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# Physical activity of Chinese American immigrants with type 2 diabetes/prediabetes: A mixed method study

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## Abstract

**Aim—**To understand physical activity (PA) intensity, types, knowledge, and barriers to PA among Chinese American immigrants with type 2 diabetes/prediabetes.

**Background—**Although the benefits of aerobic and muscle-strengthening activity for patients with type 2 diabetes have been studied extensively, research on PA performance among Chinese American immigrants with type 2 diabetes/prediabetes is limited.

**Design—**A mixed-method design.

**Methods—**The short version of the International Physical Activity Questionnaire-Chinese version was used to measure participants' levels of PA intensity. Semi-structured face-to-face interviews were conducted to obtain additional information regarding PA types, knowledge and barriers to PA.

**Results—**A total of 100 Chinese immigrants, within an average of three years of type 2 diabetes/prediabetes history and 22 years of living in the United States, were recruited in New York City, from January 2012 to July 2012. The average PA metabolic equivalent of task (MET) was 2743.590 ± 3210.209 METs/week, mainly from walking (1453.701±1913.772 METs/week) with mean walking minutes of 79.36 (SD = 106.770) per day. In regard to the subscales of IPAQ-C, mean vigorous PA was 398.788 (SD = 1117.204) METs/week with a mean total vigorous time of 17.22 minutes/week. The most common type of PA performed was housekeeping, followed by walking. Only 8.05% (n=36) of them preformed brisk walking, Tai Chi, and Kung Fu. Based on the interviews, three themes were identified as pertaining to barriers to perform moderate to vigorous PA: inadequate knowledge regarding the intensity and types of PA, concerns about PA due to health conditions, and a busy work schedule.

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**Conclusion—**The majority of Chinese American immigrants with type 2 diabetes/prediabetes do not engage in sufficient PA, having a rate significantly below national populations with diabetes in the United States. An increase in the PA intensity level of the diabetic care for Chinese immigrants should be promoted.

## Background

The rapid and exponential increase of type 2 diabetes, along with its complications and healthcare expenditures, has become a major public health problem worldwide (Centers for Disease Control and Prevention [CDC], 2013a). In 2010, diabetes was the seventh-leading cause of death in the United States and the fifth-leading cause of death among Asian Americans (CDC, 2013b, 2013c). As of 2012, Chinese Americans comprised the largest subgroup of Asian Americans, numbering over 4 million (Hoeffel, Rastogi, Kim, & Shahid, 2012). In 2011, more than one in three (38.3%) Chinese Americans who lived in New York City (NYC), United States, had prediabetes or diabetes (Rajpathak & Wylie-Rosett, 2011), indicating a great health threat to this population. In addition, Chinese American immigrants have a higher risk of diabetes than do their counterparts in China. As of 2011, Chinese Americans who lived in NYC had much higher age-standardized prevalence of impaired glycemic levels in terms of fasting plasma glucose (34.5%) than did Chinese (15.5%) who lived in China (Rajpathak & Wylie-Rosett, 2011). The vast environmental and social differences between China and the United States, particularly in terms of immigrants' lifestyle behaviors, may have an effect on the risk of diabetes among Chinese Americans.

Individuals with prediabetes have impaired glucose tolerance or impaired fasting glucose and are at high risk for developing type 2 diabetes. Research has demonstrated the significantly high risk of macrovascular complications along with low rates of microvascular complications early in the stage of prediabetes (Coutinho, Gerstein, Wang, & Yusuf, 1999; Rathmann, Dickhaus, Meisinger, Mielck, & Group, 2008; Tanne, Koren-Morag, & Goldbourt, 2004). Thus, it is equally important to manage the glucose levels of prediabetic and type 2 diabetic patients. The latest diabetes care guidelines recommend regular aerobic exercise and strength training programs (e.g., walking briskly, riding a bicycle, playing badminton, practicing tai chi, engaging in large muscle exercise) as key elements of both prevention and management of prediabetes and type 2 diabetes (American Diabetes Association, 2015). Studies have shown that Asians are less likely to engage in physical activity (PA) as compared to other ethnicities in the United States (HealthyPeople.gov, 2014). There is a lack of data, however, on the type and level of intensity of PA that urban Chinese Americans perform in the context of the prevention and management of diabetes (Wyatt, Trinh-Shevrin, & Kwon, 2014).

In addition, Chinese American immigrants who live in NYC might be more vulnerable to health problems than are other minorities due to their limited English proficiency (Hooper & Batalova, 2015; Shelley, Russell, Parikh, & Fahs, 2011). According to a Migration Policy Institute report, in 2013, 62% of Chinese immigrants age 5 years and older reported limited English proficiency, compared to 50% of the total foreign-born populations (Hooper & Batalova, 2015). Shelley et al. found that older Chinese American immigrants who lived in NYC had even less sufficient English proficiency, more dental problems, and less healthcare

utilization as compared to other minorities. These findings show the unique characteristics of Chinese immigrants that should be taken into consideration when providing healthcare. Given the high prevalence of type 2 diabetes/prediabetes among Chinese Americans and the need for their engagement in PA, the purpose of this study was to investigate the type and intensity level of PA, PA information resources, and barriers to exercise among Chinese American immigrants with type 2 diabetes/prediabetes.

## Theoretical Framework

The self- and family management framework (Grey, Schulman-Green, Knafl, & Reynolds, 2015), which has been applied to people with chronic conditions, was used to guide our study design. Grey et al. view self-management as a dynamic process in which an individual uses certain behaviors to manage his or her condition in the context of daily life. In Grey et al.'s self- and family management framework, facilitators and barriers are the antecedents to processes and outcomes. Therefore, an understanding of barriers to PA would be the first step in helping clinicians to develop an effective plan to facilitate the behaviors toward preferred outcomes, i.e., sufficient PA.

## Methods

### Aim

The aim of the study was to understand physical activity (PA) performance, PA information resources, and barriers to PA among Chinese American immigrants with type 2 diabetes/prediabetes.

### Design

A concurrent mixed-method design was employed, as qualitative data have the ability to provide a richer perspective than quantitative results alone can provide (Creswell & Plano Clark, 2011; Polit & Beck, 2004). The quantitative portion was cross-sectional and descriptive, involving the collection of quantitative data on PA intensity through the use of the International Physical Activity Questionnaire-Chinese (IPAQ-Chinese) (Deng et al., 2008). The qualitative portion, which involved a phenomenological approach (Husserl, 1962), provided a further understanding of Chinese immigrants' experience in terms of performance and knowledge of, as well as barriers to, PA. The study used a single interview with each participant, guided by a semi-structured interview protocol, which ensured the reliability of the interview (Cohen & Crabtree, 2006). The researchers (SH and MF) conducted content analysis to determine the themes and patterns that emerged from the interview data.

### Sample size

The sample size calculation was based on the primary study, which investigated the relationship between body composition (i.e., muscle and fat) and PA in Chinese Americans. For the sample size calculation, a point biserial model for a correlation test was used in G*Power 3.1.5 (Faul, Erdfelder, Buchner, & Lang, 2009). Based on a power of 0.80, an alpha of 0.05, an effect size of 0.30, and two-tailed significance, the results indicated that a

minimum sample of 82 participants was needed. A total of 100 participants of community-based convenience sample was recruited for the study.

## Study participants

A convenience sample of 100 participants in a community health center was used. The inclusion criteria included self-identified as a Chinese immigrant over age 18 years (legal age to sign consent), diagnosed with type 2 diabetes or prediabetes, and able to communicate in English, Mandarin, or Cantonese. People who could not stand alone on a stadiometer, equipment used to measure height and weight, or who had a physical disability were excluded. Participants received a free exercise and diet consultation based on their current diabetes/prediabetes management knowledge once they completed the study. The interview was conducted before the education was provided in a private room in a community health center.

## Study site, recruitment, and data collection procedures

The IRB approval (IRB#: S12-00456) was granted before any data collection commenced. The study was conducted in a community health center affiliated with a medical center in Queens, NYC. The community health center was chosen because it provided diabetes management care, and their clinicians can speak many Chinese dialects. Thus, in this site, the language and cultural barriers to diabetes management for Chinese immigrants should be less limited.

To recruit participants, study flyers were placed at the front desk of the study site to make them available to any Chinese patients who would be interested in participating in the study. If patients were interested in the study, they would inform the research nurses directly about their interest, or the physicians or nurses at the study site would inform research nurses of potential participants and obtain patients' permission for the research nurses to contact them. Then, the research nurses would verify with potential participants their eligibility for the study based on the inclusion and exclusion criteria, to address any questions, and to administer the informed consent process. All participants were checked for their understanding of this study by verbally repeating the purpose of the study and voluntary nature of participating in the study prior to signing the informed consent form (in either English or Chinese). Trained research nurses gave the participants the questionnaire and conducted a semi-structured interview in a private and quiet examination room.

## Semi-structured interviews

Trained research nurses conducted the semi-structured interviews, which included three open-ended questions: "What do you know about the exercise for diabetes management?" "What are the most common types of physical activity that you have practiced in the past three months?" and "What are the barriers to your exercising?" The interviews were transcribed and stored in a password-protected computer. Two researchers (SH and MF) independently coded PA into the four categories of being active, flexibility exercises, aerobic exercise, and strength training, as recommended by the American Diabetes Association (2015), and then reconciled any inter-coder inconsistencies in terms of the types of and knowledge of, as well as barriers to, PA. Participation in the interview was voluntary, and

participants could answer the survey questions but choose not to participate in the interview. All of the participants received a free diabetes lifestyle modification consultation, whether or not they participated in the interview after completing the study.

## Demographic information

Demographic information, such as age, gender, education level, years in the United States, and occupation, was collected. Anthropometric measures were used to for height and weight. The average of the three measurements of height, weight, and waist circumference was used for data analysis. Body mass index (BMI) was defined as weight (kg) divided by height ($m^2$). Increased body weight is a risk factor for type 2 diabetes, but the relationship between body weight and type 2 diabetes is more significantly related to the distribution of body fat, specifically visceral abdominal fat. Evidence has shown that Asians have more abdominal and visceral fat than do Whites (Lim et al., 2011; Morimoto et al., 2012). Chinese Americans have a high incidence of diabetes/prediabetes with a low BMI (<23.0 $kg/m^2$) (Rajpathak & Wylie-Rosett, 2011). Instead of using the parameters of overweight (BMI = 25.0 < 30.0) and obese (BMI ≥ 30.0), based on the general population (CDC, 2016), in this study, BMI was categorized as <18.5 (underweight), 18.5–22.99 (normal), 23–27.49 (pre-obese), and ≥27.5 (obese), as such parameters are the cutoff points for Asian Americans' risk of developing type 2 diabetes (Hsu, Araneta, Kanaya, Chiang, & Fujimoto, 2015).

## Intensity levels of PA

The short version of the IPAQ-Chinese (Deng et al., 2008) was used to assess intensity levels of PA. The IPAQ-Chinese has good test-retest reliability (intra-class correlation coefficients range from 0.81 to 0.89, $p < 0.00$) and moderate-to-good validity for total activities (partial $r = 0.33$, $p < 0.00$), including vigorous and moderate physical activities and walking (partial $r = 0.58$, $p < 0.001$) (Deng et al., 2008). The IPAQ-Chinese provides information regarding the amount of time spent per week engaged in PA in terms of intensity of moderate and vigorous PA, duration (minutes/week), and average energy expenditure during the period of time (Deng, 2008). Data collected with IPAQ can be both continuous and categorical (International Physical Activity Questionnaire, 2005). A continuous score could be expressed as the value of the metabolic equivalent of task (MET) minutes per week (8.0 METs for vigorous activities X minutes X days per week, 4.0 METs for moderate intensity X minutes X days per week, and 3.3 METs for walking X minutes X days per week) (IPAQ, 2005). In this study, MET values were the energy expenditure and were defined as the ratio of the metabolic rate associated with PAs divided by the resting metabolic rate (Meyerhardt et al., 2006). In addition, a qualitative 24-hour recall was used to validate the consistency between the information obtained from the IPAQ-Chinese and participants' self-reported exercise pattern and intensity. Any inconsistency was clarified immediately with the participant. In this study, when assessing the intensity level, we also considered the frequency. Moderate to vigorous activity had to be of at least 30 minutes and three days per week to be counted as one moderate or vigorous PA, a criterion that was used in Morrato, Hill, Ghushchyan, and Sullivan (2007) national survey study on PA performance in U.S. adults with diabetes.

### Data Analysis

IBM SPSS Statistics for Windows, Version 20.0, was used for quantitative data. The participants' demographic and PA types were analyzed using descriptive statistics. Two researchers did a content analysis of the responses to the open-ended question at the end of the diabetes education. To assess the interrater reliability, two researchers separately coded the qualitative data of the responses to the open-ended questions. If there was any inconsistency in the coding, the two researchers discussed the coding until 100% agreement was reached. For the most common types of PA that participants performed, the research nurses developed four categories, i.e., aerobic exercise, strength training, flexibility exercise/stretching, and activity throughout the day, all of which are recommended for people with diabetes by the American Diabetes Association (2015).

## Results

### Participant characteristics

Data were collected from 100 Chinese American immigrants with diabetes/prediabetes who live in Queens, NYC. The mean age of the participants was 63.01 years (SD = 14.48, range = 26–92 years), and 47% were female (Table 1). On average, the length of time lived in the United States was 21.53 years (SD = 12.69), and the majority had lived in the United States longer than 5 years (82.9%). The mean time since diabetes diagnosis was 3.33 years (SD = 6.64). Most participants received education at the level of junior/senior high school (46%) or beyond (44%). The majority of the participants were retired or not employed (48.9%). Half of the participants had a high BMI ($n$ = 50, 50%), and among them, 62 (63.2%) were pre-obese (BMI ≥23).

In addition, 67 of 100 (67%) Chinese Americans participated in the semi-structured interview. Their mean age was 62.82 (SD = 15.661) years. They had lived in the United States for a mean of 22.73 years (SD = 13.453), received a mean length of education of 10.98 years (SD = 4.786), and been diagnosed with type 2 diabetes/prediabetes for a mean of 3.41 years (SD = 7.692). There were no statistically significant differences in the demographic characteristics of those who participated in semi-structured interview and those who did not.

**Chinese American Immigrants' PA intensity—**As shown in Table 2, the mean metabolic equivalent time was 2743.590 (SD = 3210.209) MET/week. Walking was the most performed PA, contributing to the majority of the metabolic equivalent time, and the mean walking minutes were 79.36 (SD = 106.770) per day. In regard to the subscales of IPAQ, mean vigorous PA was 398.788 (SD = 1117.204) MET/week with a mean total vigorous time of 17.22 minutes/week.

**PA types—**Study participants also reported the types of PA that they commonly performed (Table 3). Housekeeping ($n$ = 62) was the most common PA reported, followed by walking or going up and down the stairs instead of taking an elevator, if possible ($n$ = 54), walking or stretching hourly during work ($n$ = 53), and stretching before exercise ($n$ = 49). Very few

patients performed aerobic or strength training PA. *Being active* was the most common PA category performed.

**PA information resources—**As seen in Table 4, Participants' PA information was learned mainly from their family doctors ($n$ = 53; 53%), followed by newspapers ($n$ = 36; 36%), and friends ($n$ = 31; 31%). A very small portion of PA information was learned from endocrinologists or nurses.

**Barriers to PA—**The content analysis of the qualitative data revealed three themes:

1. Insufficient education for PA

   The participants did not say directly that they did not receive sufficient exercise education; however, they did mention that they only modified their diet but did not know the intensity and types of PA that they should perform. As one participant stated:

   > Although I have been diagnosed with diabetes for 17 years, I still was not clear about this disease. I manage my blood glucose with oral hypoglycemics and frequent finger sticks almost every day. I rarely eat sweets and try to eat healthy, but I don't like to exercise. I do know that exercise is important for me, but I don't know how important it is, so I don't really do it.

   Another participant stated, "I eat very healthy, but I don't know much about exercise. I don't know the difference between walking, aerobic exercise, and muscle training exercise."

   In addition, we also noticed a problem that participants experienced: They did not know that exercise also was an important part of lifestyle modifications. They had tried lifestyle modification, but it seemed that they knew and performed more in terms of diet management. They did not know the importance of PA, so they were less likely to perform it or to perform it with sufficient intensity levels, as recommended by the American Diabetes Association (2015). Although it was not the purpose of this study, we provided a free face-to-face diabetes lifestyle modification consultation to our participants. After the consultation, many participants realized that they needed to engage in lifestyle modification, including both diet and PA, to manage their blood sugar better. For example, one participant explained:

   > I know that I have prediabetes, and I have tried to be healthy, so I have been very cautious about my diet. I don't understand why my HbA1C is still increased. I know diet can help my sugar, but I didn't know exercise is important, too. Now I know that diet is not the only thing that matters to my sugar. Exercise is also important to help me prevent and manage my prediabetes status, in addition to diet.

2. Health concerns regarding performing PA

The participants mentioned that they might have had good exercise habits in the past but that they were not able to continue due to their aggravated health conditions. During the interview, participants mentioned that they did not know how to continue to exercise or what exercise they could perform, given their health limitations. As the result, participants did not know what exercise they could do now or whether they had to stop doing exercise that they used to do. One participant explained, “I used to ride my bike frequently and kept a very good shape 20 years ago. But riding a bicycle is too aggressive an exercise for me now.” Another stated, “I was very active and did lots of exercises, push-ups, running before having lung cancer. After I had surgery, I can only do a few sit-ups and walking.

3. Work-related barriers: Busy schedule, too tired after work

Some participants experienced work-related barriers, such as being too busy to exercise or too tired after work to exercise. Some participants’ work required them to stand on their feet for long periods of time, so they thought that they had exercised enough. Others, who had long working hours, just wanted to rest on their days off. One said, “I’m a nurse. I know my health. I walk a lot during work. After work, I just want to rest. I thought walking during my work is sufficient to manage my sugar.” Another explained, “I know that I need to exercise more, but I am always too tired after work, and I have no extra time.” Another participant stated, “I work in a restaurant five days a week and stand most of the time…. I rarely exercise. When I have some free time, I just want to sit and go surfing on the Internet.”

## Discussion

The findings indicated that, within an average of three years of type 2 diabetes/prediabetes history and 22 years of living in the United States, the Chinese immigrants who would be assumed to be assimilated well into the Western healthcare system still encountered challenges in PA performance and received insufficient PA information. These findings advance our understanding of Chinese American immigrants’ PA performance and the barriers experienced as well as indicate areas for greater involvement by nurses.

Increased PA has been well established as an effective method to prevent and manage impaired blood glucose and type 2 diabetes in addition to pharmacotherapy, diet, and weight loss (Schellenberg, Dryden, Vandermeer, Ha, & Korownyk, 2013). Diet (low-calorie and low-fat) and moderate intensity exercise (e.g., 150 minutes brisk walking per week) can improve blood glucose control (Schellenberg et al., 2013). Individuals with type 2 diabetes or at risk of developing type 2 diabetes are less likely to be involved in regular PA as compared to national norms (Morrato et al., 2007). In the 2003 national Medical Expenditure Panel Survey of U.S. populations, only 39% of 23,283 adults with diabetes were physically active (Morrato et al., 2007). In the current study, using the same definition of physically active (moderate to vigorous exercise for at least 30 minutes per day, 3 days per week) as did Morrato et al.’s study, we found that only 25% of Chinese immigrants with type 2 diabetes/prediabetes were physically active, implying a great need to improve

Chinese immigrants' PA performance in terms of intensity and frequency. Although the mean PA intensity level of Chinese immigrants with type 2 diabetes/prediabetes was 2743.59 (SD = 3210.209) MET-min/week, the majority of the energy expenditure of study participants involved walking (1453.701 ± 1913.772 MET-minutes/week), indicating the importance of understanding Chinese immigrants' PA types and categories as more than just a summed value of PA energy expenditure, which might overestimate the PA intensity levels. In addition, the average sitting time was 320.39 minutes per weekday, which was considered to be long sitting hours (Leach, Mama, Soltero, & Lee, 2014) and was associated with metabolic syndrome and diabetes (Ford, Kohl, Mokdad, & Ajani, 2005). Ancient Chinese immigrants usually engaged in high intensity work, e.g., manual labor in mining and farming, but now, as seen in our study findings, their work types and intensity levels reflect a more sedentary lifestyle. Thus, Chinese Americans with type 2 diabetes should be the target group to enhance PA both within and outside the workplace.

The qualitative data in regard to PA performed helped us to further understand study participants' PA performance, which consisted mainly of being active and doing flexibility exercises, as recommended by the American Diabetes Association (2015), but not as much aerobic exercise or strength training. Interestingly, fewer than 10% of the study participants performed traditional Chinese aerobic exercises, such as Tai Chi and Kung Fu. We thought that a possible reason might be that the study participants had been living in the United States for a long time but that their mean age was not considered old (mean = 63.01 ± 14.48 years); as such, the participants may have made the transition from Eastern to Western culture. Further, they did not perform traditional Chinese exercises, but neither did they do Western exercises. As such, the majority of Chinese immigrants with type 2 diabetes/ prediabetes did not engage in regular moderate to vigorous PA and had a rate of participation significantly below national data, indicating a great need to target interventions to increase moderate to vigorous PA with sufficient duration and frequency.

Our study supports the self- and family management framework (Grey et al., 2015), in which facilitators and barriers are the antecedents to processes and outcomes. The barriers identified by our participants to performing moderate to vigorous PA include inadequate knowledge of the intensity and types of PA appropriate for patients with type 2 diabetes, concerns about PA due to health conditions, and a busy work schedule. The barriers reflected Chinese Americans' knowledge about PA and prior life experience associated with the outcome of PA practice. Our study findings also showed that family doctors play an important role in providing diabetes management information to Chinese American immigrants. Nevertheless, study participants stated that they did not have sufficient knowledge regarding PA practice, indicating that Chinese immigrants need more effective interventions to promote their PA practice. A systematic review study revealed that, when healthcare professionals coached adults with chronic diseases, including diabetes, such coaching could improve their PA (Kivela, Elo, Kyngas, & Kaariainen, 2014). Further, the addition of a health coach results in an increase in trust between healthcare providers and immigrants (Kivela et al., 2014). Healthcare providers who understand Chinese dialects and work closely with family doctors might play a key role in listening to, understanding, supporting, and motivating Chinese immigrants to increase their PA intensity to moderate to vigorous levels.

### Strength and limitations

The strengths of this study include its mixed-method design, which helped to broaden our understanding of PA performance, barriers to exercise, and PA information resources among Chinese American immigrants with prediabetes/types 2 diabetes. In addition, the results of the study can be used by healthcare providers to design interventions for Chinese immigrants at early stages of the development of types 2 diabetes to prevent its complications. The Chinese background of some researchers helped with participant recruitment and an understanding of the cultural influence on PA performance.

We cannot, however, exclude the possibility of recall bias in self-reporting PA patterns and preferences, which may underestimate or overestimate the actual PA levels. Nevertheless, the consistency of quantitative assessment and qualitative 24-hour recall enhanced the validity of the self-reported data on PA. Further, Chinese Americans may change their PA in response to their illness and health status or their perceived need to change, which can be elucidated only in longitudinal studies. The use of a community-based convenience sample was a limitation, but it allowed us to reach a community-based sample of hard-to-reach Chinese Americans, who often are missed by more representative sampling strategies (Creator, Booth, Manuel, Moineddin, & Glazier, 2012; Okrainec, Booth, Hollands, & Bell, 2015).

## Conclusion

Chinese Americans with type 2 diabetes/prediabetes have sedentary behaviors and less moderate to vigorous PA. Healthcare providers should increase Chinese immigrants' awareness of the importance of PA, teach the appropriate PA types and intensities, and encourage them to increase their PA intensity levels, as needed. At the same time, providers should assess barriers to performing PAs and help patients to change their behavior as so to improve their blood sugar management. In addition, healthcare providers' role in coaching PA performance for Chinese American immigrants should be enhanced. Finally, providing essential information in the primary care sites is essential.

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## Table 1

Participants' demographics, physical activity intensity, and body mass index ($N = 100$)

| Variable | *n* (%) |
|---|---|
| Gender | |
| Male | 53 (53.0%) |
| Female | 47 (47.0%) |
| Age (in (63.01 ± 14.48, range: 26–92) years) | |
| <30–44 | 10 (10.0%) |
| 45–64 | 44 (44.0%) |
| ≥65 | 46 (46.0%) |
| Highest education (11.87 ± 4.66, range: 0–21 years) | |
| Elementary and below | 10 (10.0%) |
| Junior high and senior high | 46 (46.0%) |
| Associate's degree and higher | 44 (44.0%) |
| Marital status | |
| Married | 78 (78.0%) |
| Single/widowed/separated/divorced | 22 (22.0%) |
| Years in the United States (21.53 ± 12.69, range: 2–71) | |
| <5 | 17 (17.0%) |
| 5–10 | 45 (45.0%) |
| 11–20 | 26 (26.0%) |
| >20 | 11 (11.0%) |
| DM years (3.33 ± 6.64 years) | |
| Physical activity | |
| Low | 75 (75.0%) |
| Moderate | 15 (15.0%) |
| Vigorous | 7 (7.0%) |
| Moderate and vigorous | 3 (3.0%) |
| BMI level (kg/m$^2$) | |
| <18.5 (underweight) | 2 (2.0%) |
| 18.5–22.99 (normal) | 34 (34.0%) |
| 23–27.49 (pre-obese) | 40 (40.0%) |
| ≥27.5 (obese) | 22 (22.0%) |
| Employment status | |
| Full-time | 39 39.0%) |
| Part-time | 5 (5.0%) |
| Not employed/retired | 47 (47.0%) |

Note: DM = diabetes. BMI = body mass index. Due to missing data, cumulative percentages might not be 100%.

**Table 2**

Physical activity intensity levels and time ($N$ = 100)

| | Mean (SD) |
|---|---|
| IPAQ (total) (MET/minutes-week) | 2743.590 (3210.209) |
| Moderate | 576.735 (2139.383) |
| Vigorous | 398.788 (1117.204) |
| Walking | 1453.701 (1913.772) |
| Duration (minutes) | |
| Total moderate exercise time (per week) | 31.04 (84.323) |
| Total vigorous exercise time (per week) | 17.22 (59.514) |
| Total walking time (per day) | 79.36 (106.770) |
| Total sitting minutes (per weekday) | 320.39 (196.404) |

Note: IPAQ = International Physical Activity Questionnaire; MET=metabolic equivalent time.

**Table 3**

Physical activity types and categories (n = 67; *N* = 100)

| PA Type (Ranking) | *n* | % |
|---|---|---|
| Being Active | | |
| Housekeeping (1) | 62 | 13.87% |
| Walking on stairs (2) | 54 | 12.08% |
| Stretching every hour during work (3) | 53 | 11.85% |
| Walking through every aisle when shopping (5) | 43 | 9.61% |
| Stretching/walking in the same spot when watching TV (6) | 39 | 8.72% |
| Walking around while talking over the phone (8) | 35 | 7.83% |
| Parking far away (9) | 28 | 6.26% |
| Flexibility Exercises | | |
| Stretching (4) | 49 | 10.96% |
| Yoga (13) | 3 | 0.67% |
| Aerobic Exercises | | |
| Brisk walking, Tai Chi, and Kung Fu (7) | 36 | 8.05% |
| Playing ball (e.g., basketball, ping-pong) (10) | 13 | 2.9% |
| Bicycle riding (11) | 10 | 2.23% |
| Swimming (12) | 5 | 1.11% |
| Aerobic dancing (12) | 5 | 1.11% |
| Strength Training | | |
| Weightlifting (11) | 10 | 2.23% |
| Muscle strengthening (14) | 2 | 0.44% |

Note: Participants can report more than one PA performed in the prior three months. A total of 67 out of 100 participants volunteered for the semi-structured interviews, and 447 instances of exercise were mentioned.

**Table 4**

Sources of DM management information ($N = 100$)

| Source | *n* (%) |
|---|---|
| Family doctor | |
| Yes | 53 (53%) |
| No | 47 (47%) |
| Nurse | |
| Yes | 6 (6%) |
| No | 94 (94%) |
| Endocrinologist | |
| Yes | 1 (1%) |
| No | 99 (99%) |
| Friends | |
| Yes | 31 (31%) |
| No | 69 (69%) |
| Newspaper | |
| Yes | 36 (36%) |
| No | 64 (64%) |
| Family members | |
| Yes | 25 (25%) |
| No | 75 (75%) |
| Radio | |
| Yes | 7 (7%) |
| No | 93 (93%) |

Note: Sources of DM management information were collected from our survey questionnaires.