

Health Awareness, Attitudes, and Behaviors Among Young-Adult Tutors in the Intergenerational Mobile Technology Opportunities Program in Taiwan

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ABSTRACT *Objective:* Health-risk behaviors (e.g., inadequate dietary choices, physical inactivity) predispose young adults to a greater risk for diabetes. This study examines young-adult tutors' experience in a nonfamilial intergenerational program with older diabetic adults and the tutors' perceptions of program benefits relative to promoting their own healthy behavior. *Method:* Using a qualitative purposive sampling method, we recruited 146 college students to participate as technology support tutors in an 8-week Intergenerational Mobile Technology Opportunity Program (IMTOP) for older adults with type 2 diabetes. *Results:* Tutors reported knowledge gains in understanding the association between behavior in early life and later-life health consequences when older diabetic patients shared their stories and experiences with chronic disease. Tutors also described using gained knowledge for self-care, such as addressing sedentary lifestyles, making good dietary choices, and better managing weight. *Conclusions:* Intergenerational programs may promote healthy development for young adults by encouraging behavioral modifications that reduce risks of developing diabetes and other conditions that jeopardize health.

KEYWORDS: diabetes prevention, health promotion, young adult

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The increasing incidence of prediabetes and diabetes is a considerable global health challenge. The World Health Organization (2016) reported that between 1980 and 2014, the number of people with diabetes quadrupled from 108 million to more than 400 million worldwide. In addition, the past two decades have witnessed a global increase in the prevalence of type 2 diabetes among young adults (L. Chen, Magliano, & Zimmet, 2012; Farsani, Van Der Aa, Van Der Vorst, Knibbe, & De Boer, 2013; Pinhas-Hamiel & Zeitler, 2005). In the United States, approximately 18% of youth have prediabetes (Menke, Casagrande, & Cowie, 2016). Similarly, in Taiwan over the last 10 years, the prevalence of type 2 diabetes increased by 32% among adults ages 20–40 and by 11% among those under age 20 (Y. T. Lin, 2016). This growth rate was faster than in other Asian countries, including Japan and Singapore. In 2015, diabetes was one of the 10 leading causes of death among late teens and young adults in Taiwan (Ministry of Health and Welfare in Taiwan, 2017).

The incidence of type 2 diabetes is associated with unhealthy lifestyle choices (Diabetes Prevention Program Research Group, 2002). Young people tend to consume insufficient fruits and vegetables, and they get many of their daily calories from low-nutrition snacks—a pattern that deviates from a three-meal-a-day eating pattern recommended by nutrition experts (Dwyer et al., 2001; Jenkins & Horner, 2005). Adolescents also tend to be sedentary, spending too much time sitting in front of computer screens (Wilmot et al., 2012). Fewer than 25% of children and adolescents participate in physical activities for the recommended 60 minutes daily, especially in higher income countries (World Health Organization, 2016). In Taiwan, physical inactivity, obesity, excess weight, and metabolic syndrome correlate with the prevalence of type 2 diabetes among late teens and young adults (Chin, Chu, Shen, & Wu, 2007; Y. T. Lin, 2016; Yen et al., 2008). Hence, young adults' susceptibility to diabetes is a health issue for Taiwan as well as for the United States and other nations worldwide.

Health-risk behaviors such as poor diets and physical inactivity coincide with risk factors for diabetes, cardiovascular diseases, and other chronic conditions (Chin et al., 2007; Menke et al., 2016; World Health Organization, 2016). As adolescents transition from youth to adulthood, they shift from parent-managed health care to self-care responsibility (M. Chen, Lai, Chen, & Gaete, 2014; Srof & Velsor-Friedrich, 2006). The habits they create during emerging adulthood shape their future lifestyle patterns and affect long-term health outcomes; therefore, it is important to help adolescents make healthy choices as early as possible (Gropner, Simmons, Connell, & Ulrich, 2012). However, health promotion—a process to increase young adults' control over their health—has met with obstacles such as low health literacy and awareness (Gray, Klein, Noyce, Sesselberg, & Cantrill, 2005; W. Lin, Hang, Yang, & Hung, 2011). The prevalence of sedentary or unhealthy

lifestyles among college students may also be associated with peer influence, since peers play a central role in behavioral choices during the transition from youth to adulthood (Hoffman, Sussman, Unger, & Valente, 2006; Houldcroft, Haycraft, & Farrow, 2014). Peer influence has been a significant predictor of behavioral choices with negative consequences, such as smoking and substance abuse (Hoffman et al., 2006) and may be a barrier to promotion of healthy lifestyles among young adults. Health-promotion programs that could overcome barriers (e.g., low health literacy, low awareness, peer influence) and foster healthy behaviors during emerging adulthood are needed.

Taiwan's collectivist culture is characterized by extended family systems and filial piety, which calls for respect and care for older family members (Hofstede, 1980; Falicov, 2001; Mor Barak, 2014). Taiwan also is a hyper-aging society, with low birth rates and increasing numbers of older adults, many of whom have diabetes (Ministry of Health and Welfare in Taiwan, 2017; United Nations, 2015, World Health Organization, 2011); therefore, the younger generation is more likely to interact with and provide support for a larger proportion of older adults—especially family members—with chronic disease. Intergenerational support has proven to be a source of social capital that promotes sustainable social interactions between generations and has a positive impact on older adults' physical and psychological health (Huvila, Holmberg, Ek, & Widén-Wulff, 2010; Trepte, Reinecke, & Juechems, 2012). However, intergenerational support is rarely examined in the context of health-promotion programs among young adults.

The health belief model (HBM) proposes that individuals will be more motivated to act in healthy ways if they believe they are susceptible to a particular negative health outcome (Carpenter, 2010; Rosenstock, 1974). The HBM has been used to examine college students' diabetes self-management, healthy eating habits, and weight management (Deshpande, Basil, & Basil, 2009; McArthur, Riggs, Uribe, & Spaulding, 2017). Drawing from the HBM and intergroup contact theory (Allport, 1954), a health-promotion program in which young adults interact with older adults with chronic disease may improve the health of young adults by mitigating the negative influence of their sedentary lifestyles and motivating them to modify their unhealthy behaviors.

Study Aims and Research Questions

Intergenerational support may motivate older adults to learn health-enhancing technology and diabetes self-management skills, but it may also influence young adults' perception of their own health and behaviors. To explore that possibility, we developed the Intergenerational Mobile Technology Opportunities Program (IMTOP) to empower older adults with type 2 diabetes by improving their self-management skills and knowledge using mobile technology with tutoring support from college students. This study addresses the following research questions:

- After attending an 8-week IMTOP class with older diabetic patients, what are the young-adult tutors' perceptions of their own health attitudes and behaviors?
- How do young-adult tutors perceive the association between their current lifestyles and health problems associated with type 2 diabetes later in life?
- How do young-adult tutors apply the diabetes self-management knowledge and self-care skills they learned from IMTOP?
- What do young-adult tutors perceive to be the benefits of IMTOP for themselves and their family members?

Literature Review

The transition from youth to adulthood provides an opportunity to implement health-promotion interventions aimed at decreasing unhealthy eating habits that lead to weight gain (Cavallo et al., 2012; Gropper et al., 2012; Kattelman et al., 2014) or diabetes (Anand, Ingle, Meena, Kishore, & Yadav, 2015; Ezendam, Brug, & Oenema, 2012; Racey et al., 2016). Studies indicate that physical inactivity, dietary choices, and increased sedentary time contribute to unhealthy lifestyles among young adults (Boyle, Mattern, Lassiter, & Ritzler, 2011; Gow, Trace, & Mazzeo, 2010; Plotnikoff et al., 2015). Evaluations of health-promotion interventions for young adults are often limited to college student samples (e.g., Abu-Moghli, Khalaf, & Barghoti, 2010; Grim, Hertz, & Petosa, 2011; Huang, Hung, Chang, & Chang, 2009); results from these investigations indicate that health-promotion interventions effectively mitigate barriers to practicing healthy behaviors among students.

Investigators have also examined disease-specific self-management behavioral changes in children and young adults—specifically, dietary choices and physical activity among young patients with type 1 or type 2 diabetes (Holmes et al., 2005; Naughton et al., 2014; Wysocki, Buckloh, Lochrie, & Antal, 2005). Many of these studies include both children and young adults, and findings suggest that diabetes knowledge and self-efficacy not only predict how well young adults will take responsibility for self-care during emerging adulthood but also are cognitive and attitudinal prerequisites for young adults to take responsibility for diabetes management (Holmes et al., 2005). Among young diabetic patients, low levels of self-autonomy and reduced parental (i.e., intergenerational) involvement contribute to poor self-management (Holmes et al., 2005; Naughton et al., 2014; Wysocki et al., 2005).

Although there has been limited investigation of peer influence on self-management among young adults, other research has demonstrated that peers play a central role in adolescents' and young adults' behavioral choices during the transition from youth to adulthood (Hoffman et al., 2006; Houldcroft et al., 2014). For example, peer conformity has been a significant predictor of behavioral choices with negative consequences, such as smoking and substance abuse (Houldcroft et al., 2014).

Several studies have used the HBM, a framework that attempts to explain and predict health-related behaviors, to assess college students' diabetes self-management, osteoporosis-preventive behaviors, physical activity, and weight management (Deshpande et al., 2009; McArthur et al., 2017; Wdowik, Kendall, Harris, & Auld, 2001). Findings based on this framework suggest that individuals are more motivated to act in healthy ways if they believe they are susceptible to a particular negative health outcome (Carpenter, 2010; Rosenstock, 1974).

Interventions based on intergenerational relationships have also been the focus of several investigations (e.g., Allport, 1954). Traditionally, intergenerational programs (e.g., daycare, volunteer, and recreation programs) have been designed to reduce intergroup prejudice and enhance the cognitive competence of two generations (Christian, Turner, Holt, Larkin, & Cotler, 2014; Middlecamp & Gross, 2002; Souza, 2011; Y. C. Lin, Dai, Huang, Wang, & Huang, 2016). In some programs, older adults teach courses for youths or share life experiences, leading to positive outcomes in both generations' social and emotional domains as well as improvements in the young participants' academic performance (Cohen-Mansfield & Jensen, 2017; Kaplan, 2001; Souza, 2003). In other programs, youths volunteer as helpers for older adults (including adults with dementia) in assisted-living facilities; such programs generally focus on improvement in the older adults' quality of life or the quality of the interactions between the two generations rather than on youth volunteers' well-being (Biggs & Knox, 2014; Chung, 2009; George & Whitehouse, 2010). Most studies examine either social aspects of outcomes with respect to intergroup stigmatization and anxiety, attitudes, and communication among youth, or they investigate well-being among older adults (Park, 2015; Chua, Jung, Lwin, & Theng, 2013; Y. C. Lin et al., 2016). Empirical evidence is limited for the effectiveness of intergenerational diabetic self-management programs involving older diabetic patients and young adults.

Few studies have examined how health-promotion programs influence young adults' lifestyle choices via nonfamilial intergenerational interaction with diabetic patients. This study helps to fill that gap by exploring IMTOP's effect on young adults' perceived benefits of health-promoting attitudes and behavior. Given the lack of relevant research, we used qualitative methodology to gain an in-depth perspective of (a) the young-adult tutors' experiences participating in IMTOP classes with older diabetic adults, and (b) the young-adult tutors' perceptions of IMTOP's health-promotion benefits in the broader context of family and community.

Method

Approach

Using a purposive sampling approach, we recruited college students from six universities and colleges in Taiwan; the schools were located close to two community

hospitals. The students participated as IMTOP technology support tutors assisting older adults who had type 2 diabetes. Because we were interested in understanding tutors' perceptions of their health attitudes, awareness, and lifestyle choices, we used tutors' self-reflection notes and monthly written reports as a source of qualitative data.

Procedures

Recruitment flyers were distributed to students via e-mail. Participation criteria included the following: (a) ages 18–30; (b) basic technology skills, such as the ability to use smartphones or tablet computers; and (c) commitment to volunteer at a study site for approximately 50 hours during the 8-week intervention period (2 hours per week, 6 hours of training, plus time to complete self-reflection notes and two written reports). Students who met the inclusion criteria were invited to attend a 2-hour on-campus orientation workshop to learn more about the study.

Enrollment packages distributed at the tutor orientation workshop included a participant consent form and a self-administered survey to collect information about sociodemographic characteristics; tutors were asked to complete the written consent and survey at the workshop. Prior to start of the intervention, tutors were required to complete a 6-hour online training on volunteers' roles, the aging experience, problem-solving skills, and communication skills with older adults. Ultimately, 157 college students consented to participate as tutors.

To recruit older adults, we contacted doctors in the metabolism and endocrinology departments of two hospitals and asked them to refer patients who had been diagnosed with type 2 diabetes at least 6 months prior, were at least 55 years old, and who met inclusion criteria. Patients who showed interest in participating met with recruiters in the patient waiting area to complete the informed-consent process and eligibility screening. Patient inclusion criteria included (a) the ability to read a Chinese newspaper; (b) normal eye–hand coordination; (c) an ability to understand Mandarin (in listening, speaking, reading, and writing); (d) a home telephone or a cellular phone; and (e) the ability to attend the IMTOP training course. Of the patients who met inclusion criteria, 431 consented to participate in the IMTOP study.

Patients were divided into 37 weekly classes instructed by health professionals, with four tutors assigned to each class of 10 patients. Tutors assisted patients with computer skills, such as use of Web browsers, use of social media, and searching diabetes-related resources online. The class curriculum included diabetes self-management knowledge and skills and use of a mobile technology application to schedule appointments, request medication refills, get appointment reminders, and access online health information. The instructors used lectures, videos, and group sharing to teach patients about type 2 diabetes.

During the intervention, 11 tutors and 97 patients dropped out of the program due to scheduling conflicts, a change of residence, or sickness; 146 tutors and 334 patients completed the full program. Among patients, 42% were female, and the mean age was 64.66 years ($SD = 13.21$). Among tutors, 92% were female, and the mean age was 20.1 years ($SD = 1.5$). The majority of tutors were either sophomores (34%) or juniors (38%), 53% majored in social science, and 69% studied at five universities in Taipei (the rest were from a university in Hualien). See Table 1 for tutor demographic characteristics.

Data Collection

Tutors were asked to complete self-reflection notes after class (at the end of the first and last weeks) and two monthly reports, all via the study website. We provided the following questions to guide tutors' after-class reflections and monthly reports: "What are the important takeaways that you learned from this volunteer experience? Have you developed or improved any skills from this volunteer experience, such as teaching, communication, etc.? What do you think about older adults and

Table 1
Demographic Characteristics of Young-Adult Tutors (N = 146)

Variable	Range n	Mean (SD) %
Age (years)	18–27	20.1 (1.4)
Gender		
Female	134	92
Male	12	8
Student level		
Freshman	31	21
Sophomore	50	34
Junior	55	38
Senior	6	4
Graduate	4	3
Student major		
Humanities	35	24
Social science	78	53
Science/technology	4	3
Health care	29	20
Region		
Taipei	101	69
Hualien	45	31

Note. SD = standard deviation.

the aging process after this volunteer experience? Does this volunteer experience influence your health attitude and behaviors? If so, what are those impacts? Does this volunteer experience influence your attitude and thoughts toward helping older adults? If so, what are those impacts?" Institutional review boards at the University of Southern California and at Taipei Tzu Chi Hospital and Hualien Tzu Chi Hospital in Taiwan approved the research.

Data Analysis

Three members of the research team coded all self-reflection notes and monthly reports through a process of selective open coding. For the first stage of the process, each coder worked independently to read and code several randomly assigned notes and monthly reports. Coders and the principal investigators then met to discuss the responses and identify emergent patterns (Patton, 2005). This iterative process of coding and consensus building continued for 3 months as the coders analyzed additional sets of notes and reports. At the end of the iteration period, all three coders had analyzed all of the written material. During regular meetings, the coders and principal investigators reviewed the open-coded data to enhance intercoder agreement; that process helped ensure that the codebook reflected a high degree of intercoder agreement. The codebook was imported into Dedoose, a Web-based, cross-platform application used to analyze qualitative research (Fortier et al., 2015; Niedzielski, Rodin, Emmerson, Rutgers, & Sellen, 2016; Unertl, Field, Price, & Peterson, 2015).

Prior to data analysis, the coders used Dedoose to test interrater reliability to ensure a high level of consistency. The coders earned Cohen's kappa scores above 0.85, indicating high reliability (Landis & Koch, 1977). Following coding and analysis, a research assistant who is proficient in English translated a selection of self-reflective notes and monthly reports related to key themes for use in English-language journal articles.

Results

Tutors' after-class notes indicated that the 8-week intervention—with its structured curriculum and intergenerational interaction between older diabetic patients and young-adult tutors—influenced their perceptions of health awareness, attitudes, and behaviors in the following ways: (a) risk perception (perceived susceptibility to and severity of diabetes), (b) the association between adolescent lifestyle and health outcomes later in life, (c) diabetes literacy and awareness, and (d) improved daily lifestyle and self-care activities relative to diabetes prevention. Tutors also described sharing with their families what they learned about diabetes prevention skills.

Risk Perception

Most tutors stated that as they interacted with patients in class, they heard stories about the older adults' experiences with diabetes-related self-regulation (e.g.,

blood-sugar testing, compliance with insulin medication protocols, and prolonged dietary abstinence), which imposed functional limitations that decreased patients' quality of life. Many tutors reported that after listening to patients' experiences about adverse effects and diabetes self-care, they now believed that type 2 diabetes is a problem with serious consequences that may interfere with daily functioning in later life.

I learned that older adults paid the price for diabetes, which is much more than what I expected, so I started to control my food intake. (Participant 156, female)

Through interaction with older adults in class I realized that there are various types of functional impairment or limitations in patients with diabetes who have endless daily to-do lists. It reminds me to take good care of my health when I am young because it will cost me more to get treatment when I have health problems in later life. (Participant 50, female)

The more I learn about diabetes as a chronic disease, the more I understand how patients suffer from diabetes! They couldn't eat the food they desire, which greatly impacted my dietary habits. (Participant 116, male)

After participating in IMTOP, tutors reported that they were more risk-averse with regard to the serious consequences of diabetes.

Lifestyle Choices and Health Problems Later in Life

Self-reflection notes and reports indicated that prior to participating in IMTOP, the majority of tutors rarely recognized links between early life eating habits or lifestyle and later-life consequences. They stated that their dietary choices or physical inactivity seemed to have no effect on health outcomes in later life. However, patients' in-class discussions about unhealthy lifestyles and dietary habits in early life allowed tutors to recognize that a sedentary lifestyle and unhealthy food choices might lead to later health problems associated with type 2 diabetes. Tutors mentioned that they were concerned that their adolescent choices would make them susceptible or vulnerable to diabetes as they aged. According to tutors' written notes, patients' stories motivated tutors to reflect on their own lifestyle choices and practice self-care to reduce their risk of developing type 2 diabetes.

We often think because we are young, we can eat or drink whatever we want, sleep at irregular schedules, and use electronic products excessively. These are all habits that could be harmful to our health. Being a volunteer, I encountered many older adults with other health problems in addition to diabetes. Therefore, we should start taking care of our physical health when we are still young. (Participant 98, female)

Being part of this program has greatly influenced my attitude and behavior towards health. After going through this program and learning about the older adults' personal

experiences, I became a little worried that I may also have diabetes one day. Because of it, I began to watch what I eat and exercise whenever I can. (Participant 106, female)

After participating in IMTOP, tutors reported that they might reduce their risk of developing chronic diseases by making an effort to live a healthier lifestyle while they are young. Through in-class sharing of older diabetic patients' experiences, the majority of tutors reported an improvement in their understanding of how adolescent lifestyle choices influence health consequences in later life.

Diabetes Literacy and Awareness

Some tutors expressed that before they volunteered for the IMTOP study, understanding medical terminology and language was daunting; however, they benefited from the easy-to-understand approaches (i.e., listening to lectures and in-class intergenerational group activities and exercises) that the IMTOP educational workshop used, as well as the topics it introduced—such as understanding diabetes and self-management, complications, calculation of glycemic index (which helps students make better dietary choices), exercise, and online diabetic communities. As a result, most tutors reported an improvement in their knowledge of diabetes, health-related online resources, diabetes-related mobile apps, and self-care skills.

I learned what diabetes is and how to control it effectively. I also became aware of the precautions for older adults with diabetes, the tests that they need to do every day, the diet that they should partake, and the hands and legs exercises that they can practice daily. (Participant 37, female)

I can review and assess my own health status along with the older adults as we are calculating the BMI [body mass index] and GI [glycemic index] together. At the same time, I am learning to watch health-related videos and browse relevant websites. (Participant 33, male)

Tutors' written notes indicated that most felt that IMTOP's curriculum helped them learn to navigate health-related information and determine the credibility of the information. Specifically, they believed they knew more about what health indicators to look for and which health-related resources to trust after the intervention. As a result of the perceived improvement in knowledge of diabetes and self-management skills, the majority of tutors expressed that their awareness of diabetes as a personal health concern was enhanced.

Preventive Lifestyle Modification and Self-Care

With an improved understanding of type 2 diabetes risk factors and knowledge of diabetes-related self-management skills, most tutors described reflecting on their

sedentary lifestyle and attempting to practice self-care skills in their daily lives. Some mentioned that they seldom exercised prior to participating in the program, but that once they learned that physical inactivity is the major risk factor for developing diabetes and other chronic diseases, they planned to modify their exercise behaviors by building individualized workout routines with the goal to make workouts a habit. Tutors who worked out regularly before the intervention expressed greater confidence about their exercise habit after they learned about the benefits of physical activity. In addition, the majority of tutors reported during the program that they had started dietary and weight management by using health indicators (e.g., body mass index) to regularly track their body weight and by developing healthy eating habits based on nutrition guidelines.

Yes, I am more aware of my eating habits now. I realized that I have been consuming too much carbohydrates and oil, so I have begun to calculate my daily portion of carbohydrates, oil, and protein and try to keep them under the maximum recommended daily intake. (Participant 118, female)

I will be taking better care of my physical health through proper diet and sufficient exercise. The slogan “three lows and one high” (low oil, low sugar, low salt, high fiber) has greatly influenced my eating habits. In addition, exercising three times a week, recording body weight and blood pressure regularly, and having a healthier daily routine at an early age will prevent possible age-related health problems. (Participant 132, female)

After learning the risk factors for developing diabetes and the benefits of a healthy lifestyle for diabetes prevention, most tutors expressed that they needed to be more cautious about their health status and that they planned to take more proactive roles and responsibility for their health.

Benefit to Family

Many tutors reported that they now cared more about the health status and lifestyles of the diabetic patients they knew personally and described introducing the knowledge and skills learned in the class to their diabetic family members and friends, including exercise video clips and the Diabetes Passport (a tool for patients to document information such as education, tests, medications, and goals to share with their diabetes care team).

Having some understanding of diabetes does come in handy when I meet people with diabetes. For example, I am able to share what I have learned from the classes with my father, who has diabetes. (Participant 73, female)

Even though my mother also has diabetes, I was never aware of her medical details, such as medication management, Diabetes Passport, and emergency contact card. Now I am much more aware of my mother's health status. (Participant 170, female)

One time my grandmother told me that she had been gaining weight and was not sure what kind of exercise she could do. She happened to be in Taipei a couple of days ago to receive a volunteer award, and so I had the opportunity to share with her what I have learned about exercises for people with diabetes. I introduced YouTube to her with her cell phone so that she can practice them at home during the weekdays. (Participant 19, female)

Although the IMTOP self-management courses targeted older adults with diabetes, the young-adult tutors reported that they transferred skills from the context of classroom interaction with nonfamilial adults to the context of interacting in their own homes with family members; this effect of the tutors' IMTOP participation may potentially facilitate or improve their familial relationships in terms of intergenerational interaction about health concerns.

Discussion

This study examined the effects of nonfamilial interaction with older diabetic patients on young-adult tutors' perceptions of their health awareness, attitudes, and behaviors. IMTOP's qualitative findings extend the literature in the field of youth health development and aging-related intergenerational programs in several ways.

First, although the IMTOP curriculum was designed to train older diabetic patients in self-management skills, the majority of the college students recruited to provide technology tutoring support perceived substantial improvement in their health literacy, awareness, and self-care skills with respect to type 2 diabetes after they attended the eight educational workshops with older-adult patients. Tutors' written notes indicated that prior to participating in IMTOP, they rarely understood the association between their current lifestyle and future health outcomes. However, after in-class interaction with diabetic patients who shared stories about their early lifestyles and subsequent serious health consequences or complications in later life, tutors described reflecting on their own unhealthy lifestyles and better understanding the relationship between adolescent lifestyle and health outcomes in late adulthood.

In addition to their perceived improvement in knowledge and self-care skills through the IMTOP workshops, most tutors reported an improved understanding that unhealthy diet and lack of physical activity are risk factors for type 2 diabetes and other chronic diseases. These results align with the constructs of perceived susceptibility and severity of the HBM (Carpenter, 2010; Rosenstock, 1974). With perceived susceptibility to developing diabetic symptoms and an improved understanding of the potential for severe health consequences (e.g., dietary restrictions, multiple complications, low quality of life) after listening to the older patients, tutors expressed stronger intentions to make lifestyle modifications to reduce their risk

of developing diabetes. These findings support the HBM assumption that nonfamilial interaction with diabetic patients would lead to development of college students' perceptions of vulnerability to diabetes (Cao, Chen, & Wang, 2014; Conner & Norman, 2005; Davis, Campbell, Hildon, Hobbs, & Michie, 2014; Rosenstock, 1974). With knowledge learned from the IMTOP curriculum, tutors reported understanding that healthy eating habits and regular physical activity are protective factors that may reduce the risk of developing diabetes—findings suggesting that tutors' perceived health responsibility is improved by making them more aware of their own and others' health status and influencing them to manage diet and weight in their daily lives.

Whereas most previous research on health-promotion programs for young adults has engaged only one generation in higher-education settings (Abu-Moghli et al., 2010; Grim et al., 2011; Huang et al., 2009; Kattelman et al., 2014; Plotnikoff et al., 2015), the IMTOP study engaged two generations in community-based settings. Informed by intergroup contact theory and HBM, the IMTOP study design applied nonfamilial intergenerational interaction in the context of health-promoting behavior. The nonfamilial interaction (sharing stories of living with diabetes and doing health-promotion group exercises) improved tutors' perceived awareness of their current sedentary lifestyles and facilitated behavior change.

Also distinguishing the present study from previous research on youth health promotion is our finding that the majority of tutors reported transferring learned health-promotion skills from the nonfamilial setting to a family context. Tutors stated that during and after the intervention they were more attentive to the health of their family members—especially those with diabetes—and shared diabetes-related knowledge and skills learned in the class with their grandparents, parents, and siblings. Hence, the IMTOP intervention might improve not only tutors' relationship with family members from the perspective of intergenerational interaction, but it may also increase intergenerational health literacy, awareness, and behaviors.

Finally, our results suggest that intergenerational interaction affected tutors' perception about self-responsibility for their health outcomes. The literature on intergenerational programs has traditionally focused on social aspects (e.g., reducing intergroup prejudice; Chua et al., 2013; Y. C. Lin et al., 2016; Park, 2015). In contrast, the IMTOP study—with its perceived benefits in health-related outcomes among young-adult tutors—sheds new light on the application of intergroup contact theory in the context of health promotion among young adults.

Limitations

Several study limitations should be noted. First, college students were recruited in two cities via a purposive sampling method, and participants were predominantly females who majored in social science. The possibility of self-selection bias limits

transferability of the findings to college students majoring in other subjects or to male students in other cities in Taiwan. Second, the IMTOP curriculum was developed specifically to train older diabetic patients about self-management behavior, with young-adult tutors playing supporting roles as technology teaching assistants. Self-care training topics that meet tutors' needs (e.g., stress management, meaning of life) were not included in the orientation training and IMTOP curriculum. Third, the study included young adults as technology tutors; however, the benefits they perceived may have been similar even if they were simply present in the classroom hearing the older adults' experiences. If that is the case, future programs could include young adults who are not comfortable serving as tutors.

Implications for Practice and Research

Study findings have implications for practice and future research on health-promotion interventions for young adults. First, in the context of youth health-promoting behavior or diabetes prevention, nonfamilial intergenerational interaction with people with diabetes or other chronic illnesses may promote positive lifestyles or behaviors among young people. Disease-specific health-promotion programs that involve older patients and also target young adults at colleges or universities are needed, as is research examining the outcomes of such programs. Second, this study was designed to explore the effects of IMTOP with a curriculum targeted at diabetic patients. To better understand the impact on multiple generations, intergenerational health-promotion program curricula could include shared activities for two or three generations rather than focusing on one. As Chua et al. (2013) suggested, activities shared among youths and older adults could be deployed to observe behavioral outcomes for multiple generations. Because this study did not specifically address peer influence, which has been shown to be a significant predictor of behavioral choices with negative consequences (Hoffman et al., 2006), we recommend further exploration of peer influence on inhibiting or promoting healthy lifestyles among young adults.

Conclusion

In the context of Taiwan's hyper-aging society and fast-growing adolescent population with prediabetes, our findings shed new light on the application of intergenerational programs to promote healthy lifestyles and reduce young adults' risk of developing diabetes, cardiovascular diseases, and other chronic conditions. Our results suggest that intergenerational programs with older diabetic patients improve young-adult tutors' perceptions of their susceptibility to diabetes and relevant health consequences in later life, which may facilitate modification of sedentary lifestyles and poor dietary habits in early life.

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