Daily living activities in older adults: Part II—effect of age on physical activity patterns in older Mexican American adults

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Abstract

This paper, the second of a two-part paper, reports results from an experimental study conducted to understand physical activity patterns, and determine the effect of age on physical activity patterns in older Mexican American adults. The Yale Physical Activity Survey was administered to 49 older Mexican American adults (42 females and seven males), aged 68–80 years, recruited from senior recreation centers in the city of El Paso. Based on participant responses to questions about the type and duration of different types of physical activities, overall physical activity indices including the total time (h/week), the total energy expenditure (kcal/week), a summary index score, a vigorous activity score (units/month), a leisurely walking score (units/month), a moving score (units/month), and a standing and sitting score (both in units/month) were computed. These responses were then regressed with age (as the predictor variable). Since the number of older males in the study was small, data from men and women were combined. Results indicate that the standing score index ($p<0.1$) and the sitting score index ($p<0.05$) are linearly related to age. None of the other Yale Physical Activity Survey indices including the total time index and the weekly energy expenditure index are linearly related to age. Fitted line plots for Yale indices that do not show a linear relationship with age indicate that total time, energy expenditure, leisurely walking index score, and summary index score, all have a quadratic fit with age. A cubic fit is indicated for the vigorous activity score and the moving index score.

Relevance to industry

Understanding physical activity patterns (both work and leisure activities in daily living) in older adults is important for estimation of activity metabolism for among older adults.

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Keywords: Physical activity patterns; Older Mexican American adults; Yale physical activity survey

1. Introduction

The changing nature of the definition of “work activities” with aging trends in the population, the need to quantify energy expenditure among older adults in basic activities of daily living, and the
paucity of research studies in the ergonomics literature addressing this problem, were outlined in part I of this paper.

The problem of aging is especially important for minority populations, particularly the Hispanic population, as survey statistics show that aging minorities will represent nearly a quarter of the older adult population in 2030, up from about 16% in 1998. Several recent studies show that Hispanics, particularly, Mexican Americans, have greater incidences of cardiovascular diseases in the United States than the non-Hispanic white population (Goff et al., 1993a, b, 1994, 1997; Nichaman et al., 1993). Recently compiled and published statistical data, from the American Heart Association (2001), show that Hispanic men and women have higher risk of developing various types of cardiovascular diseases than other population groups. Studies on dietary trends among different ethnic groups (Siega-Riz and Popkin, 2001; Tortolero et al., 1999; D’Agostino et al, 1996) tend to largely confirm these findings. Physical inactivity, another important risk factor for cardiovascular disease (Pescatello et al., 2000), was more prevalent among women than men, and among Hispanics than white Americans, and furthermore among older adults than younger adults. The National Health Interview Survey conducted in 1997 by the National Center for Health Statistics shows that among adults aged 18 and older, nearly 50% of Hispanic men and 57.1% of Hispanic women have no leisure physical activity. This is in comparison to 33.3% of non-Hispanic white men and 38.9% of non-Hispanic white women, 46% of non-Hispanic black men and 57.1% of non-Hispanic black women, and 36.2% of non-Hispanic Asian/Pacific Islander men, and 49.2% of non-Hispanic Asian/Pacific Islander women. Steffen-Batey et al. (2000), in quantifying the association between the change in level of physical activity and risk of death due to cardiovascular disease or reinfarction, found that physical activity was beneficial for Mexican American men and women who survive a first myocardial infarction. Recent studies on body mass indices across ethnic groups (Fitzgibbon et al., 2000; Okosun et al., 2000) support the contention that ethnicity and body image discrepancy and body mass index can have a relationship to obesity and weight control. Data from the population-based Hispanic EPESE (with data from a representative sample of 3050 older Mexican Americans from five Southwestern states including Texas, California, Colorado, New Mexico and Arizona), on obesity and health conditions, show that nearly 23% of older Mexican American men and nearly 35% of older Mexican American women are obese (Ostir et al., 2000). Further, the prevalence of obesity was found to be much higher in this older Mexican American population than in the general population. In addition, Ostir et al. (2000) found that obesity was significantly associated with hypertension, diabetes, arthritis, cancer, and other health risks. They call for more studies exploring the association between diet and nutrition and physical activity and obesity.

This paper, the second of a two-part paper, reports results of a study to determine the cross-sectional effect of age on physical activity patterns in older Mexican American women and men. Section 2 presents the methods used in this experimental study. Results are presented in Section 3, and findings from the study are discussed in Section 4.

2. Methods

2.1. Tools used

The Yale Physical Activity Survey (YPAS), developed by DiPietro et al. (1993), was used in this research to quantify the type and intensity of physical activity of older Mexican American adults. The YPAS is an interview-administered questionnaire designed to measure physical activity in older adults. The survey yields three indices of physical activity including Total Time, Total Energy Expenditure, and Total Activity Summary Index, in addition to other indices.

Total time spent performing physical activity is estimated from the reported time spent by participants in each physical activity during a typical week in the past month. Activities in the YPAS are broadly classified into work activities,
yard work activities, care-taking activities, exercise activities, and recreational activities.

Each of these classes of physical activity is further subdivided into several activities—work activities are further subdivided into shopping for groceries, clothes, etc., stair climbing while carrying a load, laundry (time loading, unloading, hanging, and folding), light housework (including tidying, dusting, sweeping, collecting trash in home, polishing, indoor gardening, ironing), heavy housework (including vacuuming, mopping, scrubbing floors and walls, moving furniture, boxes or garbage cans), food preparation lasting 10 or more minutes in duration (including chopping, stirring, moving about to get food items and pans), food service activities (including setting the table, carrying food, and serving food), dish washing lasting 10 or more minutes in duration (including clearing table, washing/drying dishes, and putting dishes away), light home repair (including small appliance repair, and light home maintenance), and heavy home repair (including painting, carpentry, washing/polishing car). Yard work activities are further broken down into gardening, lawn mowing, clearing walks/driveways, and raking. Care-taking activities are further classified into adult care and child care activities. Exercise activities are further categorized into brisk walking, pool exercises/yoga, and vigorous activities such as aerobics, cycling, and swimming. Recreational physical activities in the YPAS are further categorized as leisurely walking lasting at least 10 min in duration, needlework, dancing, bowling, golf, racquet sports, and billiards.

The total time recorded for all activities is then summed to create a total time summary index expressed in hours per week. Total energy expenditure on physical activity (expressed in kcal/week) is obtained by multiplying the time recorded for each activity by a corresponding intensity weight (kcal/min) (Taylor et al., 1978; McArdle et al., 1981; Ainsworth et al., 1993) for that activity, and then summing this product for all activities. The intensity weights used in the YPAS are based on a standard resting metabolic rate of 60 kcal/h and are independent of any variation in individual participant body weight and resting metabolic rate.

In addition, activity indices are computed for vigorous activity (defined as activities lasting at least 10 min and causing large increases in breathing, heart rate, or leg fatigue or causing perspiration), leisurely walking (defined as walking for at least 10 min or more without stopping which was not strenuous enough to cause large increases in breathing, heart rate, or leg fatigue or cause perspiration), moving (defined as moving around on feet while doing things), standing, and sitting. The individual activity indices were calculated by multiplying a frequency score (based on the number of times the activity was performed in the past month) by a duration score for each of the five activities and multiplying by a weighting factor.

For computation of the vigorous activity index, the frequency score is assigned based on the following scale: 0 if the participant did not participate in any vigorous activity, 1 if the participant engaged in vigorous activity 1–3 times per month, 2 if the participant engaged in vigorous activity 1–2 times per week, 3 if the participant engaged in vigorous activity 3–4 times per week, 4 if the participant engaged in vigorous activity more than 5 times per week, 7 if the participant refused to answer the question, and 8 if the participant did not know how many times he or she engaged in vigorous activity. Each time that the participant engaged in vigorous activity, the duration score is based on the following scale: 0 if not applicable, 2 if the duration was 10–30 min, 2 if the duration was 31–60 min, 3 if the duration was more than one hour, 7 if the participant refused to answer the question, and 8 if the participant did not know the duration each time a vigorous activity was performed.

Vigorous activity is assigned a weight of 5 based on being the most intense of all activities. The product of the frequency score, the duration score and the weight is computed as the vigorous activity index score.

For computation of the leisurely walking index score, the frequency score is based on the following scale: 0 if the participant did not engage in any walking at all, 1 if the participant engaged in leisurely walking 1–3 times a month, 2 if 1–2 times a week, 3 if 3–4 times a week, 4 if more than
5 times a week, 7 if the participant refused to answer the question, and 8 if the participant did not know how many times he or she engaged in leisurely walking. Each time that the participant engaged in leisurely walking, the duration score is based on the following scale: 0 if not applicable, 1 if the duration was 10–30 min, 2 if 31–60 min in duration, 3 if more than 1 h in duration, 7 if the participant refused to answer, and 8 if the participant did not know the duration.

Leisurely walking is assigned a weight of 4. The product of the frequency score for leisurely walking, the duration score for leisurely walking, and the weight for leisurely walking is computed as the leisurely walking index score.

For computation of the moving index score, a moving score is computed based on the following scale: 0 if the participant did not move at all, 1 if less than 1 h per day, 2 if 1 to less than 3 h per day, 3 if 3 to less than 5 h per day, 4 if 5 to less than 7 h per day, 4 if 7 or more hours per day, 7 if the participant refused to answer the question, and 8 if the participant did not know how many hours he or she spent moving around on their feet. Moving was assigned a weight of 3. The product of the moving score and the weight is computed as the moving index score.

For computation of the standing index score, a standing score for an average day during the past month is computed based on the following scale: 0 if the participant did not stand at all, 1 if less than an hour per day, 2 if 1 to less than 3 h per day, 3 if 3 to less than 5 h per day, 4 if 5 to less than 7 h per day, 5 if more than 7 h per day, 7 if the participant refused to answer the question, and 8 if the participant did not know how many hours per day he or she spent standing. Standing was assigned a weight of 2. The product of the standing score and the weight is computed as the standing index score.

For computation of the sitting index score, a sitting score for an average day during the past month is computed based on the following scale: 0 if the participant did not sit at all, 1 if less than 3 h, 2 if 3 to less than 6 h, 3 if 6 to less than 8 h, 4 if more than 8 h per day, 7 if the participant refused to answer the question, and 8 if the participant did not know many hours per day he or she spent sitting. Sitting is assigned a weight of 1. The product of the sitting index score and the weight is computed as the sitting index score. A summary activity index is then calculated as the sum of the five individual indices.

2.2. Participants

Study participants for the YPAS were recruited from the Foster Grandparents program in the Leona Ford Washington Center, the San Juan Senior Recreation Center, and the Father Martinez Senior Center in El Paso, Texas. For the YPAS survey, a total of 49 participants were recruited from these three different sites. Out of these 49, 42 participants were female and seven participants were male. Forty-one seniors completed the YPAS in Spanish and five of the participants reported in English. Since the number of male participants in the study were very small compared to the number of female participants, and since our study is only pilot in nature, analyses were not carried out separately for male and females. Selected anthropometric characteristics of participants who completed the Yale physical activity survey are provided in Table 1.

Based on classification of overweight and obesity by the National Heart, Lung, and Blood Institute expert panel on the identification, evaluation, and treatment of obesity in adults (National Heart, Lung, and Blood Institute, 1998), of the 49 participants in YPAS, one male and six females were normal weight (BMI ranging 18.5–24.9), five males and 22 females were overweight (BMI ranging 25–29.9), one male and 13 females were obese (BMI ≥ 30). One participant was

<table>
<thead>
<tr>
<th>Participant characteristics</th>
<th>Mean</th>
<th>SD</th>
<th>(Q1, Q3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>74.27</td>
<td>7.45</td>
<td>(68, 80)</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>159.21</td>
<td>7.01</td>
<td>(154.94, 162.56)</td>
</tr>
<tr>
<td>Weight (lbs)</td>
<td>155.27</td>
<td>26.54</td>
<td>(144, 170)</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>27.882</td>
<td>4.786</td>
<td>(25.568, 30.347)</td>
</tr>
</tbody>
</table>

\(\text{Table 1}
Selected participant characteristics

\(n = 49\), 42 females and seven males in the Yale physical activity survey Q1 represents the first quartile and Q3 represents the third quartile.
underweight (BMI < 18.5) from the self-reported heights and weights.

All participants were volunteers and were not paid any form of compensation for their participation in the study. All participants were of Mexican origin, and spent childhood to teenage years in Mexico. When asked about what prevented them from physical exercise, a majority of study participants reported that none of the factors (in a health habits questionnaire administered separately), including not having a safe place to exercise, being self-conscious about being overweight, general ill-health, lack of enjoyment, interest or motivation, not having an exercise partner, lack of time and energy for exercise, fear of getting hurt from exercise, poor weather conditions, childcare responsibility, and lack of space and appropriate exercise apparel, prevented them from exercising.

2.3. Procedure

Once approval was obtained from the UTEP Institutional Review Board for Human Subjects Research, data collection was scheduled in coordination with the Aging Services Administration of the City of El Paso. The Aging Services Administration initially coordinated all the data collection with the directors of the Senior Centers and the Foster Grandparents program. Older Mexican American adults who participated in this research study and who were part of the Foster Grandparents program in the City of El Paso, met, as a group, only on the last Friday of every month. Therefore, data collection with the Foster Grandparents group was scheduled first on a Friday. Since the Foster Grandparents are a large group (more than 100 older adults), who meet in a classroom type setting, the investigators used an overhead projector and a screen to present an overview of the study goals, objectives, and requirements of the participants allowing 15 min for questions. Overview information was presented first in English and then translated into Spanish by a speaker well-versed in English and Spanish (with use of corresponding Spanish overhead transparencies). The overview session explained that the purpose of the study was to understand physical activity patterns in older Mexican American adults. It was also explained that the goal of the study was merely to understand, on a pilot basis, physical activity in older adults, and that the study was not meant to be punitive in nature (i.e., punish poor physical activity patterns, etc). After the overview session, older adults interested in participating in the study were requested to move to one side of the room, so that biographical information could first be collected from them. They were then handed the bound booklets containing the YPAS and a modified version of a health habits questionnaire.

Five interviewers, two trained only in English, and the other three bilingual, participated in the interview administration. Since the number of participants was rather small, they were divided into smaller groups, with each interviewer handling approximately four to five participants at the same time. Participants who preferred to complete the YPAS in English were assigned to the English-speaking interviewers.

Interviews were conducted in accordance with the YPAS instructions. When participants did not understand a question, it was repeated and clarified until they understood what was being asked in the question. Participants were reminded that this was not a test of how fast they could complete the survey, but that they could take as much time as they needed to recall as accurately as possible information required for their responses. This instruction was very encouraging to the participants, and almost all participants provided a detailed talk-through of the amount of time they spent performing certain physical activities (for example, a talk-through stating... “I leave home every morning at 10 am and walk to the school; the walk takes me about 10 min one way. I then walk back to my home, so that is 20 min of walking every day going to school; I go to school 3 days in a week, so that makes it 60 min of walking per week.” For some other activities such as swimming laps, the participants were very quick to state that they do not engage in such activity.

Although DiPietro et al. (1993) state that a complete administration of the YPAS should not take more than 20 min, our experience indicates that it took, on the average, more than 35 min to
completely administer the survey—this was due to
the extra time that participants in the survey had
to recollect their experiences as young adults (for
example, several participants mentioned that they
were good dancers when they were young, but,
were unable to dance now), and the time
participants were provided to talk-through in
estimating the time they spent on a certain type
of physical activity in a week.

The YPAS was administered next at two senior
recreation centers. These senior recreation centers
are open every day of the week, and therefore,
scheduling data collection during any day of the
week did not pose any problems. Both these
centers serve lunch at noon; therefore, the
investigators only had one and half hours at one
center, and approximately 2h at the other center
for the Yale administration. An approach similar
to the one followed at the Foster Grandparents
program was followed at both these senior centers.
An overview in both English and Spanish was first
provided to all those present in the center, and
volunteers were recruited for participation in the
study. All volunteers who agreed to participate in
the study were instructed on the informed consent
form and were administered the YPAS by five
interviewers trained in administering the survey:
again, two interviewers only spoke English; the
other three were bilingual and could administer the
survey in Spanish.

2.4. Data analysis

Once data collection was complete, all raw data
from the YPAS including time information for all
physical activities (which was directly reported by
the participants), and information on the vigorous
activity frequency and duration, leisurely walking
frequency and duration, moving frequency and
duration, standing frequency and duration, and
sitting frequency and duration, were transferred to
Microsoft Excel in the form of a spreadsheet. All
records were tagged by the name of the particip-
ant. Formulae were then created in the Excel
spreadsheet to calculate the total time, the total
energy expenditure (which was the reported times
multiplied by a constant intensity weight for each
activity) for each participant. Formulae were also
created in the spreadsheet to calculate the vigorous
activity index score, the leisurely walking index
score, the moving index score, the standing index
score, and the sitting index score. All these
columns generated in MS Excel were then
transferred to Minitab Version 13 for further data
analyses. Once data were transferred to Minitab,
descriptive statistics including the mean, maxi-
mum, minimum, the standard deviation, the
standard error of the mean, the median, and the
first (Q1) and the third (Q3) quartiles for time
spent in each activity, energy spent for each
activity, all the activity dimension indices includ-
ing the summary index, and the total time and the
total energy expenditure were generated. The
average energy expenditure was then easily esti-
mated from the Minitab analysis. It should be
noted that since the number of male participants
was very small compared to the number of female
participants, and since this research study was only
pilot in nature, data from males and females were
not separated for analyses.

Separate linear regression models were run to
regress age with total time (h/week), total energy
expenditure (kcal/week), summary index (units/
month), vigorous activity score (units/month),
leisurely walking score (units/month), moving
score (units/month), standing score (units/month),
and sitting score (units/month). In cases where a
linear fit was not indicated, a polynomial regres-
sion was run to obtain an idea about the
appropriate regression model fit.

3. Results

Table 2 presents summary statistics on energy
expenditure reported by older Mexican American
adults for various physical activities. The average
weekly energy expenditure on physical activity for
older Mexican American adults was 6750 kcal/
week, which translates to 964.29 kcal/day. Table 2
also indicates that among all activities included in
the Yale physical activity survey, older Mexican
American adults spent the greatest amount of
energy during walking activities (brisk walking
lasting 10 min or more in duration, and leisure
walking lasting 10 min or more in duration). After
walking, light housework activities (including tidying the home, dusting, sweeping, collecting trash in home, polishing, indoor gardening and ironing), food preparation activities lasting 10 min or more in duration (including chopping, stirring, moving about to get food items and pans), and child care activities, were top-ranked activities in terms of weekly energy expenditure for older Mexican American adults. Results also indicate that older Mexican American adults spent the least amount of energy in a week, in playing billiards, aerobics and calisthenics, cycling, yoga, swimming laps, bowling, golf, and racquet sports (including tennis and racquet ball). Table 3 presents summary statistics on total time (h/week) older Mexican American adults (females and males together) spend on physical activity. Results indicate that they spend, on an average, 31.32 h/week on physical activity. Older Mexican American adults report that they spend most time on leisure walking activities (3.84 h/week), followed by food preparation activities (3.801 h/week), and light housework (3.687 h/week). Table 4 is a summary of the YPAS index scores.

To determine any cross-sectional effects of age on the overall physical activity indices from YPAS, separate regression analyses with age as the predictor variable and all overall YPAS indices including the total h/week, the total energy expenditure/week, the vigorous activity score, the leisurely walking score, the moving score, the standing score, and the sitting score, as measured

Table 2
Summary statistics on energy expenditure (kcal/week) for physical activity reported by participants who completed the YPAS (males and females together)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (n = 49)</th>
<th>Standard deviation (Q1, Q3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shopping</td>
<td>367.8</td>
<td>266.0 (210.000, 630.000)</td>
</tr>
<tr>
<td>Stair/load</td>
<td>163.9</td>
<td>356.8 (0, 127.500)</td>
</tr>
<tr>
<td>Laundry</td>
<td>274.9</td>
<td>194.3 (165.000, 450.000)</td>
</tr>
<tr>
<td>Light housework</td>
<td>663.6</td>
<td>688.0 (135.000, 810.000)</td>
</tr>
<tr>
<td>Heavy housework</td>
<td>468.8</td>
<td>503.2 (0, 810.000)</td>
</tr>
<tr>
<td>Preparing food</td>
<td>570.2</td>
<td>645.9 (93.800, 900.000)</td>
</tr>
<tr>
<td>Serving food</td>
<td>172.9</td>
<td>265.5 (0, 187.500)</td>
</tr>
<tr>
<td>Dish washing</td>
<td>293.1</td>
<td>367.5 (0, 450.000)</td>
</tr>
<tr>
<td>Light repair</td>
<td>93.7</td>
<td>371.1 (0.0)</td>
</tr>
<tr>
<td>Heavy repair</td>
<td>151.5</td>
<td>409.5 (0.247.500)</td>
</tr>
<tr>
<td>Gardening</td>
<td>427.9</td>
<td>643.4 (0, 810.000)</td>
</tr>
<tr>
<td>Lawn mowing</td>
<td>110.2</td>
<td>238.1 (0, 67.500)</td>
</tr>
<tr>
<td>Raking</td>
<td>248.0</td>
<td>319.0 (0, 300.000)</td>
</tr>
<tr>
<td>Adult care</td>
<td>74.1</td>
<td>303.2 (0)</td>
</tr>
<tr>
<td>Child care</td>
<td>552.0</td>
<td>1327.0 (0, 40.000)</td>
</tr>
<tr>
<td>Brisk walking</td>
<td>886.0</td>
<td>1588.0 (0, 1440.000)</td>
</tr>
<tr>
<td>Aerobics</td>
<td>23.2</td>
<td>117.8 (0)</td>
</tr>
<tr>
<td>Yoga/stretch</td>
<td>16.53</td>
<td>67.93 (0)</td>
</tr>
<tr>
<td>Cycling</td>
<td>22.0</td>
<td>154.3 (0)</td>
</tr>
<tr>
<td>Swimming laps</td>
<td>0.000</td>
<td>0.000 (0)</td>
</tr>
<tr>
<td>Leisure walk</td>
<td>806.0</td>
<td>1007.0 (0, 1260.000)</td>
</tr>
<tr>
<td>Needle work</td>
<td>155.6</td>
<td>272.4 (0, 202.500)</td>
</tr>
<tr>
<td>Dancing</td>
<td>154.9</td>
<td>386.1 (0)</td>
</tr>
<tr>
<td>Bowling</td>
<td>0.000</td>
<td>0.000 (0)</td>
</tr>
<tr>
<td>Golf</td>
<td>0.000</td>
<td>0.000 (0)</td>
</tr>
<tr>
<td>Racquet ball</td>
<td>0.000</td>
<td>0.000 (0)</td>
</tr>
<tr>
<td>Billiards</td>
<td>52.0</td>
<td>232.3 (0)</td>
</tr>
<tr>
<td>YPAS energy expenditure</td>
<td>6750.0</td>
<td>3292.0 (4575.000, 8881.00)</td>
</tr>
</tbody>
</table>

Table 3
Summary statistics on total time (h/week) for physical activity reported by participants who completed the YPAS (males and females together)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (n = 49)</th>
<th>Standard deviation (Q1, Q3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shopping</td>
<td>1.752</td>
<td>1.267 (1.000, 3.000)</td>
</tr>
<tr>
<td>Stair/load</td>
<td>0.321</td>
<td>0.700 (0.000, 0.250)</td>
</tr>
<tr>
<td>Laundry</td>
<td>1.527</td>
<td>1.079 (0.917, 2.500)</td>
</tr>
<tr>
<td>Light housework</td>
<td>3.687</td>
<td>3.822 (0.75, 4.500)</td>
</tr>
<tr>
<td>Heavy housework</td>
<td>1.736</td>
<td>1.864 (0.000, 3.000)</td>
</tr>
<tr>
<td>Preparing food</td>
<td>3.801</td>
<td>4.306 (0.625, 6.000)</td>
</tr>
<tr>
<td>Serving food</td>
<td>1.153</td>
<td>1.77 (0.000, 1.250)</td>
</tr>
<tr>
<td>Dish washing</td>
<td>1.954</td>
<td>2.45 (0.000, 3.000)</td>
</tr>
<tr>
<td>Light repair</td>
<td>0.520</td>
<td>2.061 (0.000, 0.000)</td>
</tr>
<tr>
<td>Heavy repair</td>
<td>0.459</td>
<td>1.241 (0.000, 0.750)</td>
</tr>
<tr>
<td>Gardening</td>
<td>1.585</td>
<td>2.535 (0.000, 3.000)</td>
</tr>
<tr>
<td>Lawn mowing</td>
<td>0.408</td>
<td>0.882 (0.000, 0.250)</td>
</tr>
<tr>
<td>Raking</td>
<td>0.827</td>
<td>1.063 (0.000, 1.000)</td>
</tr>
<tr>
<td>Adult care</td>
<td>0.224</td>
<td>0.919 (0.000, 0.000)</td>
</tr>
<tr>
<td>Child care</td>
<td>2.299</td>
<td>5.529 (0.000, 0.165)</td>
</tr>
<tr>
<td>Brisk walking</td>
<td>2.462</td>
<td>4.41 (0.000, 4.000)</td>
</tr>
<tr>
<td>Aerobics</td>
<td>0.0645</td>
<td>0.3273 (0.000, 0.000)</td>
</tr>
<tr>
<td>Yoga/stretch</td>
<td>0.0918</td>
<td>0.3774 (0.000, 0.000)</td>
</tr>
<tr>
<td>Cycling</td>
<td>0.0612</td>
<td>0.4286 (0.000, 0.000)</td>
</tr>
<tr>
<td>Swimming laps</td>
<td>0.000</td>
<td>0.000 (0.000, 0.000)</td>
</tr>
<tr>
<td>Leisure work</td>
<td>3.840</td>
<td>4.797 (0.000, 6.000)</td>
</tr>
<tr>
<td>Needle work</td>
<td>1.728</td>
<td>3.027 (0.000, 2.250)</td>
</tr>
<tr>
<td>Dancing</td>
<td>0.469</td>
<td>1.17 (0.000, 0.000)</td>
</tr>
<tr>
<td>Bowling</td>
<td>0.000</td>
<td>0.000 (0.000, 0.000)</td>
</tr>
<tr>
<td>Golf</td>
<td>0.000</td>
<td>0.000 (0.000, 0.000)</td>
</tr>
<tr>
<td>Racquet ball</td>
<td>0.000</td>
<td>0.000 (0.000, 0.000)</td>
</tr>
<tr>
<td>Billiards</td>
<td>0.347</td>
<td>1.549 (0.000, 0.000)</td>
</tr>
<tr>
<td>Total time</td>
<td>31.32</td>
<td>15.31 (21.79, 40.58)</td>
</tr>
</tbody>
</table>
from the YPAS was performed. Polynomial regression analyses and fitted line plots were also generated to determine if any relationship other than a linear relationship between age and the overall YPAS indices was found. Table 5 presents results from the linear regression analysis. Figs. 1–6 present the fitted line plots, with the fitted model.

Results from the linear regression analyses indicate that the standing score index and the sitting score index are significantly linearly related to age. None of the Yale physical activity summary indices including total time index and weekly energy expenditure are significantly linearly related. Fitted line plots for Yale summary indices that do not have a linear relationship with age indicate that total time (Fig. 1), energy expenditure (Fig. 2), leisurely walking index score (Fig. 3), and summary activity index score (Fig. 4) all have a quadratic fit with age. A cubic fit is indicated for vigorous activity score (Fig. 5) and moving index score (Fig. 6).

Table 4
Summary statistics for the YPAS indices reported by participants who completed the YPAS (males and females together)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (n = 49)</th>
<th>Standard deviation (Q1, Q3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary index</td>
<td>49.04</td>
<td>33.19 (25.50, 75.50)</td>
</tr>
<tr>
<td>Vigorous activity index</td>
<td>13.06</td>
<td>20.53 (0.00, 30.00)</td>
</tr>
<tr>
<td>Leisurely walking index</td>
<td>15.51</td>
<td>15.44 (0.00, 20.00)</td>
</tr>
<tr>
<td>Moving score index</td>
<td>8.633</td>
<td>3.951 (6.00, 12.00)</td>
</tr>
<tr>
<td>Standing score index</td>
<td>8.184</td>
<td>5.215 (5.00, 10.00)</td>
</tr>
<tr>
<td>Sitting score index</td>
<td>2.020</td>
<td>0.968 (1.00, 2.00)</td>
</tr>
</tbody>
</table>

Table 5
Linear regression analyses results to determine cross-sectional effect of age on YPAS overall physical activity measures for older Mexican American adults (n = 49)

<table>
<thead>
<tr>
<th>YPAS index</th>
<th>p-value</th>
<th>Linear regression model for significant variables (p &lt; 0.05, or p &lt; 0.10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total time (h/week)</td>
<td>0.189</td>
<td></td>
</tr>
<tr>
<td>Energy expenditure (kcal/week)</td>
<td>0.223</td>
<td></td>
</tr>
<tr>
<td>Summary index</td>
<td>0.477</td>
<td></td>
</tr>
<tr>
<td>Vigorous activity score (units/month)</td>
<td>0.165</td>
<td></td>
</tr>
<tr>
<td>Leisurely walking score (units/month)</td>
<td>0.203</td>
<td></td>
</tr>
<tr>
<td>Moving score (units/month)</td>
<td>0.713</td>
<td></td>
</tr>
<tr>
<td>Standing score (units/month)</td>
<td>0.073</td>
<td>21.6–0.181 (age)</td>
</tr>
<tr>
<td>Sitting score (units/month)</td>
<td>0.012</td>
<td>-1.40 + 0.0461 (age)</td>
</tr>
</tbody>
</table>

Fig. 1. Regression of total time spent in physical activity (h/week) with age of older Mexican American adults.

Fig. 2. Regression of total energy spent in physical activity (kcal/week) with age of older Mexican American adults.
4. Discussion

Standing and sitting scores indicate a linear relationship with age. Since responses of 7 (refused to answer question), and 8 (did not know) are scored as missing responses in the analysis, and since the weight for standing score is larger than the weight assigned to sitting score (a sitting score of 4 corresponding to 8 or more hours of sitting, with an assigned weight of 1 would result in a
sitting index score of 4; this would be equivalent to
a score of 2 (1 to less than 3 h per day) for the
standing score and result in a standing score index
of 4 after multiplication by a weight of 2 for
standing). The total time (h/week) spent on
physical activity, and the total energy expenditure
(kcal/week) spent on physical activity, peaks
around 70 years of age for older Mexican
American adults, and then declines with increasing
age. Older adults aged 60–70 spend more time and
energy on physical activity than their counterparts
aged 70 and above. The peak leisure walking index
score occurs at age 75. The leisure walking index
score at age 60 is much less than the leisure
walking index score at ages 75 and above—this
may be indication that the young–old are more
active at other physical activities than leisure
walking. The summary index score is maximum
at approximately age 72. The summary index
for the young–old is higher on the average, than for
the older adults aged more than 70. The vigorous
activity index score is highest at age 60 and
decreases until approximately age 72. It increases
again at age 72 and becomes minimum at age 80.
The moving index score is maximum at age 60, and
then falls until age 68. It increases again until age
80, and then falls rapidly after age 80.

Our study indicates that the magnitude of
weekly energy expenditure (6750 kcal/week) by
older Mexican American adults (males and
females combined) on physical activity was very
similar in magnitude to that previously reported
by other researchers with other older adult
populations. DiPietro et al. (1993) reported in
their original YPAS study that older adults in
Connecticut spent an estimated average of
7176 kcal/week during two administrations of the
YPAS. Schuler (2001), in their study among 56
healthy older individuals (31 women and 25 men
age range 56–86), reported an energy expenditure
of 8000 kcal/week for men and 10,000 kcal/week
for women using the YPAS. This is higher than the
energy expenditure reported by older Mexican
Americans in our study. Young et al. (2001)
reported an average weekly energy expenditure
of 3769 kcal/week for non African-American older
adults (data from 32 men and women combined),
and 3285 kcal/week for African-American older
adults (data from 27 men and women combined).
These estimated values are lower than our study
and the values reported by DiPietro et al. (1993) or
Schuler (2001). In a study of 108 independent
community dwelling older adults residing in Leon,
Spain, De Abajo et al. (2001) estimated weekly
energy expenditure using the Yale survey was
6335 kcal/week for 38 older men, and 7314 kcal/
week for 40 older women. These magnitudes are
comparable with the estimated weekly energy
expenditure reported by the older Mexican Ameri-
can adults who participated in our study.

Although the overall magnitude of weekly
energy expenditure from our study is comparable
in magnitude to studies that have used the YPAS
for physical activity assessment among older
adults other than predominantly Mexican Amer-
ican, this may not necessarily mean that older
Mexican Americans spend about the same energy
in weekly physical activities. Since overall energy
expenditure is a function of both duration and
intensity of an activity, it is important to look at
the types of activities older Mexican American
adults engage in, for example, older Mexican
American adults may engage in less intense
activities for longer durations compared to older
adults in other parts of the US who may engage in
more intense physical activities for shorter time
periods, thereby resulting in very similar overall
weekly energy expenditures on physical activity.

A comparison of the magnitude of total time
spent in physical activity in a week shows that
older Mexican Americans in our study spent about
the same amount of total time (in h/week) in
physical activities (as measured by the YPAS) as
the older adults considered in the original Yale
study, DiPietro et al. (1993) report a total weekly
time of 34.3 h/weeks reported during their first
administration, and 30.6 h/week reported during
their second administration compared to 31.32 h/
week reported by the 49 older Mexican American
adults who participated in our study. These results
are very similar to what was reported by Schuler
(2001), for their older adult participants—an
estimated 34 h/week for older men and an esti-
mated 35–47 h/week for older women. De Abajo
et al. (2001) report slightly higher weekly total
times for their for older adults from Spain—and
estimated 43 h/week for older men and 62 h/week for older women. Older women from Spain seem to spend almost twice the time in a week on physical activity compared to older Mexican American women who participated in our study. On the other hand, older non-African-Americans in the Young et al. (2001) study reported only 20 h/week with African American older adults reporting even smaller numbers (19 h/week average).

Among other overall Yale Physical Activity Dimensions, the summary index score, the vigorous activity index score, the leisure walking index score, and the sitting index score from our study all have comparable magnitudes to the ones reported in the original Yale study by DiPietro et al. (1993). The standing index score in our study, on the other hand, was almost twice that reported in the original Yale study (ranging 4.4–4.9 units). A similar pattern was seen when magnitudes of activity dimension indices are compared between our study and the studies by Schuler (2001) and Young et al. (2001).

There are several limitations of our study vis-à-vis assessment of energy expenditure and total time spent on physical activity in older Mexican American adults. Since our study was only preliminary in nature, our study sample was based on a convenience sample of older adults recruited from senior recreation centers in El Paso. The number of males in the study was very small compared to the number of females. Since all physical activity studies using the YPAS have reported more weekly energy expenditure for women than men, and since our estimates are based predominantly on participation of older women as well, grouping of data from men and women may not reflect the extent and nature of physical activity performed by older Mexican Americans. It is also likely that since the interviews were conducted in groups (due to problems with logistics and scheduling of time in the senior centers), participants may have over-reported the times they spent on physical activities to avoid social desirability problems.

Although the YPAS is available only in English, a back translation approach was used to minimize translation errors. When asked in a health habits survey about barriers to their participation in physical activities, a majority of the participants reported that factors such as not having a safe place to exercise, being self-conscious about being overweight, general ill-health, lack of enjoyment, interest or motivation, not having an exercise partner, lack of time and energy for exercise, fear of getting hurt from exercise, poor weather, childcare responsibilities, and lack of space and appropriate exercise apparel, did not affect their participation in physical activities—this ties in with the fact that the group of older adults surveyed in this study were able to go to the senior centers daily (or every month to the Foster grandparents program meetings), and may have added to the sample bias and error.

Although our study did not formally measure the cognitive abilities of the older adults
participating in our study (since all adults who participated in the study self-reported that they were able to read and write and understand instructions provided to them), studies (Raji et al., 2002) investigating the effect of cognitive and emotional status on subsequent lower body functioning from the Hispanic Established Population for the Epidemiologic Study of the Elderly (Hispanic EPESE) have shown that, among older Mexican American adults, both cognitive function (measured by the Mini-Mental State Examination) and emotional health (measured by the Center for Epidemiological Studies-Depression (CES-D) scale) affect performance measures of lower body functioning—the effect of cognitive and emotional status on physical activity among older Mexican American adults is still an open question. Therefore, inclusion of older adults with low to moderate cognitive functioning abilities may result in a downward revision of the estimates of physical activity measures in our study.

The Hispanic EPESE indicates that while approximately 6% of older White Americans reside in nursing homes, only between 2% and 3% of older Mexican American adults reside in nursing homes, due to the unwillingness or the inability of Mexican American families to formally institutionalize their older family members. As a result, Mexican Americans who are institutiona-}
ized tend to be more functionally impaired (Markides and Wallace, 1996; Espino and Burge, 1999; Chiodo et al., 1994; Rudkin et al., 1997). Ma et al. (1998) have also shown that selected medical conditions, including heart attack, stroke, hip fracture, diabetes, arthritis, and obesity, were also significantly associated with a greater risk for physical functional limitation. Hip fracture and stroke limited physical activity more than any other medical condition. Exclusion of these factors in our pilot study may have resulted in an overestimate of physical activity measures in our study.

5. Conclusions

The goals of this study were to assess energy expenditure due to physical activity among older Mexican American adults, and determine the effect of age on physical activity patterns. Physical activity has been linked to causation and prevention of many chronic diseases including coronary heart diseases. Studies show that the older Mexican American adults are at a higher risk for chronic diseases caused due to lack of physical activity, and obesity/overweight conditions (Ostir et al., 2000). Existing epidemiological tools for physical activity assessment among older Mexican American populations may be inadequate from both content and criterion-validity perspectives. Older Mexican American adults have a different culture and sociodemographic milieu affecting their daily physical functioning compared to other older American adults—hence, new reliable and valid tools for physical activity assessment need to be developed for older Mexican American populations. Since physical function and physical activity limitations are crucial components in the disable- ment process, and in the etiology of disease, it is important to understand the factors that affect physical functioning and the barriers that prevent physical activity among older Mexican American adults. Models predicting disablement process in older Mexican American adults are currently being developed (Peek et al., 2002). These models hypothesize that risk factors for disablement among older Mexican American adults will include being older, female, widowed or never married/separated/divorced, and having lower BMI scores will be associated with an increase in pathology (presence of absence of disease), impairment (abnormalities at the physiological, anatomical or mental level) and functional limitations (limitations in physical and mental actions). In addition, these models hypothesize that functional limitations will be the main pathway through which disability in older Mexican American adults will be affected, and that functional limitation will be the intermediate step between pathology and impairment and a person’s ability to perform physical and social activities (disabil- ity). Results from validation of the disablement process model among older Mexican American adults will assist in understanding further physical activity participation, and ways to enhance such participation in an effort to slow the disablement process.
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References


