabetes health status, and provide the information that counselors may require to effectively assess clients with diabetes. A course in human growth and development can discuss the potential impact of diabetes on human development and share diabetes knowledge that can help parents and others prevent diabetes from negatively affecting their families. Courses not traditionally linked to diabetes but crucial in diabetes management, such as career counseling and multicultural counseling, are invaluable avenues to explore. For example, some cultures are more vulnerable to diabetes because of factors such as diet. Some courses (e.g., classes on multiculturalism) that cover social justice and health disparities can be expanded to include cultural differences in diets and their impact on diabetes-related health. An activity wherein students bring food from various cultures to learn about different diets can foster discussion about the benefits and adverse effects of some of the diets. This can help students understand particular cultures in relation to diet and health and as a result better prepare the students to help their future clients from disparate cultures.

While participants in this study were knowledgeable about some aspects of diabetes, generally they were deficient in specific content information related to diabetes (e.g., DM symptoms), with rehabilitation-services students having the least knowledge. Courses that currently provide basic knowledge about diabetes could be modified to include in-depth knowledge about it. A possible class activity could require students to read about diabetes and identify a certain number of questions about it to share with other students in small groups. The answers to these questions could be gathered and given to students to learn before the end of the semester.

The current COVID-19 crisis and its long-term implications can be used as a motivator to spark interest in diabetes knowledge (and other health-related knowledge). In a lesson related to medical aspects of disability, a class can focus on diabetes as a risk factor in severe COVID-19 illness and its long-term consequences. Students can talk about the people they know with diabetes and their concerns about them regarding COVID-19, in the present and in the years to come in cases where the effects linger. Video clips of persons with diabetes talking about how COVID-19 has affected them and others with diabetes can be shown, and students can be encouraged to create strategies to help persons with diabetes with general-health and

COVID-19-related issues. Class material can also focus on long-term concerns related to COVID-19 and diabetes, and how to tackle these issues now and in the future.

Internship trainings are used to put theory into practice. The commission on Accreditation of Allied Health Education Program (CAAHEP)/commission on Rehabilitation Accreditation (CoRA), overseeing undergraduate accreditation, and CACREP, focusing on graduate accreditation, recognize experiential learning, whereby students are provided with opportunities to practice and integrate knowledge and skills necessary to develop entry-level skill and professional dispositions as rehabilitation service providers (in practicum and internship contexts). These accreditation organizations also adhere to holistic approaches to rehabilitation, including the Biopsychosocial Model, whether in classroom or practice settings (in internship or real world; CAAHEP, 2019; CACREP, 2016). Yet this study's results show that the students lacked diabetes knowledge—that could be invaluable in many practice and holistic treatment settings. Educators working with students in internships may need to help their students gain more diabetes-related knowledge, aligning their curriculum with CAAHEP standards, as well as other graduate accreditation standards, such as CACREP and others, given students may be attending graduate programs adhering to CACREP or others graduate accreditation standards.

This way, students can be ready to effectively provide high-quality services to their clients with diabetes and/or to succeed in graduate programs. Students planning to work primarily with diabetes clients can do their internships, or parts of them, in settings focusing on diabetes or settings where the disease is common but not the main focus.

Given the benefits of holistic treatment (Myers et al., 2000), educators can make sure that students are aware of the importance of incorporating diabetes knowledge when helping certain clients with nondiabetes-related issues (but who are prone to diabetes due to their lifestyles or cultural heritage) that may negatively affect their lives, employment, and health. By doing so, counselors can help their clients in a holistic manner. While part of rehabilitation counseling training is understanding any disability and its influence on psychological, social, and vocational factors, a specific focus on diabetes would be appropriate, given its particular adverse impact on some cultural groups, such as African Americans and Hispanic Americans, and the health disparities that disfavor minority groups. College students in general and some preservice rehabilitation counseling professionals in particular may be working with these cultural groups and other groups (e.g., persons with substance-use disorders and other issues that can affect employment) and highlighting diabetes general negative influence and its potential influence on COVID-19 severity, now and in the future. In this vein, including recent issues such as COVID-19, along with their potential long-term consequences, discussions of persons with diabetes can be appropriate. Lessons can focus on the impact of COVID-19 on employment among persons with diabetes (e.g., people might have to quit their jobs because they are depressed) as well as the impact of employment on these same populations in relation to mental health (e.g., anxiety felt by persons with diabetes while working). Students can work on case studies related to dilemmas such as when persons with diabetes have to choose between working to provide for their families and staying home to avoid catching COVID-19 and experiencing the serious health issues that can occur with it. An ethics class can use ethical models related to dilemmas, such as the Tarvydas model (Cottone & Tarvydas, 2016), to help guide students as they work through case studies.

Many persons with diabetes may be ambivalent about returning to work or getting jobs, especially when COVID-19 is such a salient concern. Returning to work or gaining and

maintaining employment may also be difficult, as the long-term impact of COVID-19 can present obstacles, and given that diabetes (along with related concerns, such as substance misuse) already negatively affect employment. Knowing more about diabetes, including its risk factors and symptoms and its impact on employment and substance misuse, can be useful when working with such clients. Educators can make sure that information specifically related to diabetes, including accommodation information, the links between diabetes and employment, and the relationship of diabetes to mental health medications and substance misuse, is emphasized in the curriculum.

A crucial factor educators can consider regarding diabetes knowledge is myths or cultural beliefs regarding chronic illness and disability, including diabetes, since these myths and beliefs are common in some cultural groups (Espinosa de los Monteros & Gallo, 2013; Latino Diabetes Association, 2018; Su et al., 2014) and may adversely affect college students in general and preservice rehabilitation counseling professionals in particular who belong to these cultural groups. Accordingly, the use of educational materials that contain accurate information about diabetes, while also mentioning the myths and including activities that use accurate diabetes knowledge to challenge the myths, can be invaluable in these cases. Educators can be mindful of such beliefs and use them, when teaching about diabetes, to inform their curricula and guide their students.

Diabetes knowledge has the potential to mitigate this problem, and educators are well prepared and positioned in a community of knowledge transmission to provide such knowledge. Educators can inform university administrators about students' lack of diabetes knowledge and the importance of giving students such knowledge, with the intent of extending or adding courses dealing with health issues such as diabetes for the students' and society's benefit. Courses focus on diabetes knowledge can be at both the undergraduate and masters level—with different emphasis (e.g., learning the diabetes information vs reinforcing the diabetes information gain in the undergraduate level and focusing on its applications).

Rehabilitation Research Implications

Researchers can focus on specific research activities, including: (a) replicating this study, using a sample similar to the one it used, which will increase confidence in its generalizability. (b) collecting data on rehabilitation undergraduates and masters level students as well as other academic groups of students to better understand specific academic groups in relation to diabetes knowledge. (c) Replicating this study using diverse ethnic populations and covering other regions of the country. Cultural beliefs that affect diabetes knowledge may be mediated or moderated by acculturation among some minority groups (O'Brien et al., 2014). (d) Understanding cultural factors that affect knowledge about diabetes and the role played by acculturation. (e) Studying interventions (emotional and educational) designed to reduce or eliminate cultural beliefs about diabetes that are detrimental to gaining accurate diabetes knowledge, exploring the interventions' effectiveness, how they work, and for whom they work. (f) Determining the knowledge that may be required to assist persons with diabetes and COVID-19 now and in the long term. (g) Measuring the prevalence of myths related to diabetes in the student population and following up in qualitative studies to gain in-depth knowledge regarding this issue for future studies. (h) understanding how diabetes relates to both traditional and modern gender roles for women in different cultures, as this study's findings show that female students outperformed male students in diabetes knowledge. One plausible explanation, as noted above, may be the particular socialization of women in certain cultures.

Implications for Counseling Practice

Educators and agency personnel can work together to make sure the students entering the field have the basic diabetes knowledge they need to effectively serve their clients with diabetes. Preservice students working with rehabilitation counseling clients are likely to interact with other professionals regarding issues related to mental illness that affect or are affected by diabetes. A lack of knowledge about diabetes on the part of a professional serving persons with diabetes is unethical and can lead to ineffective or harmful treatment outcomes (Lee, 2018; Sue & Sue, 2016). They will need some diabetes-related knowledge to work effectively with an interdisciplinary team and better help persons with diabetes. Educators, in collaboration with agency personnel, can train new graduates working for these agencies to understand this context of interdisciplinary teamwork in delivering and receiving diabetes information, including the delivery of certain information to members of the team who may have limited knowledge about the disease and the bidirectional relationship between diabetes as a secondary disability and employment.

CONCLUSION

Our study found that, while participants seemed to have some knowledge about diabetes, they generally lacked specific content information about the disease. Results also indicate female students outperformed male students in diabetes knowledge. This insight can be used to help rehabilitation educators improve their courses and curricula, which may lead to better prepared students as rehabilitation counseling professionals and informed citizens. Rehabilitation educators can focus on teaching students in ways that ensure that male and female students have equal level of diabetes knowledge. Rehabilitation counselor educators can be instrumental in equipping students to address diabetes and related issues by covering the topic of diabetes in their courses and curricula.

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