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DEVELOPMENT AND VALIDATION OF A BRIEF PHYSICAL ACTIVITY  
ASSESSMENT TOOL FOR THE EXPANDED FOOD AND NUTRITION  
EDUCATION PROGRAM

BY

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Dr. Debra M Palmer-Keenan

And approved by

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## **ABSTRACT OF THE DISSERTATION**

Development and Validation of a Brief Physical Activity Assessment Tool for  
the Expanded Food and Nutrition Education Program

By CHENG LI

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Physical activity is a core educational focus for the Expanded Food and Nutrition Education Program (EFNEP), a federally funded nutrition education program that works with low-income families. However, there have been no previously validated tools to assess adults' physical activity behavior changes resulting from EFNEP participation. This research's primary purpose was to develop a brief physical activity assessment tool (BPAAT) that is reliable, valid, and sensitive for measuring changes in physical activity behaviors among EFNEP adult participants. Notably, this research was part of a multi-state, multi-year Agricultural Experiment Station research project, NC2169/3169: EFNEP-Related Research, Program Evaluation and Outreach.

The BPAAT includes 3 questions written in accordance with the Physical Activity Guidelines for Americans and the contents taught in EFNEP. A mixed method approach, with samples from various States, was used to accomplish the following: establish

content validity, face validity, test-retest reliability, concurrent validity, and sensitivity to change for the BPAAT.

In summary:

- Physical activity experts and State EFNEP Coordinators reviewed the BPAAT and response options to confirm content validity. Questions and response options were revised as necessary.
- One-on-one, semi-structured cognitive interviews (N=57) were conducted with adults who were eligible for EFNEP to test the BPAAT's ease of understanding and appropriateness. Questions and response options were revised as needed.
- Test-retest reliability was established with low-income adults (N=75). Testing results showed all questions had at least moderate correlations using Spearman's rank order correlation coefficients and Cohen's weighted kappa ( $> 0.40$ ) and "good" agreement (intraclass correlation coefficients  $> 0.70$ ).
- Concurrent validity testing was done with EFNEP participants (N=106) who, for 5 days: wore an accelerometer-based PA monitors for at least 10 hours per day; and, completed a self-reported physical activity log. The Spearman rank order correlation coefficient ranged from -0.18 to 0.87 comparing the BPAAT responses to the accelerometer data and the self-report logs.
- A secondary data analysis, using EFNEP's national dataset from federal fiscal year 2018, was performed to assess sensitivity to change. Participants' responses (N=53,393) to all questions demonstrated significant increase from pre to post-EFNEP ( $p<0.0001$ ).



This newly developed BPAAT is the first to have been validated in a national representative sample of low-income adults. It is reproducible, sensitivity to intervention change, and rigorously tested for validity. The BPAAT provides a practical method to assess PA for programs with limited time and resources.

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## **Chapter 1: Introduction**

The Expanded Food and Nutrition Education Program (EFNEP) is a federally-funded program designed to improve the overall health and well-being among limited-resource populations.<sup>1</sup> It was first established in 1969 by U.S. Department of Agriculture's (USDA) Cooperative Extension Service (now National Institute of Food and Agriculture, NIFA) to reduce malnutrition and hunger among low-income American families.<sup>2</sup> The primary goal of this program is to assist limited-resource audiences in acquiring the knowledge, skills, attitudes, and behavior necessary for the improvement of the total family diet and nutritional well-being.<sup>3,4</sup>

The four core areas that have been addressed by EFNEP since its inception are: 1) dietary quality; 2) food resource management; 3) food safety; and 4) food security. Due to the increased awareness of the importance of physical activity on obesity and chronic disease prevention, it was added in the Dietary Guidelines for Americans (DGA) in 2005. Thus, EFNEP's nutrition education, which is guided by these guidelines, added physical activity as one of its core educational areas in 2005.<sup>5-7</sup>

Prior to 2018, EFNEP utilized two pre- and post-program evaluation tools: 1) a 24-hour recall and 2) a 10-item survey called the Behavior Checklist (BC). The 24-hour recall has been used to capture changes in EFNEP participants' dietary quality before and after program participation. Of note, the group-administered 24-hour recall, was not administered according to the standard 3-day recall protocol,<sup>8-10</sup> The BC evaluates behavior changes not captured by 24-hour recalls, such as meal planning, budgeting,

label reading, food insecurity, and food safety. The nationally administered BC was originally developed in 1990.<sup>11</sup> In 1997, a bank of optional questions was added to the 10 core questions so states could choose to add them to meet goals and objectives that were not captured by the core questions.<sup>11</sup>

Although, for years, the BC had been a valuable tool for measuring program impacts, the emerging research, guidelines (i.e., 2015 Dietary Guidelines for American's and 2018 Physical Activity Guidelines) and the policies used to guide the education EFNEP offers,<sup>4,12-14</sup> prompted its re-evaluation and revision. Further, at the time the BC was originally developed, the tool had undergone limited reliability and validity testing. To address these issues, in 2008, a USDA Agricultural Experiment Station multi-state research project (NC1169/2169/3169: EFNEP Related Research, Program Evaluation and Outreach) was formed,<sup>15,16</sup> to design a new evaluation tool to measure all the core areas for EFNEP. A 20-item food and physical activity questionnaire (FPAQ) was developed and used nationally for EFNEP in 2018. This research was a part of this larger effort. The overall aims of this research were to address:

- The development of a brief physical activity assessment tool (BPAAT) used in FPAQ, and
- The psychometric properties of the BPAAT (specially, the validity, reliability, and sensitivity to change)

## **Dissertation Format**

A non-traditional dissertation format has been used for this dissertation. Rutgers Graduate School-New Brunswick accepts dissertation formats with data chapters written in manuscript form ready for submission to peer reviewed journals. In this case, Chapter 1-3 and 6 are written and referenced separately from standalone data chapters, Chapter 4 and 5. Chapter 4 reports the findings from the BPAAT's cognitive interviews and is formatted with the American Medical Association reference style. Chapter 5 reports the results for the brief physical activity assessment tool (BPAAT)'s validity, reliability and sensitivity to change and has been formatted in accordance to the Vancouver reference style.

## **Chapter 2: Literature Review**

Increased physical activity (PA) has been associated with lower risks for chronic diseases; it has therefore been identified as one of EFNEP's core areas. Since PA is a relatively new core area for EFNEP, no PA assessment questions had been designed. Thus, the aim of this research was to design and test new PA questions, developed for EFNEP evaluation, for their validity, reliability, and sensitivity to change. This literature review opens with an overview of EFNEP and its program policies (i.e., educational focus, delivery mode, target population). This review continues with the evolution of the EFNEP evaluation tools that have been used to assess adult participants' behavior change impacts, as well as the research that has preceded this work in the development of new PA questions. The review also includes a discussion about PA definitions and categorizations, national PA recommendations, PA levels among limited-resource populations, and the scientific literature on PA assessment methods.

### **Expanded Food and Nutrition Education Program (EFNEP)**

#### **EFNEP Overview**

The origins of EFNEP can be traced back to the 1960s, when hunger and poverty in the U.S. first became identified as major public issues. In 1967, a report by the President's National Advisory Committee, "The People Left Behind" documented that a total of 14 million Americans were living in poverty (defined as family income less than \$3000 a year).<sup>17</sup> At that time, those families with an annual family income of less than \$3,000 were more likely to suffer from hunger and malnutrition, and consequently higher rates of

chronic diseases, infant mortality, anemia, and infections.<sup>18,19</sup> In July, 1967, a group called the Citizens' Board Inquiry created a report called "Hunger U.S.A." to investigate hunger and its related problems."<sup>19-22</sup> This publication was the first report to point out the significance of malnutrition and hunger in the U.S., and the severity of malnutrition among limited-resource populations. As a result, the widespread coexistence of malnutrition and poverty issue were brought to the public attention.<sup>20,22</sup>

Malnutrition and hunger had many causes, including: inadequate food availability, poor absorptions of nutrients (e.g. diarrhea, intestinal parasites), and increased metabolic needs due to diseases (e.g. fever).<sup>18</sup> In addition to all the reasons mentioned above, low-income families may also suffer from malnutrition because they lacked the knowledge about, or ways to obtain, information/resources about the nutritional value of foods and household budgeting to ensure ample funds for food.<sup>18,19,23</sup> Furthermore, in the 1960s, the Cooperative Extension Services (CES, later known as National Institute of Food and Agriculture), were focused on mainstream Americans and had limited abilities to provide such education to the poor.<sup>24</sup> The CES, funded by the USDA, was subsequently urged to seek ways to fight against hunger and malnutrition among limited-resource populations by providing structured programs to increase their confidence in serving nutritious and balanced meals to themselves and their families.

### **EFNEP Legislation**

In 1968, EFNEP was initiated with a \$10 million funding appropriation in Section 32 of *An Act to Amend the Agricultural Adjustment Act, and For Other Purposes August 1935 Chapter 641, 74th Congress 1st sess., 49 Stat.750 744*. Since 1971, EFNEP has been appropriated through Smith-Lever Act 3(d) funding and delivered as part of State and Local CES, which are operated through 1862 land grant Universities (i.e., colleges and universities designated by the States or by Congress to receive federal support under the Morris Act of 1862, *12 Stat. 503, chapter 130; 7 U.S.C. 301*). Since that time, EFNEP was expanded to the District of Columbia and the 1890 schools (i.e., historically black colleges and universities under the Morris Act of 1890, *26 Stat. 419, chapter 841; 7 U.S.C. 321*)),<sup>4</sup> formula funded under Section 1425 of the National Agricultural Research, Extension, and Teaching Policy Act of 1977.<sup>4</sup> EFNEP was mandated to “provide for the employment and training of professional and paraprofessional aides to engage in direct nutrition education of low-income families and in other appropriate nutrition education programs.”(*P. L. 95-113*) The legislation went on to state: “To the maximum extent practicable, such program aides shall be hired from the indigenous target population.” the rationale for which is described below. (*P.L.97-98*) As of the writing of this dissertation, EFNEP was operated through 75 Land-Grant universities in all 50 states, U.S. territories, and the District of Columbia, with a federal allocation of approximately \$67 million.<sup>4</sup>

### **EFNEP’S Educational Focus**

Beginning in 1969, EFNEP adult programming focused on addressing low-income families’ nutrition-related knowledge and skills, based on the most current research and



national guidelines at that time.<sup>24</sup> The initial focus of adult EFNEP nutrition education included nutrition; financial management (as it related to food); food preparation, storage and utilization; and food safety.<sup>23</sup> As national guidelines evolved from emerging research, PA was added as a priority area to EFNEP.<sup>25</sup> Up until 2019, EFNEP continued to assist low-income families in gaining knowledge and developing skills to make better decisions about nutrition based on the 2015-2020 Dietary Guidelines for Americans (DGA), and the 2018 Physical Activity Guidelines for Americans (2018 PAG).<sup>13,14,25,26</sup>

Based on EFNEP's core areas, it was expected that through the program's education, participants would be able to: 1) adequately choose and eat a nutritious and balanced diet and participate in PA to improve health and reduce risks for chronic disease; 2) improve their food resource management skills, such as budgeting and planning; 3) improve their food safety handling and sanitation practices, to reduce the risk of foodborne disease; and 4) increase their ability to get food directly, or from food assistance programs, to ensure household food security.<sup>25</sup>

### **EFNEP's Delivery Modes**

In 1964, CES initiated five pilot studies to identify viable approaches for reaching low-income families and for providing nutrition education that addressed the nutritional needs of the poor.<sup>23,24</sup> These pilots were conducted in Alabama, Massachusetts, Missouri, Rhode Island, and Texas to examine the feasibility of the programs in both rural and urban settings.<sup>23,24</sup>

The most successful and best-documented study was a 5-year pilot project that was conducted in Alabama between July 1, 1964 and June 30, 1969.<sup>27</sup> This project was developed to test the feasibility of using program aides, (later referred to as paraprofessionals) to teach nutrition and nutrition/budgeting-related skills to low-income homemakers and their families.<sup>2,23,27</sup> Paraprofessionals were defined as people who were indigenous to the community, who had less than a Baccalaureate degree, and who worked under the supervision of CES professionals.<sup>23,28</sup> The paraprofessionals identified the needs of the homemakers and delivered tailored-learning plans to address their needs in either individual or group settings. It was expected that by increasing knowledge in nutrition and nutrition-related topics, low-income homemakers participating in EFNEP would improve their families' diets and health outcomes. Results from this project showed that over 50% of the homemakers had improved their overall eating habits, increased their milk consumption, better balanced their families' meals, improved their food preparation skills, and exhibited better food budgeting skills.<sup>27</sup> This indicated that paraprofessionals could effectively educate low-income families under the supervision of CES professionals.<sup>24,27,29</sup> It was suggested that the major reason for the success of this program was the employment of paraprofessionals.<sup>3,30,31</sup> Coming from the same community, paraprofessionals shared a common understanding of the cultural beliefs and barriers among the people with whom they worked.<sup>3,30,31</sup> Studies have suggested that a shared background also made it easier for paraprofessionals to establish rapport and communicate with the target audiences.<sup>3,30,31</sup> The results from this pilot project successfully demonstrated the benefits of incorporating paraprofessionals in the delivery

of nutrition education programs, which informed the development of EFNEP in 1968.<sup>2,5,23,29,32</sup> However, despite all these merits, it should be noted paraprofessionals need to be supervised and trained by CES professionals in order to provide effective nutrition education. Ongoing training is the key to maintain the integrity for EFNEP's nutrition education.

For adult EFNEP, one-on-one individualized, in-home learning was primarily used at the beginning of EFNEP establishment (71% of the participants were enrolled in individual sessions and 12% in group sessions in 1978).<sup>24</sup> In 1979, the federal evaluation found that heavily relying on the one-on-one delivery mode was too costly, and suggested that more EFNEP classes be offered in small group settings to improve the cost-effectiveness of the program.<sup>3,32-34</sup> Nowadays, EFNEP programming is provided mostly in small-group settings. In 2017, over 90% of participants were taught through group sessions, and only 3% were taught through individual sessions.<sup>35</sup> The average number of classes taken by adults who completed the program was 8, with the majority (70%) being 7-12.<sup>35</sup>

### **EFNEP's Target Populations**

In 1969, EFNEP's adult target audiences were low-income homemakers.<sup>2,24,29</sup> An in-depth analysis, using data from 1969, indicated that most families enrolled in EFNEP were from racial or ethnic minorities (mostly Black) and had low educational attainments (8<sup>th</sup> grade or less).<sup>36</sup> Due to funding limitations, in 1974, a transition was made to direct EFNEP to populations identified as those being in greatest need (i.e., low-income

families with young children and homemakers who were pregnant).<sup>2,3</sup> Since then, the adult audiences for EFNEP have remained almost the same. In the 2017 Policy document, it was clearly defined that adult EFNEP programming should focus on: 1) low-income parents and other adult caregivers (such as grandparents and guardians) who had the primary responsibility for obtaining and preparing food for their children (with an emphasis on families and caregivers of young children); and 2) low-income pregnant women/teens.<sup>4</sup> In federal fiscal year 2018, EFNEP impacted 90,325 adults directly.<sup>37</sup> Over 80% of the EFNEP adult participants were female and had an income at or below 100% of the poverty line. About 70% were from racial or ethnic minorities and had an educational level equal to a high school degree/GED or less.<sup>37</sup>

### **The History of EFNEP Program Evaluation**

Program evaluation has been a critical part of EFNEP from its inception to justify the use of Section 32 funds and to document whether the program has met its goals.<sup>3</sup> The initial evaluation tool, developed in conjunction with the USDA Economics Research Service in 1969, was the 24-hour food recall.<sup>3</sup> The objective of this evaluation was to determine whether the quality and adequacy of participants' diets were improved as a result of the EFNEP participation. Data were captured by self-reported recalls collected from adult EFNEP participants at initial enrollment and repeated at each six-month interval until they left the program. The number of servings consumed from each of the four major groups, (i.e., milk, meat, fruit and vegetables, bread and cereals) were calculated from the 24-hour food recalls. The changes in the number of servings consumed from each of the

food groups among the recalls were used to assess the program's success. A family record including demographic information (e.g. family income, participation in welfare or other food assistance programs) was also collected.<sup>3</sup>

Based on program data from 1974, over 60% of EFNEP's participants stayed in EFNEP for about 18 months or less, and about 10% stayed as long as three years.<sup>3,23</sup> Aggregated evidence indicated that the greatest improvement in participants' diets occurred within the first year, but lesser improvements occurred afterwards.<sup>23</sup> In response to these findings, the Progression Model was introduced as an evaluation method in 1976.<sup>2,3,38</sup> This model used the combination of a 24-hour recall, along with the food behavior checklist (BC), upon entry into the program and every six months thereafter, to help paraprofessionals track EFNEP participants' behavior changes, to guide further teaching experiences, and to assess their readiness to exit the program.<sup>3,23,24,38</sup> Later, in response to the reduction in the amount of time that participants spent in the program, the evaluations were only conducted at entry and exit from the program.<sup>39</sup>

The initial BC included 70 items and was later reduced to 35 items due to its lengthiness and complicated nature.<sup>3,29,38</sup> The revised 35-item BC was presented at 1979 national EFNEP conference and implemented in 1980.<sup>3</sup> The 35-item BC was used to assess whether participants met the behavioral objectives of EFNEP in five major categories: nutrition, food purchasing, food storage and sanitation, meal planning, and food preparation.<sup>39</sup> Behaviors were measured using four answer categories: "Yes" (the practice was used), "No" (the practice was not used), "N/A" (this practice was not usable or not

applicable for this homemaker), and “Don’t know” (DK, was not able to determine whether the practice was used or not used). The paraprofessionals were expected to assess EFNEP participants’ knowledge and food behavior through direct observation during home visits and to complete the BC every six months until participants exited the program.<sup>39</sup> Although these questions had not been rigorously or nationally tested, they informed the development of future evaluation tools.

In 1990, a subcommittee, led by Jean Anliker, formed to develop a BC that could be incorporated into a standardized national evaluation and reporting system.<sup>11</sup> Question sets were developed, based on EFNEP curriculum objectives, to assess diet quality, food handling practices and food preparation skills, food resource management, and mastery of living situation/self-esteem.<sup>40</sup> The first draft of the questions was generated from existing instruments that had been used by EFNEP, and questions that had been used in national studies. After preliminary testing for validity and reliability, a 15-item BC was finalized in 1993.<sup>11,40</sup> Few publications have been published regarding the development, the testing and the use of the 15-item BC.<sup>11,40</sup>

The only documentation regarding the development and use of the 15-item BC stated that some states raised concerns about some of the questions after their use for 4-years.<sup>11</sup> For example, the questions asking about “whether EFNEP participants had to cut down the size of their children’s meal because there was not enough food” raised concern that a positive response may cause problems with social services.<sup>11</sup> Some questions also seemed to cause confusion among the clients.<sup>11</sup> In 1994, a new committee was

established to revise the 15-item BC.<sup>11,40</sup> The committee further reduced it to 10 items focusing on four domains: diet quality, food security, food resource management, and food safety.<sup>11,40</sup> Questions not included in the 10-item BC were added as a bank of optional questions so states could choose to add them to meet their diverse local goals and objectives.<sup>11,40</sup>

In 1997, the 10-item BC (**Appendix I**) was released for national use, however, limited validity and reliability testing had been conducted.<sup>11</sup> Validity had been assessed via triangulation with other related indicators (e.g. Partial Healthy Eating Index, income) and reliability had only been assessed using Cronbach's alpha statistics for internal consistency estimates. Results indicated that the 10-item BC showed adequate reliability (Cronbach's alpha 0.71 (raw) and 0.72 (standardized)) and was consistent with other related indicators.<sup>40</sup> The optional questions from the bank had not been tested at all. The 10-item BC was a valuable tool for measuring program impacts for many years. However, the emerging research in nutritional sciences and the most recent DGAs<sup>13,41-44</sup> and PAGs<sup>12,14</sup>, which formed the basis for policies used to guide the education EFNEP offers, prompted its re-evaluation and revision.

In response to increased interest in EFNEP evaluation, in 2008, a group of researchers and State EFNEP coordinators initiated a 5-year multi-state research project: NC1169 EFNEP Related Research, Program Evaluation and Outreach.<sup>15</sup> Multi-state research projects are integrated research activities that are designed to study high priority agricultural topics that cannot be addressed by one state.<sup>45</sup> These multi-state research

projects are funded under the Agricultural Research, Extension, and Education Reform Act of 1998 (7 U.S.C. 3175) and carried out by State Agricultural Experiment Stations within Land Grant Universities. The original goal of NC1169 was to conduct a cost-benefit analyses for EFNEP. However, at that time, it was impractical to perform such analyses without a valid and reliable evaluation tool..<sup>15</sup> Thus, between 2008-2011, researchers from NC1169 initiated the development of an evaluation tool to assess EFNEP participants' nutrition, food safety, and food resource management behaviors.<sup>46</sup> The multi-state project was renewed under a new number (i.e., NC2169) and incorporated areas such as PA and food insecurity in 2013 for another 5 years till 2018, during which this dissertation took place.<sup>47</sup> This project was renewed again in 2019 as NC3169.

Meanwhile, in 2011 Dr. Helen Chipman, National Program Leader of EFNEP, formed a national committee of EFNEP coordinators and researchers.<sup>48</sup> The mission of this group was to evaluate whether the behaviors in the 10-item BC were the most important ones for improving the health and well-being of EFNEP participants, based on 2010 DGA and 2008 PAG.<sup>48</sup> The committee was divided into 4 subcommittees: 1) food security, 2) food safety, 3) food resource management, and 4) nutrition and PA.<sup>48</sup> Each subcommittee was charged with 1) reviewing the literature to identify the most salient behaviors to improve the health and well-being of EFNEP participants, 2) assessing the behaviors currently measured from the 10-item BC and the optional questions by EFNEP, and 3) determining the gaps between the most health-enhancing behaviors identified from the literature and the behaviors measured by EFNEP.<sup>48</sup> One major gap identified was that PA, which had



shown consistent health benefits in the literature and included in both 2010 DGA and 2008 PAG,<sup>12,41</sup> was not captured in the BC. The nutrition and PA sub-committee recommended separating PA into a unique category, when developing a new evaluation tool.<sup>48</sup> A full discussion of other gaps and recommendations in the areas of nutrition, food safety, food security, and food resource management is beyond the scope of this literature review and, as such, is not further discussed.

## Physical Activity

### Physical Activity Definitions and Categorization

The most widely cited definition for PA was developed by Caspersen et al. in 1985.<sup>49</sup> According to Caspersen, PA was defined as “any bodily movement produced by skeletal muscles that result in energy expenditure.”<sup>49</sup> The Surgeon General’s Report on PA and Health (1996) revised the definition to “bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above the basal level”.<sup>50</sup> This definition added the concept that PA did not account for the energy expenditure spent at basal level, (i.e., the amount of energy expended while at rest at a neutral temperature).<sup>50</sup> This definition has been generally accepted and was used in the 2018 PAG.<sup>14</sup>

PA is a complex set of behaviors that can be categorized in many ways. A common way to categorize PA is based on the context in which the activity is performed, such as leisure time, occupational, household, and transportation.<sup>14,49,50</sup> Leisure-time PA (LTPA) is used to refer to activities that are not essential to daily living; they can be further divided into sports, exercise, and recreational activities.<sup>49,51</sup> Another way to categorize PA is based on intensity (i.e. light, moderate, and vigorous), often using metabolic equivalents (METs) as the reference.<sup>52</sup> Based on the report from the 2018 Advisory Committee, light, moderate, and vigorous intensity PA were defined as activities that resulted in an energy expenditure of 1.6-2.9 METs, 3.0-5.9 METs, and 6.0 METs or more, respectively.<sup>52</sup> (**Table 2.1**)

<b>Table 2.1 Physical Activity Classification by Intensity and Corresponding Examples</b>		
<b>Intensity</b>	<b>*METs</b>	<b>Examples</b>
Light	1.6 MET to 2.9 METs	Walking—slowly Sitting—using computer Standing—light work (cooking, washing dishes)
Moderate	3.0 to 5.9 METs	Walking at 3.0 miles per hour Water aerobics Bicycling slower than 10 miles per hour General gardening
Vigorous	6.0 METs or more	Race-walking, jogging, or running Swimming laps Aerobic dancing Bicycling 10 miles per hour or faster Heavy gardening (continuous digging or hoeing, with heart rate increases)
*MET: Metabolic Equivalent of Task is a physiological measure to indicate energy expenditure of different physical activities. One MET is the rate of energy expenditure while sitting at rest, approximately 3.5 ml O <sup>2</sup> /kg/min (1.2 kcal/min for a 70-kg person). <sup>14,53</sup>		

Additionally, PA can be categorized into aerobic and muscle-strengthening activities; two types of activities recommended by the 2018 PAG.<sup>14,52</sup> Based on 2018 PAG, aerobic activities were defined as activities that primarily used the aerobic energy-producing systems and used large muscles in a rhythmic manner for a sustained period (e.g., walking, bicycling, and playing basketball).<sup>14,52</sup> Muscle-strengthening activities were defined as activities that can firm, strengthen, and tone the muscles and that have the benefits of improving bone strength not provided by aerobic activities (e.g., push-ups, lounges, weight lifting).<sup>14,52</sup> Other ways to categorize PA are as those performed on weekdays vs. weekends; and activities that are completed intentionally or unintentionally.<sup>49</sup>

Two other terms, “exercise” and “physical fitness” are often confused and sometimes used interchangeably with PA in the literature. In fact, they have distinct meanings. Caspersen et al. defined “exercise” as “planned, structured, and repetitive bodily movement done to improve or maintain one or more components of physical fitness.”<sup>49</sup> This definition was widely accepted and later adopted by the both the Surgeon General’s Report and the 2008 PAG.<sup>14,50,52</sup> Exercise is a subcategory of PA and is performed during leisure time.<sup>14,49,52</sup> It should be noted that occupational, household and other activities of daily living, are not considered to be exercise.<sup>12,49</sup> This is primarily because such activities are performed with little regard with physical fitness.

The term “physical fitness” describes one’s ability to carry out daily tasks, occupational activities, and sports; it reflects a general state of health and well-being.<sup>49,50,54,55</sup> Physical fitness includes cardiorespiratory endurance (aerobic power), muscular endurance, muscular strength, body composition, flexibility and performance-related fitness (agility, balance, coordination, speed of movement, power and reaction time).<sup>14,49,50</sup>

A knowledge of the distinctions between the aforementioned terms is essential to understanding the PA literature. A glossary of other specific PA terms and concepts is shown below. (**Table 2.2**)

<b>Table 2.2 Glossary of Physical Activity Terms Commonly Used in the Literature</b>	
<b>Terms</b>	<b>Definitions</b>
Exercise	Planned, structured, and repetitive bodily movement done to improve or maintain one or more components of physical fitness.
Endurance exercises (endurance training)	Exercises that are repetitive and produce dynamic contractions of large muscle groups for an extended period of time (e.g., walking, running, cycling, and swimming).
Flexibility exercise	Exercises that enhance the ability of a joint to move through its full range of motion.
Leisure-time physical activity	Physical activities performed by a person that are not required as essential activities of daily living and are performed at the discretion of the person. These activities include sports participation, exercise conditioning or training, and recreational activities such as going for a walk, dancing, and gardening.
Lifestyle activities:	Activities that one carries out in the course of one's daily life, that can contribute to sizeable energy expenditure, e.g., taking the stairs instead of using the elevator, walking to do errands instead of driving, getting off one bus stop earlier, or parking further away than usual to walk to a destination.
Physical fitness	Attributes that people have or achieve that relates to the ability to perform PA. The ability to carry out daily tasks with vigor and alertness, without undue fatigue and with ample energy to enjoy leisure-time pursuits and meet unforeseen emergencies
Resistance exercises (muscle-strengthening activities)	Exercise training primarily designed to increase skeletal muscle strength, power, endurance, and mass
Definitions provided for each term were taken either from 2018 PAG or 2018 PAG Advisory Committee Report. <sup>14,52</sup>	

## National PA Recommendations

The health benefits of PA and exercise have been well established in the literature. There is strong evidence to support that regularly engaging in moderate to vigorous physical activity (MVPA) decreases the risk of chronic diseases, including coronary heart disease, stroke, type 2 diabetes, hypertension, obesity, osteoporosis, and some cancers.<sup>50,52,56-59</sup> Further, numerous research studies and reviews have indicated that being inactive or unfit results in increased all-cause mortality.<sup>55,60-67</sup> Evidence continues to accumulate regarding the benefits of PA on improving physical well-being, such as managing body weight, reducing blood glucose and cholesterol, lowering blood pressure, increasing muscle strength and bone density, preventing falls among the elderly, and helping with sleep quality.<sup>52,68-70</sup> PA can also improve psychological well-being by improving self-image, reducing stress, improving mood and decreasing depression symptoms.<sup>50,52,70,71</sup> For these reasons, recommendations on the amount of PA that would lead to health benefits have become prominent public health foci.

Beginning in the 1970s, several professional organizations began to issue PA recommendations, guidelines, and position stands.<sup>12,50,68,72-77</sup> Early recommendations and guidelines were mainly focused on the clinical implications of exercise training or vigorous PA on disease outcomes, primarily cardiovascular health.<sup>72-75</sup> For example, a position statement on “The Recommended Quantity and Quality of Exercise for Developing and Maintaining Fitness in Healthy Adults” was published by the American College of Sports Medicine (ACSM) in 1978.<sup>72</sup> This Statement quantified the amount of

exercise needed to improve and maintain physical fitness. The Statement recommended that individuals should perform vigorous-intensity activity (i.e., endurance activity that results in 60% to 90% of heart rate reserve, or 50% to 85% of maximal oxygen uptake), for 15 to 60 minutes, 3 to 5 days per week to improve cardiorespiratory fitness.<sup>50,72</sup> The American Heart Association (AHA) published similar guidelines regarding the benefits of exercise in reducing the risks of cardiovascular disease.<sup>74,75</sup> Notably, the early AHA and ACSM recommendations were mainly focused on the benefits of vigorous physical activities (mainly exercise) as a therapeutic agent in preventing several health problems (notably coronary heart disease). The health benefits of light or moderate PA were not acknowledged.

In the mid-1980s, there was a major paradigm shift to recognizing the health benefits resulting from the accumulation of moderate PA.<sup>50,78,79</sup> The 1990 ACSM Position Stand, and later a report published by AHA, showed that moderate amounts and intensities of PA may not improve cardiorespiratory fitness (e.g., maximal oxygen intake), but they could provide health-related benefits, such as reducing risks for chronic disease.<sup>77,80</sup>

In the 1990s, an expert panel was convened by the Centers for Disease Control and Prevention (CDC) and ACSM. The panel issued the first public health PA recommendations (i.e., “Physical Activity and Public Health - A Recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine”) in 1995.<sup>79</sup> This 1995 CDC/ACSM report summarized the literature on the importance of PA to promote health benefits. Most importantly, it reviewed the types and

amounts of PA needed for disease prevention and health promotion. The key message was that: "Every US adult should accumulate 30 minutes or more of moderate-intensity activity on most, preferably all, days of the week to derive health benefits."<sup>79</sup> Besides addressing the health benefits of moderate PA, this report also introduced the concept that PA could be accumulated through relatively short bouts (8-10 mins at a time) that added up to 30 min throughout the day.<sup>79</sup>

The DGAs, published every 5 years by the Department of Health and Human Services and the USDA, also recognized the importance of PA. Although the concept of PA was first mentioned with regards to weight maintenance in the 1980 DGAs, "PA" was not explicitly addressed in the key recommendations until 1995.<sup>44</sup> In 1995, one of the key recommendations was "Balance the food you eat with PA--maintain or improve your weight". That was the first set of dietary recommendations to emphasize both diet and PA in weight maintenance and weight loss.<sup>44</sup> The DGA published in 2000 were consistent with the 1995 CDC/ACSM report and emphasized the importance of engaging in 30 minutes or more of PA most days or every day.<sup>42,79</sup>

In 1996, the Department of Health and Human Services published a groundbreaking report "Physical Activity and Health: A Report of the Surgeon General," which served as the foundation for other recommendations developed by various medical and public health organizations.<sup>43,44,50,79,81</sup> This report more comprehensively summarized the existing literature on the effects of PA on disease prevention, PA levels in the U.S., and findings from PA intervention studies.<sup>50</sup> The key recommendations from this report



remained consistent with the 1995 CDC/ACSM report. An updated report published in 2007 (i.e., ACSM/AHA report) further clarified<sup>57</sup> the activity types and amounts recommended for healthy adults, aged 18-65 years, by shifting from:

- A “moderate amount of PA (e.g., 30 minutes of brisk walking or raking leaves, 15 minutes of running, or 45 minutes of playing volleyball) on most, if not all, days of the week.”<sup>50</sup>;

(to:)

- Moderate-intensity aerobic PA, a minimum of 30 min, 5 day each week or a minimum of 20 minimum of vigorous-intensity aerobic PA on 3 day each week, or a combination of both moderate- and vigorous-intensity aerobic PA<sup>57</sup> and
- Muscle strengthening activities at least 2 days each week.<sup>57</sup>

Both sets of recommendations suggested that amounts of PA correlated with health benefits:

- Engage in activities that beyond the minimum recommendations to gain additional benefits and reduce their risks for chronic diseases.<sup>50,57</sup>

The release of the PAG in 2008 was a major landmark in public health recommendations, as it was the first-ever set of published federal guidelines for PA.<sup>12</sup> With minor modifications from the 2007 ACSM/AHA report, the 2008 PAG recommended that most men and women aged 18 to 64 years should weekly engage in at least 150 minutes (2 hours and 30 minutes) of moderate-intensity, or 75 minutes (1 hour and 15 minutes) of vigorous-intensity aerobic PA, in bouts of 10 minutes or more.<sup>12</sup> The

2008 PAG denoted that additional health benefits could be obtained by increasing aerobic PA to 300 minutes per week at moderate intensity, or 150 minutes per week at vigorous intensity.<sup>12</sup> It also stated that an equivalent combination of moderate- and vigorous-intensity aerobic activity could be used to meet the recommendations.<sup>12</sup> Further, it recommended that muscle-strengthening activities that were moderate or high intensity, and that involve all major muscle groups should be performed on 2 or more days a week to gain benefits that were not provided by aerobic PA.<sup>12</sup> The 2008 PAG specified that some PA was better than none, even for inactive people. After the 2008 PAG was published, those recommendations were directly incorporated into the 2010 and 2015 DGAs.

In 2018, the second edition of the PAG was released.<sup>14</sup> One major change in the 2018 PAG recommendations for adults is that it no longer requires PA to be conducted in bouts of at least 10 minutes. Accumulating evidences since 2008 suggest that getting MVPA bouts of any length contribute to the health benefits, even climbing up a few flights of stairs.<sup>14,52</sup> The recommendations about “performing the muscle-strengthening activities on 2 or more days a week” and about “moving more and sitting less” remained the same.

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Both the PAGs and the DGAs have been used as guidance for determining EFNEP’s educational focus and identifying/developing educational materials.<sup>13,25,41-44</sup>

## **Physical Activity Levels among Low-Income Women**

Despite the growing body of evidence promoting the importance of PA, and corresponding national recommendations, a substantial portion of adults in the U.S. remain less active than recommended.<sup>12</sup> A 2010-2014 CDC report indicated that 20% or less of adults ( $\geq 18$  years) met both aerobic activity and muscle-strengthening recommendations.<sup>61,82</sup> Findings from objective measures of PA levels using accelerometer-based PA monitors suggested an even lower percentage of adults ( $< 10\%$ ) met the recommended aerobic activity levels.<sup>83,84</sup>

Of particular interest to this research is the PA levels among low-income women, EFNEP's primary participants.<sup>85</sup> Since the late 1980s it has been well-documented that low-income women were less active and less likely to meet the recommended amount of LTPA, than their wealthier counterparts.<sup>86-91</sup> This finding has held true in national studies where income data and/or education levels were used as proxies for income. Self-reported data from the 2007 BRFSS indicated that 51% of women with an annual income less than \$25,000 met the 2008 PAG (i.e., at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity aerobic activity per week), as compared to 71% of women with an annual income of more than \$75,000.<sup>87</sup> Two more recent regional studies found a slightly lower prevalence of low-income women meeting the recommended PA levels.<sup>89,92</sup> A study of Head Start mothers in New York concluded that 36% of low-income women (mostly White and Black) met the 2008 PAG through LTPA<sup>92</sup> and, a

study conducted in the Southeast region of the U.S found that only 11.7% of White and 13% of Black women met the recommended levels of aerobic PA via LTPA (i.e., sports and exercise).<sup>89</sup>

It has been argued that one possible reason for the lower levels of LTPA observed among low-income women is because they often have physically-demanding jobs. Failure to account for high levels of occupational PA (OPA) may explain lower PA levels and adherence to PA recommendations.<sup>86,89</sup> To examine this, some studies have specifically observed the levels of OPA among low-income women and examined how OPA contributed to meeting PA guidelines. For example, while the BRFSS found that 51% women with an annual income of \$25,000 met the 2008 PAG through non-OPA. When both OPA and non-OPA were considered, the prevalence of meeting the guidelines increased to 58%.<sup>87</sup> Also, a small group of studies on low-income Latina women found that the MVPA the women self-reported from work were 8-9 hours per week, compared to the recommended 150 mins of MVPA by 2008 PAG.<sup>93-95</sup> While low-income women reported higher levels of OPA, they demonstrated significantly lower levels of LTPA, and their total PA levels were similar to those with higher educational attainments (i.e., spent 12 years or more in school).<sup>86</sup> Moreover, emerging research has shown that LTPA and OPA might not have the same type of health benefits, the so called “physical activity/health paradox”.<sup>96-99</sup> Findings from several studies suggested that while high levels of LTPA improved health, high levels of OPA increased the risk for cardiovascular disease and mortality rates, even after adjusting for socioeconomic status and other health

behaviors.<sup>96-99</sup> Thus, even though low-income women meet the recommendation through OPA, they may not have the same health outcomes.

Engaging in household PA and transportation PA are other activities that may contribute to low-income women's activity levels. Nicaise et al found that low-income Latino women self-reported an average of 575 minutes of household MVPA per week,<sup>93</sup> which exceeds the recommended levels of 150 minutes of moderate aerobic PA.<sup>12</sup> Another study examined caregiving activities among low-income overweight or obese mothers, mostly Black and White women. The authors found the women studied reported engaging in an average of 400 minutes of MVPA caring for children and/or adults, weekly.<sup>100</sup> Research also indicated that those from low-income households were more likely to walk for transportation than women from higher income households, possibly given the lower rates of car ownerships among these populations.<sup>101</sup> The total walking time reported by low-income Latino women on the West Coast was similar across studies, (i.e., about 5 hours per week).<sup>93,94</sup> Low-income White and Black women from the Southeast reported slow walking (e.g., moving around the house, walking at work, walking the dog) an average of 3 hours per day and one hour of fast walking (e.g., climbing stairs, walking for transportation, or for exercise) per day.<sup>89</sup>

Although findings from the previous studies suggest that low-income women engage in substantial levels of OPA, household PA and transportation PA, most studies have been largely based on self-reported data,<sup>86-92,100</sup> which often overestimates PA.<sup>93,100,102-107</sup> When measured objectively, low-income women did not engage in the recommended

levels of PA. However, no studies using national surveillance data have been published using objective PA measures for this particular audience.

## Physical Activity Measurements

Accurate and reliable PA assessment is important to programs, like EFNEP, in order to: 1) understand participants' pre-intervention PA behaviors, 2) compare their levels of PA to national guidelines and assess the impact of program education on participants' PA levels. Numerous methods have been proposed for assessment of adults' PA, all with strengths and limitations.<sup>108-112</sup> There is no ideal measure. The selection of instrumentation depends on the purpose of the assessment and logistical considerations.<sup>108-112</sup>

Researchers typically estimate free-living PA using either objective (e.g., PA monitors, HR monitors), or subjective measures (e.g., questionnaires, diaries/logs). While objective measures produce accurate PA estimations, they are too time- and labor-intensive, and therefore also too expensive for use in programs like EFNEP.<sup>108,113</sup> Self-reported diaries/logs are good subjective PA assessments for providing detailed information at a low-cost;<sup>109,114</sup> however, these methods place great burden on the participants, who must record every activity they perform during the study period; also, data analysis is cumbersome.<sup>109,114</sup> This type of assessment can be especially difficult for low-income populations to use due to their limited literacy levels. Self-report questionnaires, on the other hand, are low-cost, easy to administer with groups, and have a low response burden.<sup>109,113,115</sup> For these reasons they have been considered to be the best available measure for use in assessing EFNEP impacts.<sup>109,113,115</sup> However, it should be noted that

self-reported measures are susceptible to recall bias and social desirability, which can lead to under- or over-estimation of the true PA levels.<sup>116</sup>

The following section will provide a review of self-reported PA questionnaires that have been used in program evaluation for low-income adults and follow with an overview of accelerometers-based PA monitors, which are commonly used in questionnaire validation studies.

### **Self-Reported Physical Activity Questionnaire Used in Interventions for Low-Income Populations**

Self-reported questionnaires used in national programs must be valid (i.e., the tool measures what it intends to measure), reliable (i.e., the tool measures the same concepts consistently), and sensitive enough to capture changes that occur within the scope of the intervention. Establishment of these psychometric properties requires evidence of their: 1) content validity, 2) face validity, 3) concurrent validity, 4) criterion validity, 5) internal consistency, 6) reproducibility, and 7) sensitivity to change/responsiveness (**Table 2.3**).<sup>110,117</sup>



<b>Table 2.3 Types of Validity and Reliability Assessed in Self-reported Questionnaires and Methodological Considerations</b>			
<b>Types</b>	<b>Definitions</b>	<b>Established by</b>	<b>Statistical Methods</b>
<b>Validity</b>			
Content validity	Tests if assessment covers all relevant constructs	Literature review and expert panel review <sup>110,118,119</sup>	Qualitative analyses of literature and expert panel review
Face validity	Tests if assessment is understandable by the target population	Cognitive interviews <sup>110,118-122</sup>	Content analysis of cognitive interviews results
Concurrent validity	Tests if assessment is comparable to another measures (not “gold standard”) that assesses the same content	Comparisons of results between the target assessment with other established measurements <sup>110,118,119,123</sup>	Spearman and/or Pearson correlation coefficient, Bland-Altman analysis
Criterion validity	Tests if assessment is comparable to a “gold standard”/criterion	Comparisons of results from the target assessments and a measurement considered as “criterion” (i.e., an objective measurement) <sup>110,119,123</sup>	Spearman and/or Pearson correlation coefficients, Bland-Altman analysis
<b>Reliability</b>			
Reproducibility	Tests if assessment yields consistent results over time; keeping as many conditions (e.g., researcher, timing, etc.) as possible unchanged.	Test-retest reliability <sup>106,110,119,122-125</sup>	Spearman and/or Pearson correlation coefficients, intra-class correlation coefficient (ICC)
Internal Consistency	A measure of how well the different items in a questionnaire (sub) scale measure the same concept.	Inter-item correlation among items that reflect the same concepts on the same questionnaire <sup>119,122,123,125</sup>	Cronbach’s alpha
<b>Responsiveness/sensitivity to change</b>			
Responsiveness/ Sensitivity to change	The ability of a questionnaire to detect changes over time, even if these changes are small	Differences detected between results obtained from the measurement at baseline and post-intervention, with/without a control group <sup>122,123,125</sup>	T-tests/ANOVA, effect size

The following section provides a brief description of self-reported PA assessments that have been used in PA interventions targeting low-income adults, as well as information regarding the instruments' reliability and validity.<sup>126-128</sup> Copies of the surveys are included in Appendix II-IX. These are:

- The Stanford Seven-Day Physical Activity Recall<sup>129-135</sup>
- The Godin Leisure Time Exercise Questionnaire<sup>131,136,137</sup>
- The National Health Interview Survey<sup>129,138</sup>
- International Physical Activity Questionnaire-short form<sup>139</sup>
- The New Leaf Physical Activity Assessment<sup>140</sup>
- The Modifiable Activity Questionnaire<sup>141</sup>
- Residential Environment Questionnaire<sup>142</sup>
- Cross Cultural Activity Participation Study Physical Activity Questionnaire<sup>143</sup>

#### The Stanford Seven-Day Physical Activity Recall (7-day PAR)

The 7-day PAR was developed in 1985 as an interviewer-administered PA recall survey for a community-based health education trial, (i.e., the Stanford Five-City Project).<sup>144,145</sup> Originally, a series of 9 close-ended questions were used to elicit responses regarding the total amount of time spent in sleep, and in moderate, hard, and very hard activities, over the previous 7 days. It was stated respondents provided a more accurate energy expenditure estimate when asked to recall the activities done “in the past 7 days” than those done “in a usual week”.<sup>145</sup> Examples of PA in each of the intensity levels (i.e., moderate, hard, and very hard) were shown to the respondents during the interview to help them classify their activities. Responses were used to estimate subjects' total energy

expenditures (expressed as kcal/kg/week or day or METs-min/day). Since its development the 7-day PAR has been used extensively with different populations (e.g., college students), and modified to suit the needs of different interventions.<sup>144-149</sup>

However, the reliability and validity has only been published with regards to the original scale. Test-retest reliability were assessed over a 2-week period among 58 Caucasian adults. The Pearson correlation ( $r$ ) was 0.83 between the number of vigorous activities reported at each visit, and 0.75 between the number of moderate activities reported at each visit.<sup>144</sup> The 2-week test-retest reliability was lowest for self-reported hours engaged in moderate PA ( $r = 0.08$ ), when compared to hard PA ( $r = 0.31$ ), and very hard PA ( $r = 0.61$ ).<sup>144</sup> In a Latino adult population, 2-week test-retest reliability was 0.69 and concurrent validity ranged from 0.28 to 0.57.<sup>150</sup> The energy expenditure estimated from 7-day PAR was significantly correlated with maximal oxygen uptake using Spearman's correlation coefficients (Spearman's  $\rho = 0.33$ ,  $p < 0.05$ ), and % body fat (Spearman's  $\rho = -0.5$ ,  $p < 0.05$ ).<sup>145</sup>

7-day PAR has also been tested with students in 5th, 8th, 11th grade<sup>148</sup> and college<sup>147</sup>. The test-retest reliability ranged from 0.42-0.81 and the construct validity ( $r$  or Spearman's  $\rho$ ) ranged from 0.29-0.83.<sup>147,148</sup> In addition, the 7-Day PAR has been validated for use in telephone interviews, which correlated well with in-person interviews ( $r = 0.94$ -0.97).<sup>146</sup> A copy of the survey is included in Appendix II.

### The Godin Leisure Time Exercise Questionnaire

The Godin Leisure Time Exercise Questionnaire is a measure of weekly leisure-time exercise that includes 3 open-ended questions and 1 Likert type scale question.<sup>151</sup> The 3 open-ended questions, which address: 1. strenuous, 2. moderate, and 3. mild activities, include a variety of examples that help respondents categorize their activities. Notably, the examples include activities that are not commonly performed in low-income populations (e.g., alpine skiing, golf, etc.). Respondents are asked to report the number of times they engage in more than 15 minutes of each of the activity types. The Godin Leisure Time Exercise Questionnaire has shown a poor to moderate validity when tested with adults using different measures, including: maximum oxygen consumption ( $r = 0.38-0.56$ )<sup>151,152</sup>, body fat percentage ( $r = -0.21$ )<sup>151</sup>, Caltrac accelerometer-based devices ( $r = 0.32-0.45$ )<sup>152,153</sup>, and other questionnaires ( $r = 0.20-0.61$ )<sup>152,153</sup>. Only 2 studies have examined its test-retest reliability. The reliability for strenuous activity and sweat-inducing activities was good to excellent ( $r = 0.69-0.94$ , respectively), but reliability was poor for moderate ( $r = 0.36-0.46$ ) and light ( $r = 0.24-0.48$ ) activities.<sup>151,152</sup> A copy of the survey is included in Appendix III.

### The National Health Interview Survey (NHIS)

The NHIS is administered by the Centers for Disease Control (CDC) since 1957 to collect data on a broad range of health topics through personal household interviews.<sup>154</sup> The PA question set was first included in the NHIS in 1975; since, the questions varied from year to year.<sup>155</sup> The NHIS's PA questions have been used to provide national-level estimates about PA levels among adults aged 20 years and older. In 1975, only 3 sports

and exercise habit questions were included. Over the years, questions about OPA, transportation-related PA, perceived PA levels, and specific questions about walking have been included. A review of the PA questions from 1975 to 2016 and their changes have been described elsewhere.<sup>155,156</sup> Perhaps due to the surveys' large variations, no validity and reliability studies have been published for the entire question set/scale. One study examined the validity of 4 PA questions from the 1985 NHIS (i.e., questions about perceived PA intensity compared to peers, daily activities and OPA) against a 2-week recall of frequency, intensity and duration of 23 specific leisure-time activities (e.g., walking for exercise, gardening or yard work, jogging or running, etc.).<sup>157</sup> The responses showed a weak to moderate correlation with energy expenditures calculated from the 23 question recalls ( $r = 0.14-0.41$ ).<sup>157</sup> Two questions assessing minutes per week of walking during the past 2 weeks have been modified and used in PA intervention studies among low-income populations.<sup>129,138</sup> The 2 questions ask about how many days participants have walked for exercise in the past 2 weeks and how many minutes they walked each time. The response to these items are multiplied and then divided by 2 to yield the total minutes of walking per week.<sup>138,149</sup> Only one study examined the test-retest reliability ( $r = 0.31$ ,  $p < 0.05$ ) and the criterion validity of these two items ( $r = 0.33$ ,  $p < 0.05$ ).<sup>150</sup> The questionnaires can be found online at [https://www.cdc.gov/nchs/nhis/physical\\_activity/pa\\_questions.htm](https://www.cdc.gov/nchs/nhis/physical_activity/pa_questions.htm). An example of 1991 NHIS is included in Appendix IV.

### The International Physical Activity Questionnaire-Short Form (IPAQ-SF)

The IPAQ is one of the most widely used self-reported (telephone or self-administered) tools for assessing PA. Use of the IPAQ requires respondents to recall their PA during the past 7 days, in 4 domains (i.e., job, transportation, domestic/gardening, recreation).<sup>103,158-</sup>

<sup>160</sup> IPAQ data are aggregated and analyzed using the recommended, truncated methodology, and scored as a continuous outcome reported in MET minutes per week.<sup>103</sup>

The IPAQ is available in both a short and long form ([www.ipaq.ki.se](http://www.ipaq.ki.se)). The IPAQ-SF ([https://sites.google.com/site/theipaq/questionnaire\\_links](https://sites.google.com/site/theipaq/questionnaire_links)) is a 7-item questionnaire that measures self-reported PA (i.e., moderate PA, vigorous PA, walking, and sitting) over the previous 7-day period.<sup>103</sup> Only the IPAQ-SF has been validated with low-income populations.<sup>161</sup>

The first study performed to test the IPAQ-SF's reliability was done with a 12-country sample. It showed that the Spearman's  $\rho$  for test-retest reliability ranges from 0.32 to 0.88; and the pooled Spearman's  $\rho = 0.76$ , (95% CI, 0.73–0.77)).<sup>103</sup> The IPAQ-SF's validity was established by correlating the subjects' scale responses and to their accelerometer-based device PA measures, using the Spearman correlation coefficient. A comprehensive review of IPAQ-SF's validity, published in 2010, showed that correlations between the total PA levels measured by the IPAQ-SF and objective standards ranged from 0.09 to 0.39,<sup>162</sup> with none reaching the minimal acceptable standard (0.50 for objective activity measuring devices).<sup>117,163</sup> Similarly, the only study examined IPAQ-SF in a low-income population found poor to fair agreement between the IPAQ-SF with the accelerometer-derived PA measures ( $r = 0.07$  for women, and  $r = 0.48$

for men).<sup>161</sup> Some studies have also suggested that people tend to over report their PA levels when using the IPAQ.<sup>162,164</sup> A copy of the survey is included in Appendix V.

#### The New Leaf Physical Activity Assessment (PAA)

The PAA is a brief questionnaire administered by phone. It is used to assess self-reported time spent doing light, moderate, or vigorous activities. It was developed for assessing the impacts of a structured nutrition and PA program in North Carolina called “A New Leaf...Choices for Healthy Living,” which targeted low-literacy Southern women. The original version of the survey focused on lifestyle and leisure-time activities and assessed 8 distinct activity categories, including: work (pay or volunteer), transportation, household chores, child/elder care, yard work and gardening, church/social group activities, walking/running (for exercise), and structured exercises/sports.<sup>140</sup> No reliability or validity studies have been published for PAA; however, in one study, the author (who was also the developer of the questionnaire), stated “the correlation coefficient for PA measurement generated from PAA and accelerometer-based PA monitors was 0.36 ( $p<0.0001$ ).”<sup>140</sup> An attempt to reach the author about unpublished reliability and validity data was made, but no response was received. A new version of the survey, that added strength training and stretching, is now available online, (<http://www.centertrt.org/?p=intervention&id=1005&section=12> section C). A copy of the survey is included in Appendix VI.

### The Modifiable Activity Questionnaire (MAQ)

The MAQ, formerly the Pima Indian Physical Activity Questionnaire, is an interviewer-administered questionnaire that assesses time spent in LTPA and OPA over the past year; however, it has been validated primarily with Native American adults.<sup>141</sup> It includes several questions on LTPA and OPA performed both throughout the lifetime and during the previous year. Examples provided include common LTPA performed by Pima Indians.<sup>141</sup> Resulting estimates of individuals' PA levels are expressed as hours/week or METs-hours/week.<sup>141</sup> The test-retest reliability has been assessed using Spearman's rank-order correlation coefficients; these ranged from 0.62-0.93 for LTPA, 0.86-0.88 for OPA, and 0.89-0.94 for a combination of LTPA and OPA.<sup>141</sup> The MAQ was validated using direct measures from Caltrac accelerometer-based PA monitors ( $r = 0.41$ - $0.62$  without walking,  $r = 0.27$ - $0.80$  including walking),<sup>141</sup> and doubly labelled water ( $r = 0.56$  for LTPA,  $r = 0.52$  for OPA,  $r = 0.74$  for combined).<sup>165</sup>

A past-week version of this MAQ, which omitted the OPA section from the past-year version, suggested substantial agreement over 1 week ( $ICC = 0.77$ )<sup>166</sup> and over 4 weeks ( $ICC = 0.74$ ).<sup>167</sup> Responses from MVPA estimated from the past-week version of the MAQ showed a moderate correlation with those measured by accelerometer-based PA monitors (Spearman's  $\rho = 0.42$ - $0.54$ ), but not light PA.<sup>166</sup> When the past-week version of MAQ was tested against other physical fitness measures (i.e.,  $VO_{2max}$ , %body fat, flexibility, and balance score), the correlation were poor (Spearman's  $\rho < 0.4$ ).<sup>167</sup>



A French version of the MAQ has also been tested. Total PA by accelerometry (counts/day) correlated to LTPA in women ( $n=101$ ;  $r = 0.22$ ,  $p < 0.05$ ) and to OPA in men ( $n=59$ ;  $r = 0.43$ ,  $p < 0.01$ ) (all in MET-h/week). An inverse relationship between accelerometer-measured sedentary time (h/day) and non-occupational non-leisure PA (MET-h/ week,  $r = -0.30$ ,  $p < 0.001$ ) was found.<sup>168</sup> A copy of the survey is included in Appendix VII.

### Residential Environment (RESIDE) Questionnaire

The RESIDE questionnaire (also called the Neighborhood Physical Activity Questionnaire) was a 21-item instrument developed to assess PA, specifically transportation and recreational walking.<sup>169</sup> This instrument was based on the IPAQ and the Active Australia survey, but it includes only 2 sections, one pertinent to walking and the other to moderate and vigorous LTPA. The walking section includes 14 items measuring the usual weekly frequency and duration of walking (recreational and transportation-related), while the other section includes 7 items assessing moderate and vigorous LTPA performed both inside and outside one's neighborhood. The test-retest reliability of the walking section has been assessed in Australia<sup>169</sup>, China<sup>170</sup>, and Canada<sup>171</sup>, and has shown moderate to excellent reliability for walking (ICC range from 0.37 to 0.96)<sup>169,170</sup>, based on the criteria developed by Landis et al.<sup>172</sup> Only one study examined the reliability of the LTPA section; it found poor to excellent reliability (ICC = 0.31-0.79 for moderate PA, ICC = 0.51-0.84 for vigorous PA).<sup>171</sup> The criterion validity of the walking section from the RESIDE questionnaire was tested using Pearson correlation coefficient and ranged from 0.26 to 0.53 when tested against ActiGraph GT1M using the

Freedson cut-points.<sup>170</sup> No validation study has been published for the LTPA section. A modified version of this questionnaire was tested among women in the Weight-Wise II Study, a group-based weight loss intervention for low-income women with a walking-focused PA component.<sup>142</sup> The modified RESIDE demonstrated poor to fair criterion validity (Spearman's  $\rho = 0.18-0.37$ ) and acceptable reliability ( $ICC = 0.56-0.68$ ).<sup>142</sup> A copy of the survey is included in Appendix VIII.

#### Cross-cultural Activity Participation Study Physical Activity Questionnaire (CAPSPAQ)

The CAPSPAQ was developed by Ainsworth and colleagues to assess the usual (past month's) PA patterns of African American and Native American women, 40 years of age and older.<sup>173</sup> The questionnaire included 10 activity categories with specific examples listed next to each (e.g., household chores: heavy cleaning).<sup>173</sup> For each category, respondents were asked to specify the days of the week and the minutes or hours per day that the activities were performed. According to informal conversations with Ainsworth, the validity and the reliability of the survey were not published. However, unpublished validation data showed the correlations between objectively measured PA levels (not specified) and PA levels as measured by the CAPSPAQ ranged from 0.30 to 0.70.<sup>143</sup> One other study examined the criterion validity of the CAPSPAQ by comparing the energy expenditures (kcal/d) calculated from the survey with those measured by doubly labeled water; this showed poor validity ( $r = 0.15$ ).<sup>174</sup> This survey was adapted for use in the Multi-Ethnic Study of Atherosclerosis to assess PA in a typical week.<sup>175</sup> A copy of the survey is included in Appendix IX.

## Summary

When selecting an appropriate self-reported measure, different aspects (i.e., primary outcome, population characteristics, reliability, validity, respondent burden, time and labor constraints) should be taken into account. Of the aforementioned 8 self-reported questionnaires that have been identified to be used with low-income audiences, none would be an appropriate measurement for assessing PA behavior changes that result from national programs like EFNEP. The NHIS and RESIDE focused on only 1 type of PA (i.e., walking), and didn't account for other LTPA, which is the target of most interventions. The Godin Leisure Time Exercise Questionnaire was mostly validated with healthy volunteers and included examples that were not applicable to low-income audiences. The IPAQ-SF has been validated in low-income population but found poor validity with women, which is the primary target audience of EFNEP. Two of the surveys reviewed (i.e., CAPSPAQ and PAA) have no or limited, reliability and validity data published. The 7-day PAR and MAQ are relatively long and require interviewer administration, which would not be practical for EFNEP's use. Further, 6 of the 8 questionnaires reviewed were developed for surveillance purposes. None of the questionnaires reviewed had any published data to support their ability to respond to PA intervention changes that had been assessed during survey development. Thus, new PA surveys may need to be developed to assess PA behavior changes for programs like EFNEP.

## **Accelerometer based PA monitors**

As previously stated, it would be impractical to use objective measures to evaluate national programs like EFNEP.<sup>176</sup> However, objective measures are commonly used to validate self-reported questionnaires, and thus are important to include in this literature review.<sup>113,177</sup> Doubly labeled water has been considered to be the “gold standards” for PA measurement in many studies, but it assesses energy expenditures only, not the frequency, intensity, and duration of activities.<sup>110,114</sup> Indirect calorimetry can capture PA frequency, intensity and duration, but is impractical to use in free-living populations. Activity monitors, more specifically, accelerometer-based PA monitors, are common tools that have been widely used for assessing the aforementioned aspects of PA and for validating self-reported questionnaires.<sup>109,110,113,178</sup> The following section will provide a brief description of accelerometer-based PA monitors and the cut-points that have been developed to interpret accelerometer-generated data.

Accelerometer-based PA monitors were introduced as an objective measure of PA in the early 1980s.<sup>179</sup> These monitors are non-invasive, small electronic devices that measure body movement by detecting acceleration and providing an objective estimate of duration and intensity of movements.<sup>180</sup>

To date, most PA research has been done using ActiGraph (ActiGraph, LLC, Pensacola, Florida, USA), formally known as Computer Science and Applications (CSA) and Manufacturing Technology Inc. (MTI)). The first generation of ActiGraph monitors, such as the 7164 and the GT1M, could only measure movement in the vertical axis (i.e., they

were uni-axial.)<sup>181</sup> The later generation ActiGraphs, such as the GT3X, were tri-axial (vertical, horizontal, and perpendicular). Data generated from both uni-axial and tri-axial accelerometer-based PA monitors correlate highly with energy expenditure estimates from indirect calorimetry and doubly labelled water.<sup>182-189</sup>

The ActiGraph monitors collect and store the raw acceleration data in the device itself. Once the data is downloaded, one option is to output data as activity counts per unit of time, most frequently counts per minute (cpm). Activity counts increase linearly with PA intensity and can be translated into energy expenditure units (i.e., kilocalories or METs).<sup>190</sup> In order to translate the raw activity counts into more meaningful results, researchers have conducted monitor calibration studies to develop regression equations that relates the counts to energy expenditures in METs.<sup>84,185,191-193</sup> Based on these regression equations, cut-points can be calculated for a specific MET level (e.g., 3.0 METs).<sup>84,185,191-193</sup> Thus, these cut-points can be used to categorize activities based on different intensity levels (i.e., light, <3.0 METs; moderate, 3.0-5.9 METs, and vigorous, >6.0 METs).<sup>84,185,191-193</sup> Using these cut-points, accelerometer-based PA monitors can provide outcome data as how much time individuals spend in moderate- or vigorous-PA, which can be used to determine what percent of a given population is meeting the recommended PA guidelines.

The two sets of cut-points that are most widely used in research were developed by Freedson et al and Troiano et al.<sup>84,185</sup> Freedson et al (Freedson) established cut-points via a study done with 25 men (mean age =  $24.8 \pm 4.2$  years) and 25 women (mean age = 22.9

$\pm 3.8$  years) based on ambulatory activities. These participants were asked to walk/run on a treadmill at different paces while oxygen consumption was measured. The cut-points established by this study were:

- Light intensity PA: <1952 cpm (i.e., < 3 METs, which also included sedentary behavior),
- Moderate intensity PA: 1952-5724 cpm (i.e., 3 - 6 METs),
- Hard or vigorous intensity PA: 5725-9498 cpm (i.e., 6-9 METs), and
- Very hard PA: 9498 cpm (i.e., >9 METs).

During 2000-2010, several studies were published with different recommended cut-points.<sup>192-197</sup> These cut-points varied from Freedson's cut-points by including a range of life-style activities,<sup>192-194,196</sup> using different age groups,<sup>197</sup> and measuring PA under different conditions (i.e., lab vs field vs free-living. ).<sup>195-198</sup>

Troiano et al (Troiano) developed a new set of cut-points based on a weighted average of the cut-points derived from previous walking/treadmill studies<sup>185,195,196,198</sup>. Troiano's cut-points were:

- Light intensity PA: <2020 cpm (i.e., < 3 METs, which also included sedentary behavior),
- Moderate intensity PA: 2020-5998 cpm (i.e., 3 - 6 METs), and,
- Hard or vigorous intensity PA: >5999 (i.e., >6 METs).

These were the cut-points used to interpret the accelerometer-based PA monitor data from the 2003-2004 NHANES population surveillance of PA.<sup>84</sup> Since then, multiple studies have used them as the criteria to interpret their data.

Although the Freedson and Troiano cut-points have been widely used in accelerometer-based PA monitor research, their cut-points were solely based on studies conducted using treadmills or tracks, which may underestimate lifestyle activities that are done in free-living conditions (e.g., shoveling, sweeping, stacking).<sup>191</sup> Strath et al conducted a study to examine the accuracy of the time spent in different PA intensities generated from five published accelerometer-generated cut-points using accelerometer-based monitor (MTI 7164) when it was tested against indirect calorimetry. A range of different lifestyle activities during a 5-6 hour-period were measured among healthy volunteers. This study found that the Freedson cut-points overestimated sedentary/light PA by 13% and underestimated MPA by 60%.<sup>199</sup> Similarly, Crouter et al found that the Troiano cut-points overestimated sedentary time and LPA by 8.3%-9.9% and underestimated MPA and VPA by 50.4%-56.7%.<sup>200</sup>

Matthews et al extensively reviewed the cut-points derived from walking/running in laboratories and some other cut-points derived from free-living conditions.<sup>191,201</sup> Results indicated that cut-points derived from walking/running in laboratories are considerably higher than cut-points derived from participation in lifestyle activities (i.e., household or gardening activities). It was concluded that cut-points used from primarily walking/running research might fail to capture complex lifestyle activity movement

patterns that are associated with little vertical acceleration, meaning they exhibit lower counts.<sup>201</sup> Utilizing multiple data sources obtained from laboratory and free-living condition, Matthews et al (Matthews) concluded that 760 cpm provided the better estimate of moderate intensity activities in daily life.<sup>191</sup> Researchers concerned about the overestimation of sedentary/light PA and the underestimation of MVPA and VPA, such as those validating questionnaires applicable to free-living populations, frequently use Matthews cut-points.<sup>166,167,202-205</sup>

Currently, there is no clear consensus on which cut-points are the best to use for validating PA questions. However, it has been suggested that care should be taken when considering which cut-points to choose by examining the types of activities and population(s) in which the cut-points have been established.<sup>109</sup>

### **Summary**

In summary, this literature review provides relevant information about EFNEP, a federally funded nutrition education program for low-income population. To determine EFNEP's impacts, accurate assessments of adult participants' behavior change from the program is essential. Since PA wasn't added to EFNEP as a core area until 2005, early EFNEP evaluation tools for PA haven't been developed. Further, this review illustrated that although several self-reported questionnaires have been used in low-income populations, each has its own constraints which limit its ability to be used in EFNEP. The



aforementioned aspects support the need to develop new valid and reliable questions to evaluate the PA behavior changes among EFNEP participants.

### **Chapter 3: Methods**

This dissertation project was being carried out as part of the NC2169 multi-state project, EFNEP Related Research, Program Evaluation and Outreach. This portion of NC2169 research addressed the development and validation of BPAAT to evaluate the effects of EFNEP education on program participants' PA behaviors. Some work on this portion of the project was previously done by NC2169 researchers from Clemson University. Thus, this chapter opens with a review of the research done at Clemson. It follows with a detailed description of the methodologies applied to develop the BPAAT, which includes the initial development of the PA questions and the testing for the psychometric properties of the BPAAT (i.e., test-retest reliability, concurrent validity and sensitivity to change).

#### **Previous Related Research**

Dr. Tarana Khan from Clemson University, a member of the NC2169 project, conducted some preliminary work, which laid the foundation for the research described in this dissertation. Beginning in 2013, Dr. Khan and her colleagues created 4 PA questions to be used for EFNEP evaluation, based on a systematic content analysis of adult curricula used nationally by EFNEP and preexisting PA questions in the literature.<sup>206</sup> These 4 questions were subsequently changed in response to cognitive interviews (N=131) that were performed in 3 rounds to establish the questions' face validity (**Table 3.1**). States where participants were recruited to participate in Round 1 interviews included (n=36):

Tennessee, South Carolina, and Florida. States where participants were recruited to participate in Round 2 Interviews included (n=49): Tennessee, South Carolina, Florida, Arkansas, Pennsylvania, Texas, and Washington. States where participants were recruited to participate in Round 3 Interviews included (n=46): Florida, Maryland, New Jersey, Nevada, and Tennessee.

Based on the findings from the cognitive interviews (unpublished work), questions were deleted, modified, or re-developed, resulting in a total of 3 questions (**Table 3.2**). These questions were tested for reliability over-time with 218 low-income adults who are eligible for EFNEP, over a 30-days period. Matched test-retest surveys were collected from: Colorado (n=22), Kansas (n=35), New Jersey (n=34), Florida (n=42), Tennessee (n=33), Washington (n=35), and Pennsylvania (n=17). The Pearson correlation coefficient for the 3 questions were 0.55, 0.55, and 0.49, respectively. Analyses using Spearman's correlation coefficient and Intraclass correlation coefficients (ICC) resulted in findings that were similar to these Pearson correlation coefficients.

In late 2015, Dr. Khan turned over the leadership of the NC2169 PA sub-committee to the Rutgers University research team (i.e., Dr. Debra Palmer-Keenan and Cheng Li). After careful consideration of the findings from the prior cognitive interviews and reliability testing, the NC2169 project researchers (Appendix X) determined the questions previously developed showed inadequate levels of content validity, face validity, and reliability over-time. As such, a decision was made to repeat the question development protocol to create an entirely new question set.

<b>Table 3.1 PA Questions Tested in Different Rounds of Cognitive Interviews in Dr. Khan's research</b>		
<b>Round 1 Questions (n=36)</b>	<b>Round 2 Questions (n=49)</b>	<b>Round 3 Questions (n=46)</b>
Q1: In the past week, how many days did you exercise when you breathed harder than normal for at least 30 minutes?	How many days over/during the past week did you spend at least 30 minutes doing physical activity? The 30 minutes could be all at once or 10 minutes or more at a time.	How many days in the past week were you physically active for at least 30 minutes? The 30 minutes could be all at once or 10 minutes or more at a time.
	How many days when you were physically active did the activity increases your heart rate or made you breath harder than normal or made you sweat?	How many days in the past week did your heart beat faster when you were physically active?
Response set: 0-7 days		
Q2: In the past week, how many days did you exercise to make your muscles stronger such as lifting weights, working with elastic bands, doing push up, sit ups, etc.?	How many days over/during the past week did you do any physical activity to make your muscles stronger?	How many days in the past week did you do any activity to make your muscles stronger? Examples of activities include stretch bands, push-ups or sit-ups
Response sets: 0-7 days		
Q3: How often do you try really hard to include more activities in your daily life by doing things like taking stairs and/or moving more?	Deleted	Deleted
Response sets: Never, sometimes, always		
Q4: Do you exercise regularly?	Deleted	Deleted
Yes, I have been for more than 6 months; Yes, I have been for less than 6 months; No, but I intend to in the next 30 days; No, but I intend to in the next 6 months; No, I don't intend to in the next 6 months.		

<b>Table 3.2 PA Questions used for Test-retest Reliability Over-time in Dr. Khan's research</b>	
<b>Questions</b>	<b>Answers Categories</b>
1. How many days in the past week were you physically active for at least 30 minutes? The 30 minutes could be all at once or 10 minutes or more at a time. Examples of physical activity include: exercising, dancing, fast walking, or running.	0-7 days
2. How many days in the past week did your heart beat faster when you did any of those or other physical activities?	0-7 days
3. How many days in the past week did you do any activity to make your muscle stronger? Examples of activities include: lifting weights, push-ups or sit-ups	0-7 days

## **Process for Development of a Brief Physical Activity Assessment Tool (BPAAT) For EFNEP**

Based on Dr. Khan's previous research, the work described below is a six-phase process used for developing and testing the psychometric properties of the BPAAT.

1. Item Generation
2. Expert reviews to ensure content validity.
3. Cognitive interviews to ensure face validity.
4. Test-retest administration to establish the reliability over time.
5. Comparison with accelerometer-based PA monitors and PA log to assess concurrent validity
6. Examination of changes before and after EFNEP education to ensure sensitivity to change/responsiveness

### **Item Generation**

In planning the development of new PA questions, an expert panel was formed to review the previous questions developed and tested by Dr. Khan and to brainstorm if new questions needed to be created to address other important concepts. The expert panel was convened with 3 experts who were well versed in PA intervention, evaluation, research, and questionnaire development. Two had experience working with limited-resource audiences. The experts were:

- Scott Going, Professor. Head of Department of Nutritional Sciences, Co-Director, the Collaborator for Metabolic Disease, Prevention and Treatment. University of Arizona
- Kay Hongu, PhD, MEd, RD, Associate Specialist, University of Arizona
- Barbara Ainsworth, PhD, MPH, FACSM, FNAK Professor, Arizona State University

The panel members were sent a packet of materials including a general description of the NC2169 project “EFNEP Related Research, Program Evaluation and Outreach”, a progress report about the research conducted to date, and a copy of the questions shown in Table 3.2. A conference call was held in April, 2016 to gather qualitative feedback pertinent to:

- Conceptual considerations regarding the PA questions; and
- The appropriateness of the language used in the questions.

In addition to recommendations made by the expert panel, additional criteria taken into consideration when revising the questions were:

- Their alignment with national PA guidelines.
- Their ability to be self-administered by the participants.
- A restriction to keep the number of questions to a minimum.
- Appropriate wording for the EFNEP audience(s).

Questions were combined if they addressed the same concepts, deleted if they failed to address key concepts, and added if any key concepts were not addressed in the previously

developed questions. Findings from the previous round of cognitive interviews were also reviewed to: 1) choose words or phrases that were understood by most participants; and 2) avoid words or phrases that had confused participants. This step helped ensure wording and cultural appropriateness for EFNEP participants to improve questions' face validity. The first draft of the question was thus generated and sent out for expert review.

### **Content Validity Testing**

Content validity refers to how well an instrument/question set measures all the relevant content it intends to measure. Written and oral comments from 2 PA expert panels were used to establish the content validity for the BPAAT.

The first expert panel consisted of the aforementioned 3 PA experts that were involved in the item generation. The second expert panel was made up of the entire NC2169 project research group (**Appendix X**), who were all experts in the program evaluation or EFNEP, and who were from various regions of the country, so they were familiar with the variety of populations EFNEP serves. The primary purpose of this review was to evaluate the appropriateness of the BPAAT for the target audience (i.e., to improve the questions' content validity).

The 2 expert panels were asked to review the BPAAT and to provide qualitative feedback on:

- The alignment of the concepts being assessed with the national guidelines.



- The relevancy of the questions to EFNEP audiences.
- The questions' wording.
- General recommendations for any needed additions, deletions or modifications.

Qualitative findings from the 2 expert panel reviews were used to revise the questions.

### **Face Validity Testing**

The aim of this portion of the project's work was to assess whether the target populations, for whom the items were developed, could understand the questions and respond as intended by the researchers.

### Subjects.

Between June 2016 and September 2016, a convenience sample of EFNEP eligible individuals were recruited from sites in Washington, Tennessee, and New Jersey where EFNEP classes were routinely conducted. Participant recruits were limited to: 1) low-income adults who were at least 18 years or older; 2) primary caregivers of young child(ren); and 3) able to read, speak, and write in English. The study protocol was approved by the Rutgers Institutional Review Board #E16-321. All interview staff, as well as staff who transcribed interviews, were CITI certified.

### Test Procedure/ Methodology.

One-on-one, semi-structured cognitive interviews were conducted to gather participants' opinions about BPAAT's wording and responses. Informed consents were signed prior to interviews.

At the start of the study interview, a trained interviewer provided an introduction to the study and an overview of the interview process. Participants were asked to complete the PA questions, and to provide basic demographic information (e.g., age, gender, ethnicity, number of children in the household).

During each interview, a combination of “verbal probing” and “think-aloud” techniques, the 2 most commonly used cognitive interviewing methods, were used to test the appropriateness of each item and its response set.<sup>120,207</sup> The “think-aloud” procedure required participants to verbalize their thoughts as they answered the questions, with minimum interruptions or manipulations by the interviewer. In this study, the participants were asked to read each question aloud and tell the interviewer what the question meant to them. The procedure of “verbal probing” used a list of pre-determined questions which were based on Tourangeau four-stage model.<sup>208</sup> (**See Appendix XI**) to:

- Elicit specific and detailed information if participants were unable to respond to each question;
- Describe their interpretation of each question;
- Define their rationale for choosing the response option; and
- Obtain participant insights about optimal wording for each of the questions.

Participants' nonverbal cues were noted and added to the transcriptions. Upon completion of the cognitive interviews, participants received a \$10 appreciation payment.

Cognitive interviews were conducted in iterative rounds, with 4-25 interviews conducted per round. In each round, the number of interviews conducted was based on a classical qualitative approach (i.e., data saturation).<sup>209</sup> This meant interviews were conducted continuously until no additional meaningful results were obtained. All interviews collected for this project were kept confidential and were stored in a secure, locked closet at the research office until the study is completed.

#### Data analysis.

All interviews were tape-recorded and transcribed. Template analysis procedures<sup>210</sup> and constant comparative analysis was used to summarize the findings and incorporated direct quotes on a question-by-question basis.

#### **Test-Retest Reliability Testing**

The aim of this work was to examine the BPAAT's test-retest reliability, a measure of the questions' consistency over time.

#### Subjects.

A convenience sample of low-income women were recruited from 3 states (i.e., Colorado, New Jersey, and Nevada). Study inclusion criteria were: (1) being low-income; (2) having at least one child less than 19 years old living in the household; (3) being at

least 18 years old; and (4) being able to read, write, and speak English; and (5) having (as of yet) not taken any EFNEP classes. The study protocol was approved by the Rutgers Institutional Review Board #E16-420. All research staff were CITI certified.

#### Test Procedure/ Methodology.

Participants who agreed to participate were asked to complete the 3 PA questions using the revised response sets, 2 of which were number of days per week, and one of which was a 6-point Likert scale ranging from “never” to “always”. Seven to 10 days later, the same participants were asked by the same researcher, to complete the same questions. The 7-10 day interval decreased the likelihood that any participants would recall and repeat the answers from the first administration of the questions, while minimizing variations in the reported PA behaviors that may occur over a longer period of time. Care was taken to ensure that time intervals used were periods for which consistent weather patterns had been predicted, as inconsistent weather has been correlated with changes in individuals’ activity patterns.<sup>211</sup> Once again, participants were also asked to provide their age, gender, ethnicity, and the number of children they cared for in their households. Participants received \$25 for completing both surveys. All data collected for this project were kept confidential. Surveys collected were de-identified using a numeric ID code number. After de-identification, all the data were stored in a secure, locked closet at the research office until the study is completed.

#### Data Analysis.

Test-retest reliability was assessed by comparing the participants' responses from Time 1 and Time 2. Since the data was not normally distributed, Spearman's correlation coefficient (SCC) was used to assess the agreement between the first and second administration. Intra-class correlation coefficient (ICC) and Cohen's weighted kappa were used as alternative ways to examine the data as some claim this is the more accurate and thus preferable approach.<sup>172,212</sup> The Shrout and Fleiss method based on two-way analysis of variance was used to calculate ICC.<sup>213</sup> The ICCs were interpreted using the following criteria:  $<0.50$  = poor,  $0.50$  to  $0.74$  = moderate,  $0.75$  to  $0.90$  = good/substantial,  $\geq 0.90$  = excellent.<sup>214</sup> The SCC and  $\kappa$  were interpreted by the criteria developed by Landis and Koch:  $0.00$  to  $0.20$  = poor;  $0.21$  to  $0.40$  = fair;  $0.41$  to  $0.60$  = moderate/acceptable;  $0.61$  to  $0.80$  = substantial;  $0.81$  to  $1.00$  = near perfect.<sup>172</sup>

## **Concurrent Validity Testing**

This part of the study was done to assess the BPAAT's concurrent validity, which is defined as the degree of agreement with other measures (e.g., accelerometer-based PA monitors) that assesses similar concepts.

### Subjects.

Participants were recruited from 7 states: Colorado, Florida, Kansas, Ohio, New Jersey, Tennessee, and Washington. These states were deemed representative of the country in terms of geography and variable climatic conditions. At least 5 participants were enrolled from each state. A sample size of 100 was needed to achieve a statistically significant spearman correlation coefficient ( $r=0.4$ ) with the 95% CI (0.256, 0.527) of approximately  $\pm 0.135$  standard deviations. This calculation was determined based on the results from other studies that validated PA questionnaires against accelerometer-based PA monitors.<sup>215,216</sup> Participants were required to be either EFNEP participants or EFNEP-eligible adults who spoke English and who were able to walk without assistance. The study protocol was approved by the Rutgers Institutional Review Board #E17-667. Informed consent forms were obtained from all participants who were qualified for this study.

Study inclusion criteria were:

- Being an EFNEP participant or EFNEP eligible (low-income caregivers of young children);
- Being at least 18 years old;

- Able to read, write, and speak in English;
- Able to walk at least one block without the use of a mobility aide (e.g., cane, walker, or wheelchair); and
- Able to pass a screening to ensure they have no physical constraints, (**see Appendix XII**) answering “NO” to question 2, 3, 5 on the Physical Activity Readiness Questionnaire, ), a screening tool recommended by the American College of Sports Medicine (ACSM).<sup>217</sup>

#### Test Procedure/ Methodology.

At the enrollment visit, the researcher briefly explained the study goals and procedures. Participants were asked to complete a demographic questionnaire (gender, age, race, etc.). Their weights and heights (in light clothing, without shoes) were measured by a trained researcher. Heights were measured using a Seca model 214 stadiometer. This tool is a portable, standalone stadiometer and accurate to the nearest one-tenth centimeter (0.1 cm). Weight was measured using a portable, electronic floor scale Detecto DR550 scale, with a 400-pound capacity and accurate to the nearest one-tenth pound (0.1 lb).

After the accelerometer-based PA monitors (i.e., ActiGraph monitors) were successfully initialized, a trained researcher showed the participants how to wear the ActiGraph monitors (on the right hip, attached to an elastic band anterior to the iliac crest, above or under clothes). An instruction sheet and FAQs on the proper usage of ActiGraph monitors were provided for additional guidance. (**Appendix XIII and XIV**) Participants were asked to wear the ActiGraph monitors during all waking hours for the following 7

consecutive days while maintaining their normal activities. Because the monitors were not waterproof, the participants were advised to remove their monitors during water-based activities (e.g. showering, swimming).

A written log (**Appendix XV**) was provided for the participants to record the time they put on and took off the ActiGraph monitors each day. In the same log, participants were asked to record any strength training activities they performed during the seven days. This visit took about 1 to 1.5 hour.

Participants were asked to provide their phone number for receiving reminder texts and/or phone calls from the researchers. Reminder text messages and/or emails were sent via a password protected phone twice a day (in the morning and at night) during the seven-day period to prompt the participants to wear the ActiGraph monitors and to remind them to complete their log.

The daily reminder text messages read as follows “Hi, this is [First Name] from Rutgers University. This is just a gentle reminder to please remember to put on your device and belt today! Don’t take it off except when you are doing water-related activities. And please DON’T forget to text me the time you put on and take off the belt and write those down in the log! Also, please also record any strength training activities or any extra activities you do today! If you have any further questions, please write me back or call us at XXX-XXX-XXXX. Thanks and have a great day!”



If the subject did not respond via text, a call was made. The call scripts read as follows:

“Hello, I am [full name], from Rutgers University. I’m calling to make sure everything is going okay with the meter and the log since I haven’t heard back from you. Do you have questions about wearing the meter? How about completing the log? Call me at XXX-XXX-XXXX if you have any questions. Thank you!”

If the person didn’t pick up the call and it went to voice mail, this voice message was left:

“Hello, this is [full name], from Rutgers University, calling for [participant’s name]. I’m calling to make sure everything is going ok with wearing your meter since I haven’t heard back from you. Let me know if you have any questions regarding how to wear it. Don’t forget to also fill in the log. Please give me a call back when you hear this message at XXX-XXX-XXXX. I will check back tomorrow to see how things are going.”

At the end of the sixth day, a separate text/email reminder was sent to remind each participant to bring back the device and the log. Text reminders read as follows: “Hi, this is [First Name] from Rutgers University. This is just a gentle reminder to please remember to come back with your device and belt tomorrow! And please DON’T forget to fill out everything in the log! If you have any further questions, please write me back or call us at XXX-XXX-XXXX. Thanks and have a great day!”

At the follow up visit, after the participants returned the ActiGraph monitors, they completed the BPAAT reporting their PA levels (Q1-MVPA, Q2-strengthening PA, Q3-extra daily PA) in the past week. Data from the ActiGraph monitors were screened, using

the ActiLife software, to assess how many days the participant had 10 hours valid wear-time. Participants who didn't have sufficient data were asked to re-wear the ActiGraph monitors for an addition week and to complete the PA questions at the end of that week. After the data screening, participants engaged in a short interview with the researcher regarding their responses to the 3 PA questions. A private space was provided for the interviews. This visit took about 30 mins to 1 hour.

Participants received a \$15 compensation if they completed the enrollment visit and \$10 for each day they had worn the ActiGraph monitors for a minimum of 10 hours. Those who did not wear the device for at least 10 hours, for at least 5 days received \$1 for each day the monitor was worn. An additional \$25 compensation was provided if the ActiGraph monitors was returned and the BPAAT completed. Subject payments were not pro-rated for those who withdrew from the study prior to completion, beyond providing the payment for the enrollment visit and \$1 for each day the ActiGraph monitors were worn. All data collected for this project were kept confidential. Surveys, interviews, and data collected from the ActiGraph monitors were de-identified using a numeric ID code number. After de-identification, all the paper documents were stored in a secure, locked closet at the research office. The ActiGraph electronical files were stored in a password-protected research computer in the office. All data was to be kept for 5 years after study completion.

Instrumentation-ActiGraph (GT3X-BT) monitors. PA levels were objectively assessed using the ActiGraph GT3X-BT, accelerometers-based PA monitors (ActiGraph LLC,

Pensacola, FL). ActiGraph monitor is a small tri-axial device (4.6cm x 3.3cm x 1.5cm) that can measure body accelerations in 3 dimensions at a user defined sampling rate (between 30-100Hz). The ActiGraph monitor had been shown to be a valid and reliable tool in measuring PA in adults. The monitor can be initialized at a sample rate of 30-100 Hz to record activities for free-living conditions. Raw data were downloaded and reintegrated into 60sepochs for data processing in ActiLife v6.8.0 (ActiGraph, Fort Walton Beach, FL, USA).

### Data Analysis.

Different analyses were conducted to assess each of the three questions, as they all measured different PA constructs. Concurrent validity was assessed by comparing the estimated time spent in MVPA generated from ActiGraph monitor outputs using the Freedson and Matthews cut-points with responses to the Q1-MVPA. Q3-extra daily PA was compared with the time spent in sedentary behavior, LPA, MVPA, and total PA (TPA) generated from ActiGraph monitors. And the self-reported paper log was used to compare with the participants' responses to Q2-strengthening PA. The Shapiro-Wilk test of normality was used to determine the distribution of both the self-reported and objectively measured PA data.

Data were included for all participants who had 5 valid days' data, which has been suggested to provide reliable habitual PA estimates.<sup>218</sup> The question related to MVPA data only included participants who had 7 valid days' data since this question was referring to MVPA performed for all 7 days in the previous week. A valid day was

defined as a minimum of 10 hours (600 minutes) wear time per day. Wear-time was derived by subtracting non-wear time from the 24-hour period. Non-wear time was defined as any period of consecutive zero-counts for a minimum of 90 minutes, with an allowance for up to 2 consecutive minutes of activity counts between 0 and 100 by Choi et al.<sup>219</sup>

Two separate cut-points were applied to define MVPA. MVPA has been defined as  $\geq 1952$  counts/min by Freedson et al.<sup>185</sup> and  $\geq 760$  counts/min by Matthew et al.<sup>191</sup> While Freedson's cut-points have been more widely used in survey validation research,<sup>220-223</sup> it has been suggested that Matthew's cut-points provide a closer estimate to measured MVPA in free living environments.<sup>191,224</sup> Thus, both cut-points were used in the analyses. Additionally, bouts of MVPA were defined as intervals  $\geq 10$  minutes with counts greater than the MVPA threshold, with an allowance for interruptions of 1-2 mins with counts below the threshold.

The number of days that participants had at least 30 minutes of MVPA, according to the accelerometer-based PA monitor, were calculated using two different approaches:

- 1) The total time spent in MVPA each day were calculated by summing the time in which activity counts generated from ActiGraph monitors exceeds the cut-points (i.e., 1952 counts/min or 760 counts/min) for MVPA, regardless of bout duration. Different thresholds for total time spent in MVPA (i.e., 30 minutes, 25 minutes, 20 minutes) was used to address the possibility that participants may have inadvertently included activities that were slightly below the established MVPA

cut-points (e.g., warm-up and cool-down activities) and to allow for slight recall errors with regards to MVPA lengths.

- 2) The total time spent in MVPA each day was calculated by including the time in which activity counts exceed the cut-points for bouts of 10 mins or more. Again, different thresholds for total time spent in MVPA in bouts (i.e., 30 minutes, 25 minutes, 20 minutes) was examined.

Spearman rank-order correlation coefficients were used to assess the associations between responses to Q1-MVPA and the number of days of  $\geq 30$  mins of MVPA determined by ActiGraph monitors.

To assess Q2-strengthening PA's concurrent validity, survey responses were correlated with the number of days participants did strength training, as reported on the weekly PA logs.

For Q3-extra daily PA validation, with the lack of a direct comparison, survey question responses were correlated with ActiGraph monitor generated data regarding time spent in sedentary behavior, LPA, MVPA, and TPA. These analyses were conducted because it was assumed those participants who had provided a higher response on the question had incorporated more small changes into their daily lives, which may resulted in lower sedentary time, higher LPA (most of these small changes would be light intensity), higher MVPA (participants who were more motivated to make small changes might also be more motivated to perform MVPA), and higher TPA. Thus, a negative correlation was

expected with Q3-extra daily PA and SB and positive correlations were expected with Q3-extra daily PA and LPA, MVPA, and TPA.

All statistical procedures were performed using SAS 9.4 (SAS Institute, Inc., Cary, North Carolina). The interpretation criteria for Spearman correlation coefficients were: 0.00 to 0.20 = poor; 0.21 to 0.40 = fair; 0.41 to 0.60 = moderate/acceptable; 0.61 to 0.80 = substantial; 0.81 to 1.00 = near perfect.<sup>172</sup> Significance was set at  $p \leq 0.05$ .

### **Sensitivity to Change/Responsiveness Testing**

This portion of the study was designed to determine whether the BPAAT was responsive /sensitive enough to detect changes as a result of the intervention.

### **Subject**

This portion of the study was a secondary data analysis done using the EFNEP national data from federal fiscal year 2018 (Oct 1, 2017 to Sep 30, 2018). Each state collects data from adult participants before (pre-test) and after the program (post-test). After it is collected, EFNEP data is entered into the Web-Based Nutrition Education Evaluation and Reporting System (WebNEERS), which is an online secure database developed and maintained by Clemson University. Participants' identifiable information is not included, as it is removed by States prior to submission to the federal office.

### **Test Procedures**

These data used were obtained through a request submitted to USDA's Research, Education, and Economics. Per the Freedom of Information Act 5 U.S.C. § 552, individuals have the right to access records possessed by the Federal government. A copy of the agreement is provided in Appendix XVI.

Data requested were EFNEP participants': 1) demographic data including age, gender, race/ethnicities, educational attainments, etc. and 2) BPAAT responses, which were part of a larger questionnaire, and which had been completed by adult participants at both pre- and post- EFNEP intervention in all states. This study was approved by the Rutgers Institute Review Board (#2018002663).

#### Data Analysis

All statistical analyses were performed using SAS 9.4 (SAS Institute, Inc., Cary, North Carolina). Demographic data were analyzed using frequencies, means and standard deviations. The responsiveness of each question was assessed using paired t-tests from pre-EFNEP to post-EFNEP intervention. Significance was set at  $p \leq 0.05$ .

## **Chapter 4: Communicating and Assessing Physical Activity: Lessons Learned from Cognitive Interviews with Low-Income Adults**

### **Abstract**

**Objective:** This investigation sought to identify the physical activity (PA) terms and concepts that are best understood by low-income adults.

**Design:** This was a cross-sectional study using semi-structured, cognitive interviews that employed retrospective verbal probing techniques.

**Setting:** Interviews were conducted in Expanded Food and Nutrition Education Program (EFNEP) sites in New Jersey, Tennessee, and Washington.

**Participants:** A convenience sample of 57 adults, either participating in, or eligible for participation in, EFNEP.

**Phenomenon of Interest:** Participants' interpretations and conceptualizations of PA concepts and terms.

**Analysis:** Template and constant comparative analysis.

**Results:** Participants interpreted many PA terms and concepts in unintended ways.

“Exercise” was the term that came closest to conveying “moderate-to-vigorous PA.”

Terms used to describe muscle strengthening activities were mostly understood.

“Intentional engagement in extra activities” was difficult for participants to conceptualize despite multiple tested wordings; “making small changes to be active” came closest to

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conveying this concept. Participants' comprehension of the PA terms differed by their PA and literacy levels.

**Conclusions and Implications:** Nutrition educators should be mindful of the terminologies they used in communicating messages and assessing PA behaviors to EFNEP participants or similar populations. (Word Count: 188)

**Key Words:** exercise, surveys and questionnaires, health education, health communication, public health

## Introduction

Physical activity (PA) is a health determinant associated with lower risks for multiple diseases and deleterious health conditions.<sup>1</sup> The 2008 Physical Activity Guidelines recommend that adults perform at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity aerobic PA per week (or a combined equivalent), and engage in muscle-strengthening activities at least 2 days a week.<sup>2</sup> Unfortunately, only 1 in 5 adult Americans meet these recommendations.<sup>3</sup> Further, it has been well-documented that low-income adults are less active and less likely to meet PA recommendations than their wealthier counterparts.<sup>4-7</sup> Thus, PA has become an educational and evaluation foci in many federally funded nutrition education programs that target this population,<sup>8,9</sup> including the Expanded Food and Nutrition Education Program (EFNEP). The EFNEP is delivered in class series' aimed at assisting participants in improving their dietary quality, PA, food resource management, food safety, and food security.<sup>8</sup> PA did not become an EFNEP core educational area until 2005. Of note, EFNEP curricula vary nationally, such that the degree to which PA is addressed, as well as what is taught varies across states.<sup>10,11</sup> For example, *Eating Smart Being Active*, one of the most widely used EFNEP curricula,<sup>11</sup> includes 10-15 minutes of PA per 90 minute class as part of its 9-lesson series, whereas, *Cent\$ible Nutrition*, another widely used curriculum, includes PA as a single 60-90 minute lesson as part of its 17-lessons serie.<sup>10</sup> With PA being a relatively new EFNEP core area, prior to federal fiscal year (FFY) 2018, little was done to assess EFNEP's PA impacts.

In FFY 2018, EFNEP began using the 20-item Food and Physical Activity Questionnaire (FPAQ) that was developed by a North Central Agricultural Experiment Station's Multistate Research Group (NC2169). The FPAQ includes questions to assess EFNEP participants' behaviors regarding each of EFNEP's core areas. All FPAQ questions were developed and assessed using a 5-stage process to establish their test-retest reliability and content, face, and concurrent/construct validity, as described by Murray et al.<sup>12</sup> The authors of this study were responsible for the development of the 3 PA questions.

It is widely recognized that the design of concise and comprehensible questions is challenging. According to Tourangeau,<sup>13</sup> in order to answer questions respondents not only need to understand what questions are asking, but also which behavior they are supposed to report. Further, respondents have to recall relevant information from memory to decide whether or not the instances occurred in a given reference period, and to map their internally generated answers into the provided response options. Thus far, few studies have examined respondents' cognitive processes that are involved when answering PA questions using cognitive interviews (CIs), and none have been conducted with low-income populations.<sup>14-16</sup>

This manuscript describes lessons learned from the cognitive interviews (CIs) that were done to establish 3 PA questions' face validity among low-income adults, as well as respondents' understanding and interpretation of particular PA concepts and terms (**Table 4.1**) that are commonly used by health professionals in communications and assessments.

Additional findings pertinent to other aspects regarding the 5-stage validation process<sup>12</sup> are not discussed here.

## **Methods**

This study used a qualitative approach (semi-structured CIs) to assess low-income adults' understanding and interpretation of PA concepts and associated terms. Researchers from Rutgers University, the University of Tennessee, and Washington State University collaborated to conduct the study which was reviewed and approved by the Institutional Review Boards of all 3 Universities (E16-321, 14-00100 B, and 13952, respectively).

### **Item Development**

The PA questions were developed based on a review of the 2008 Physical Activity Guidelines for Americans<sup>2</sup> and an EFNEP curriculum content analysis.<sup>12,17</sup> Three major concepts (**Table 4.1**) were identified and served as the bases for the initial development of the PA questions. The concepts were: 1) moderate to vigorous aerobic activities, 2) muscle strengthening activities, and 3) intentional engagement in extra daily activities (since some physical activity is better than none, and adults who participate in any amount of physical activity gain some health benefits). The PA questions were designed to assess the number of days per week in which participants engaged in both moderate to vigorous aerobic activity and strength training, and the frequency in which they intentionally engaged in extra daily activities. Different PA terms tested for each concept and sample questions are shown in **Table 4.1**.

<b>Table 4.1 Physical Activity Concepts and Terms Tested in the Cognitive Interviews and Final Questions</b>		
<b>Concepts Tested</b>	<b>Terms Tested</b>	<b>Final Question</b>
Moderate-to-vigorous aerobic physical activities	<ul style="list-style-type: none"> <li>• Physical activity</li> <li>• Activity</li> <li>• Cardio</li> <li>• Aerobics</li> <li>• Exercise</li> </ul>	In the past week, how many days did you exercise for at least 30 minutes? This includes things like jogging, playing soccer, or exercise videos. The 30 minutes could be all at once or 10 minutes or more at a time. Do not count taking care of your kids or walking to get from place to place.
Muscle strengthening activities	<ul style="list-style-type: none"> <li>• Activities to make your muscle stronger</li> <li>• Muscle toning activities</li> <li>• Muscle toning exercises</li> <li>• Muscle toning workouts</li> </ul>	In the past week, how many days did you do muscle toning workouts on purpose? This includes things like lifting weights or doing push-ups, sit-ups, or squats.
Intentional engagement in extra daily activities	<ul style="list-style-type: none"> <li>• Change your daily routine on purpose to get in more activity</li> <li>• Do something extra to be more active</li> <li>• Make small changes on purpose to be more active</li> </ul>	How often do you make small changes on purpose to be more active? This includes things like getting off the bus one stop early, doing a few minutes of exercise, or moving around instead of sitting while watching TV.

All questions were designed to include the concept of intention, that is activity done “on purpose” or above and beyond one’s normal routine. An expert committee, assembled to review the original questions developed, believed it was important for this concept to be included based on previous findings that caring for children, doing housework, and walking as a means of transport was often considered to be sufficient PA.<sup>18-20</sup> This perception is incorrect in that these routine activities vary from light to moderate

intensity,<sup>21</sup> and are not necessarily done for periods of 8-10 minutes at a time. For these reasons, these activities do not significantly increase energy expenditure or cardiovascular fitness, which has raised concerns about the validity of previous self-reported PA assessments done with this audience.<sup>21,22</sup>

The questions' wording was chosen to be appropriate for low-income participants' literacy levels, which was less than 8<sup>th</sup> grade assessed by the Flesch-Kincaid Scale in Microsoft Word 2013 (Microsoft Corporation, Redmond, WA).<sup>23</sup> Words 2 or more syllables like “strengthening” were avoided, as were terms like “moderate” or “vigorous.” The concept of intensity they are meant to convey is unfamiliar to people, and thus are difficult to understand.<sup>14,16</sup> Secondly, these words have 3 syllables each, so their inclusion would substantially increase the readability level of any question containing them.<sup>24,25</sup>

### **Sample and Study Recruitment**

Interviewers from Rutgers University (n = 3), University of Tennessee (n = 2), and Washington State University (n = 1) recruited EFNEP adult participants and others eligible for EFNEP (i.e., low-income caregivers of young children) for study participation. Recruitment/interview sites included centers for family services, drug rehabilitation/treatment groups, job training sites, and transitional housing programs. Those recruited were required to be able to speak, read, and write in English and be at least age 18 years old.

## **Cognitive Interviews**

Cognitive interviewing is a method used to evaluate sources of response error in questionnaire items and to improve the wording of items by having respondents share their thoughts about the meaning of the items being tested and explain the cognitive process they used in deriving responses to those items.<sup>26</sup> This is particularly important to ensure that items and response options are relevant, understood as intended, and acceptable from the perspective of the respondent population, particularly for surveys used with diverse, low-literacy populations. Two primary CI techniques are “think-aloud” and “verbal probing.”<sup>26,27</sup> In the first approach, respondents are asked to verbalize their thoughts (“think out loud”) as they answering each question. In the second approach, the interviewer asks a list of structured and unstructured probing questions to determine respondents’ thought processes.

## **Data Collection Protocol**

Face-to-face, semi-structured CIs were conducted by experienced interviewers in private rooms at recruitment sites. To ensure procedural consistency, standardized materials and interviewer training manuals were developed and provided to all interviewers. All interviewers received training that was similar to Goodell’s protocol, (i.e., ethics training, a review of basic qualitative research methods and data collection procedures, and mock interviews).<sup>28</sup> The only difference was the mock interviews were conducted with the research team instead of with previously recorded interviews or with participants. The interviewers were trained to ask neutral, open-ended questions to minimize any social desirability in responses.

For this study, a retrospective verbal probing was selected as the major approach.<sup>26</sup> Participants were first instructed to complete the 3 PA questions. The interviewer then asked the participants to revisit the PA questions and share their thoughts about the following: (1) their understanding and interpretation of each item; (2) the level of difficulty they experienced in recalling relevant information; (3) their decision processes to come up with an answer and (4) their response processes (mapping the internal generated responses to the response categories given by each questionnaire item). This strategy was based on Tourangeau's 4-stage question-and-answer model.<sup>13</sup> Each CI lasted approximately 40 minutes. Upon completion of the CI, participants received a \$5 appreciation payment. CIs were conducted over multiple rounds through an iterative process, after which the PA questions were modified according to participants' feedback to reduce ambiguity. The number of interviews varied from 4 to 15 per round. Data collection ceased for each round of CIs when data saturation was achieved.

### **Data Analysis**

All CIs (n = 57) were audio-recorded and transcribed. Each transcription was analyzed separately by two experienced researchers using template analysis procedures<sup>29</sup> and predetermined codes based on the three major themes (i.e., aerobic activity, muscle strengthening activity, and "extra" activity). Additional codes were added to better represent themes not captured by the assigned codes. Next, the researchers used the constant comparative analysis protocol to review earlier transcripts through an iterative and inductive process to see whether there was a need to add the newer codes.<sup>30,31</sup> During



the coding process, discrepancies between coders were discussed and finalized via an iterative process until 100% agreement was reached.

## Results

Data were collected between June 1 and September 1, 2016. The sample's descriptive characteristics are shown in **Table 4.2**. Women were overrepresented in the sample as they were EFNEP's primary participants.<sup>32</sup> They ranged in age from 19 to 57 years. While most participant had received a high school diploma, only 10% had completed a 2-year or 4-year college degree.

### Moderate to Vigorous Physical Activity

To communicate “moderate to vigorous aerobic activities,” the terms “physical activity” “activities” and “exercise” were tested. When “physical activity” (or “activities”) were used, participants brought up different activities that encompassed a broad range of intensity levels. For example, one participant indicated that to her, “activities” were “*Like sports, like walking, like any physical activity...Like home stuff, as a mom, cleaning, cooking.*” Similarly, another participant who was asked to give examples of physical activities mentioned “*volleyball, riding bicycle, skating, cleaning, go shopping, go to the movies, restaurants, get active, everything.*”

<b>Table 4.2 Demographic Characteristics of Cognitive Interview Participants (N=57)</b>	
<b>Characteristics</b>	<b>Mean <math>\pm</math> SD or n (%)</b>
Age (means $\pm$ SD)	31.3 $\pm$ 7.9
Gender	<b>n (%)</b>
Female	53 (93%)
Male	4 (7%)
<b>Education</b>	
Less than high school diploma	11 (19%)
High school diploma or equivalent	22 (39%)
Some college	8 (32%)
College graduate (2 yrs)	3 (5%)
College graduate (4 yrs)	3 (5%)
Postgraduate	0
<b>Ethnicity</b>	
Hispanic or Latino	12 (21%)
Non-Hispanic or Latino	45 (79.0%)
<b>Race and ethnicity</b>	
Native American or Alaska Native	4 (8%)
Asian	0
African American	18 (38%)
Native Hawaiian or other Pacific Islanders	0
White	26 (54%)
<b>Number of children<sup>a</sup></b>	
1-2	39
3-4	13
$\geq 5$	3
<b>Federal Assistance Programs</b>	
Free or reduced school lunch or breakfast	17 (30%)
SNAP	30 (53%)
Head Start	1 (2%)
TANF	27 (47 %)
WIC	30 (53%)
<sup>a</sup> Missing data, n=1.	

When the term “exercise” was tested, most participants named intentional moderate-to-vigorous activities that were performed to stay fit. One participant defined it as *“strenuous activity, to help you stay in shape and lose weight, essentially.”* When probed about the meaning of exercise, most participants named aerobic activities such as jogging, running, dancing, walking, and playing sports. Only a few defined exercise as a mix of aerobics and muscle strengthening activities, such as *“working out, going for a walk, jog, do sit-ups, squats and all that”* and *“like going to the gym, lifting weights, or push-ups, or just like different things like that, or if even in your house walking for a certain amount of time.”*

The terms “aerobic” and “cardio” were tested with some participants but were not universally understood. Some participants had not heard of the terms or could not explain the meaning of them. One participant, who interpreted cardio correctly (*“get your heart going, and it requires you to move a lot faster”*) stated *“I don’t know if everybody understands what cardio is.”* While “cardio” was more often interpreted as activities to *“get the heart going, get the heart rate up,”* a few participants thought cardio meant muscle strengthening activities. The term “aerobics,” on the other hand, was more frequently interpreted incorrectly, for example, one respondent defined as *“yoga, dancing, stretching.”* When discussing the differences between cardio and aerobics, some participants thought cardio was more masculine and aerobics were more feminine.

In responding to this moderate-to-vigorous physical activity exercise question, the most frequent example given was walking. One participant said, *“Since we’re busy, like school and work, the only way we can do is just walking. So I am trying to encourage myself, and especially I am gaining weight, so, I am trying.”* However, the intensity of this activities varied. When probed about the speed of the walking, some participants responded with *“Fast walk. Not jogging, but it’s like fast”* or *“like 2 or 3 times a week, I walk fast, like 30/45 min, on the treadmill,”* while others stated *“maybe just regular (walk). Not too fast, not too slow. Not like I gotta rush cause I don’t like to sweat. I think that is disgusting!”*

Similarly, caring for or playing with children were examples of PA commonly mentioned by the participants, but their intensity was unknown. Some participants said they played sports that are commonly considered to be moderate-to-vigorous intensity activities with their children: *“I mean sports, I play with my kids, I got 2 boys, so you know, I gotta play ball with them.”* Others spoke of normal activities they need to do with their kids that may or may not be done at moderate-to-vigorous intensity, e.g., *“I run around all day with my son. I take him everywhere he needs to go, whether it’s the park, the doctor’s, food shopping, cleaning.”*

### **Muscle Strengthening Activities**

To communicate the concept of “muscle strengthening activities,” the phrases “activities that make your muscle stronger” and “muscle toning exercises/activities/workouts” were tested. The phrase “activities that make your muscle stronger” was interpreted broadly to

include both strength training and aerobic activities. For example, “activities to make your muscle stronger” as “*Exercise. Like walking and jogging and, you know, lifting and cardio. Any activity.*”

However, when the phrase “muscle toning exercises/activities/workouts” was tested, the definitions were largely compatible with the researchers’ intended conceptual communication. Nearly 90% of the participants understood “muscle toning exercises/activities/workouts” to mean activities that strengthen and build your muscles. One participant said muscle toning activities, to him, were “*lifting weights or trying to tighten your muscles. Push-ups, sit-ups, you’re building parts of your muscle.*” Other participants interpreted these terms in similar ways: “*building muscle, becoming stronger*”; “*the ones that make your muscle get bigger*”; and “*Like you’re focusing more on certain parts of your body that you want to work out. Like after you have a baby, toning your belly, your rear, your legs. Things like that. Like if you feel overweight, instead of just losing weight, you want to tone up your butt or your stomach.*”

When compared to aerobics activities, muscle strengthening activities were viewed to be more difficult. One participant mentioned: “*Muscle toning, I think of like resistance, not as if you’re dancing, or aerobics or cardio...*” Another participant commented “*I guess just really harder workouts, like harder core. Like they have that (at) gym, P90X or something like that. Like 20 squats or something like that, and like 20 minutes or something, you know, just more intense.*”

Some participants, predominantly males, were clearly knowledgeable about muscle-strengthening workouts. For example, one male participant said, *“Muscle toning is not trying to build bulk, but to tone....Muscle toning and muscle building, to try to build muscle, are two different things. Muscle toning, you would go with a light weight with more repetitions. And if you’re trying to bulk up, you know, it’s heavier weight, less repetitions, to take it to like that serious level.... If you’re doing dips, you’re not gonna go as far, and you’re gonna to push faster. Sit-ups, you’re going to do your basic sit-ups. You’re not going to add no weight. You’re not going to do other sit-up procedures. And the squats, again, you’re going to lower weight and more repetitions. Try to burn instead, there’s muscle toning, and not muscle building.”*

While most participants considered “muscle strengthening activities” to be associated with intentional workouts like *“lifting weights, push-ups, sit-ups, toning,”* some described it in terms of daily life activities. One participant who had completed an EFNEP series of classes said muscle toning activities, to her, were *“bringing in groceries, carrying the water bottles and stuff like that. And putting up groceries, lifting, bending up and down, like squats.”* Another participant mentioned, *“If you lift something that’s more than 10 pounds, it could be considered a weight, like a trash bag, or like moving stuff around in the house and things like that.”* Other activities brought up by the participants included lifting children/grandchildren and lifting cans of fruits and vegetables,

A few participants knew that muscle strengthening activities increased the size of the muscles. However, they said they avoided doing them when they were trying to lose

weight, e.g., *“While I’m losing the weight, I try not to do too much muscle. Because you’re building up muscle that has muscle weight. You don’t see it different on the scale, so I lose the weight, then build up my body muscle.”*

### **Extra Activity**

To query participants’ engagement in intentional extra activity performed throughout the day, this study tested phrases such as “Change your daily routine on purpose to get in more activity”; “Do something extra to be more active”; and “Make small changes on purpose to be more active” with accompanying examples (e.g., getting off the bus one stop earlier).

When the phrases “Change your daily routine on purpose to get in more activity” and “Do something extra to be more active” were tested, most people did not interpret them as intended. Many defined them as activities associated with their busy, daily lives. One participant mentioned *“I move around a lot cause I have a baby. I’ll go make his bottle, get diapers, clean them, clean his spit up, take his toys out, clean up his toys. And that’s what I consider moving around.”*

Participants seem to understand a little better with the third phrase, “Make small changes on purpose to be more active.” One participant mentioned *“it’s asking what little things do I do willingly, to be a little more active in my life. Meaning not huge steps of work, like exercising or working out, but little things, like it said, getting off the bus a stop early, and maybe walking down the hill.”* Another participant who interpreted the

question as intended mentioned that it was about “*when you go out of your way to do things, like to me, it means like taking the stairs instead of the elevator, just to get a little more exercise in. Or like getting off the bus earlier or whatever. Just doing little things in your daily activities to keep it moving.*” However, other participants found this phrase to be confusing. One participant thought “Make changes on purpose to be more active” was “*Like move stuff around or changing the house around, I guess.*” Other participants interpreted the phrase as follows: “*It’s like if you do like everyday things. It’s like asking you if you do everything, thing like clean the house, catch the bus to go places*”; “*It’s actually asking me to be more positive. Well, I don’t get off the bus early, I just get off where I’m getting off at...I watch a lot of TV, but I’m trying to change that because there’s more to life than just sitting around.*”

Notably, when the notion of incorporating extra activity was understood, it was favorably viewed as a relatable way to be active. One participant saw it as “*kind of like baby steps to get towards going to the gym or taking a run, doing some push-ups....These are like small things...I definitely related to them.*” Another responded, “*I think it’s really good cause they’re daily things that a lot of people actually do... Taking a couple minutes out of their busy lives to do a little bit of exercise, and getting up while you’re watching TV, and maybe do some squats and stuff like that when you have nothing else going on. It relates to people in general.*”

### **Ancillary Findings**



One ancillary finding was that participants' understanding of physical activity terminologies differed by their activity levels. Regular exercisers understood the terms and phrases better and more frequently referred to the differences among them. One participant mentioned that *“if you don't work out, you really won't think too much of what you're saying. But if you do work out, then you will really understand. [For people who didn't work out] they just gonna think that jogging and everything is basically all in the same category. Just like I don't workout. That was my first time working out for real. So, I wouldn't think that they're not [the same]. They don't fall in the same place. But if you do work out, you'll say, no, this is what you just said, aerobics that, and then you got the cardio and all different things.”*

A second ancillary finding was related to administration of the questions rather than their wording. Some participants appeared to have reading comprehension issues such that when they were completing the questions silently, they omitted certain information. Whereas later, when they were asked to read the question aloud and were probed about a specific question, they often comprehended the phrases as intended.

For instance, in response to the first activity question participants were asked to report how many days they exercised for more than 30 minutes. The question went on to clarify that the 30 minutes did not need to be done all together and could be done in smaller periods of 10 minutes or more. Many participants did not notice the clarification sentence when they were completing the questions silently. When asked to read the question aloud and explain how she had chosen a particular response, one participant said, *“I kind of just*

*was like, oh, did you exercise for 30 minutes? But I didn't see, I didn't really pay attention to the '30 minutes could be all done at once or 10 minutes throughout'."*

Other participants mentioned that they had a better understanding of the questions and were able to better respond after they read the questions out aloud. One participant offered, *"I thought I was sure when I first answered it, but then after rereading it (aloud), I thought twice about it. I just, probably, just not noticed the 'on purpose' thing. I had to reread. I reread this question twice before answering it. Just not realizing the 'on purpose' part at first and then noticing it the second time."* Another said *"I've got a bad habit of reading something and I don't understand what I read. That's how I am, I don't understand. I've got to keep going over and over and over again to really understand it. I've gotta be interested in it. This isn't interesting me so I really don't care."*

## **Discussion**

In this study, EFNEP participants and others who were eligible for program participation shared their understanding of physical activity-related terms commonly used by health professionals. To the authors' knowledge, this is the first study of its kind.

One of the major findings from this study was that low-income adults interpreted certain PA terminology and PA-related concepts in ways unintended by the researchers. When it comes to assessing moderate to vigorous PA, "exercise" was the term that came closest to conveying this concept. It has been well-established that physical activity is a difficult

concept to measure, especially with regard to its intensity.<sup>14,16,33</sup> Consensus from the four cognitive interviews studies about physical activity questionnaires indicated most respondents either had never heard of the words “moderate” or “vigorous” PA or misunderstood them to be stressful and mentally taxing activities.<sup>14-16,33</sup> Using the words “moderate” and “vigorous”, even with detailed explanations, still caused confusion among participants regarding what activities they should report for each intensity level.<sup>15</sup>

In this study, these intensity terms were not used in the questions. Instead, terms that are commonly used by health professionals and in the media to refer to moderate to vigorous activities (**Table 4.1**) were tested, and none of these terms were universally understood by, or familiar to, this low-income population. Perhaps the term “exercise” was the best substitute understood to represent moderate to vigorous activities like running, jogging, and fast walking with the primary purpose of improving or maintaining physical fitness, physical performance, or health due to this term’s extensive use.

In contrast, the terms examined to describe muscle strengthening activities were much easier for the study participants to understand, perhaps because these activities are typically planned and voluntary as compared to many aerobic activities. Previous studies, although not specifically examining muscle strengthening activities, found that planned and structured activities, such as vigorous activities, are easier for respondents to understand and recall.<sup>16,34</sup>

In many ChooseMyPlate educational materials,<sup>35</sup> “intentional engagement in extra daily activities” (e.g., taking the stairs instead of the elevator or getting off the bus one stop early) has been promoted frequently as a means to help adults avoid inactivity. In this study, we found that for those who understood the concept as intended, it was very relatable. However, some participants had a hard time thinking beyond their normal activities and understanding ways this could be accomplished. To the author’s knowledge, no previous physical activity questionnaires had examined and assessed this concept, possibly due to the difficulty in estimating these activities.

This study found that those adults who were more active and engaged in an exercise routine understood the terms better. These findings are consistent with a recent cognitive interview study that examined the International Physical Activity Questionnaire–Short Form and the U.S. National Health Interview Survey–Adult Core Physical Activity Questionnaire.<sup>16</sup> That study found that both questionnaires worked best with respondents who have an exercise routine. Because many low-income adults do not regularly perform PA as exercise and are engaged mostly in non-exercise PA,<sup>20,36</sup> perhaps these comprehension issues are to be expected.

Clearly the aim of educational assessment in EFNEP, and like programs, is to assess behavior, as opposed to knowledge. However, when concepts like “extra activity” and terms like “moderate” and “vigorous” are not well understood, they cannot be adequately assessed through self-reported questions. One solution to address this issue would be to abandon the pre and post-test assessment methodology for such constructs and to instead

assess them using a retrospective-pretest method. This method allows for respondents to complete a single self-reported measure in reference to both their behaviors prior to the intervention/program (retrospective pretest) and afterwards, after they have attended the classes in which they develop a common vocabulary.<sup>37-40</sup>

Further, while information regarding income and literacy rates are sparse, results from the first National Assessment of Adult Literacy suggested that a positive correlation existed between literacy levels and all variables traditionally linked with socioeconomic status (e.g., economic indicators like full-time employment and weekly income, and educational levels).<sup>41</sup> Additionally, EFNEP educators have long recognized literacy issues among their clientele, particularly with regard to program assessment.<sup>42</sup> Thus, comments from study participants suggesting they “didn’t notice” parts of the questions posed may be attribute to issues associated with poor reading comprehension levels. Further, as one participant noted, her lack of interest decreased her reading comprehension; this is consistent with the fact that reading comprehension is lower in cases when people fail to be interested in what they are reading, such that they have a low degree of metacognitive engagement.<sup>43,44</sup> Assessments may be improved by reading questions aloud to participants and encouraging discussion to include metacognition. They can also be improved by strategies proposed by Townsend and colleagues (e.g., use color-dependent instructions, use client-friendly vocabulary).<sup>42</sup>

Limitations of this study include the use of convenience samples, which might have affected the generalizability of the findings. However, participants were recruited from

varied race/ethnic groups in 3 different states to ensure representativeness. Another potential limitation is that the study created an artificial testing environment, which may have caused participants to put more thought into the comprehension and understanding of the terms and how to answer the questions. This limitation is practically unavoidable for this sort of research. Also, the fact that participants were not specifically queried regarding their previous PA experiences or their exposure to PA education limited further analyses regarding the PA terms. Further research should take this into consideration if possible. The final limitation relates to the interviewers' training. Although the interviewers were all experienced and familiar with CI interview processes, it is possible that the CIs could be improved upon had all of Goodell's 5-phases been included in the interview training protocol.<sup>28</sup>

### **Implications for Research and Practice**

Nutrition educators are often asked to administer surveys and to communicate educational information to the public about physical activity. These communications will be more effective if they are personally relevant and are tailored to the specific needs and interests of the subjects. An understanding of low-income adults' comprehension of PA terms and concepts as well as their perceptions of PA is essential to develop effective nutrition education and evaluation materials aimed at improving their physical activity levels in programs like EFNEP.

Finally, while there is great value in teaching PA terminologies (e.g., moderate to vigorous PA) to expand people's vocabularies, when time is limited, educators must constantly weigh the value of teaching new vocabularies against the value of focusing time on behavior change education. Educators may need to use slightly less correct terms to communicate concepts (e.g., exercise instead of moderate-to-vigorous PA) may need to be used. Either way, the findings generated in this study suggest that educators and participants must continue to strive to speak and understand one another's languages.

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## **Chapter 5: Development of a Brief Physical Activity Assessment Tool for Low-Income Adults**

### **Abstract**

**Background:** Measuring physical activity (PA) among low-income adults is challenging. This study aimed to develop a brief physical activity assessment tool (BPAAT) that was reliable, valid, and sensitive to PA behavior changes among low-income adults who participate in programs such as the Expanded Food and Nutrition Education Program (EFNEP).

**Methods:** The 3-question BPAAT was developed to address 3 key concepts (moderate to vigorous physical activity (MVPA), muscle strengthening PA, and move more to avoid inactivity) from the Physical Activity Guidelines for Americans. A 4-phase mixed method approach was used to establish the BPAAT's: 1) initial development, including content and face validity; 2) test-retest reliability, 3) concurrent validity, and 4) sensitivity to change/responsiveness. Content validity was assessed through expert review to ensure the BPAAT reflected the guideline's key recommendations; face validity was established by conducting cognitive interviews to ensure the questions were interpreted as intended by low-income adults. Questions were revised based on the expert panel reviews and cognitive interview results. The BPAAT was then administered to 75 low-income adults at two separate occasions, 7-10 days apart, to assess the test-retest reliability. Intra-class correlations (ICC), Cohen's weighted kappa, and Spearman correlation coefficients (SCC) were used to compare the responses at the two

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administrations. Concurrent validity was assessed using accelerometer-generated PA monitor data and a self-reported PA log from 99 EFNEP participants. SCC was used to assess the agreement between the BPAAT, accelerometer-based PA monitor data, and PA logs. A secondary data analysis of EFNEP participants' pre- and post-intervention BPAAT data (N=53,393) was used to evaluate the tool's responsiveness.

**Results:** All BPAAT questions demonstrated “moderate” to “strong” reliability (ICC, 0.77-0.84;  $\kappa$ , 0.55-0.61, SCC 0.59-0.84). The SCC for the questions assessing MVPA against the accelerometer-based PA monitor ranged from (-0.18-0.21). The BPAAT demonstrated sensitivity to change by showing significant increases on all 3 questions.

**Conclusions:** The study resulted in a nationally tested, easy to administer, reliable, and valid BPAAT for evaluating PA behavior changes for low-income adults. The process described in this study can be used by other researchers to develop and further refine the instruments for use in other programs that teach PA.

## Background

Low levels of physical activity (PA) is a leading factor in the development of chronic disease and contribute to all-cause mortality [1]. Among those with lower incomes, PA levels were lower than their higher-income counterparts in the U.S [2]. Since 2005, as PA was added as part of the DGAs, U.S. government-funded programs that serve low-income adults, such as the Expanded Food and Nutrition Education Program (EFNEP), were mandated to teach PA as part of its education [3]. To understand EFNEP and other programs' impacts on PA behavior changes among program participants, identifying or developing an appropriate measurement tool is critical. Several papers have reviewed different PA assessment methods and provided recommendations on identifying the most appropriate means of PA assessment [4-6]. While objective measures (e.g., accelerometer-based PA monitors) are considered valid and reliable in assessing PA levels, they are too time-consuming, costly, and difficult to administer in many programs [5,6]; instead, self-report questionnaires have been determined to be the most practical and cost-effective approach for programs such as EFNEP [4,6,7].

There have been a number of widely-used, comprehensive and validated PA questionnaires that addressed multiple domains (e.g., occupational, leisure-time, transportation), and frequencies and intensities, such as the International Physical Activity Questionnaire (IPAQ) and Global Physical Activity Questionnaire (GPAQ) [8-10]. However, these questionnaires were deemed too long and detailed for use in pre- and post-testing in EFNEP classes. Several shorter questionnaires were reviewed but they

were primarily focused on MVPA [8-11]. Few survey questions have addressed the assessment of muscle strengthening activity, [12-14] and none specifically assess the intentional incorporation of additional movement into individuals' daily routines (e.g., taking stairs instead of elevators/escalators, walking instead of driving), which is taught in EFNEP. To the author's knowledge, since most of these questionnaires were used for surveillance purposes, none has been tested for responsiveness to intervention change, which is an important psychometric feature that is often overlooked. The purpose of this study was to develop and validate a brief physical activity assessment tool (BPAAT) for use by EFNEP and other programs that teach PA to low-income populations.

## **Methods**

This research was part of a multi-state effort to develop a comprehensive assessment for EFNEP (i.e., including diet, PA, food resource management, food safety, and food insecurity [15]. The development and validation of BPAAT was undertaken in four phases, adopted partially from the Edinburgh Framework for validity and reliability and the COSMIN checklists [16,17]. This included phase I: initial development of the PA questions; phase II: test-retest reliability (the level of consistency over time); phase III: concurrent validity testing (the degree of agreement with an established measure that assesses the similar construct); and phase IV: responsiveness (the ability of the tool to detect change as a result of the intervention). All data collection and analysis were conducted by CITI certified researchers and approved by the Rutgers Institutional Review Board. Each participant provided written consent for participation in the study.

The test-retest reliability, concurrent validity, and responsiveness were assessed in three independent samples of low-income adults.

### **Phase 1: Initial Development of the BPAAT**

The questions for BPAAT were generated based on:

- a review of the 2008 PA Guidelines for American, [18]
- formative research conducted by Dr. Khan and her colleagues, including a systematic content analysis of 12 adult curricula used nationally by EFNEP, [19]
- an examination of existing, validated PA questionnaires.

Since the questions developed to measure PA constituted only one of five educational areas to be assessed by EFNEP, keeping the number of questions to a minimum was a priority to ensure that the program's overall assessment did not result in an excessive response burden.

Three PA questions, to be used by low-income adults, were developed, one each to assess the 2008 PA Guidelines key recommendations (i.e., Question 1: moderate to vigorous physical activity [Q1-MVPA]), Question 2 : muscle-strengthening activities [Q2-strengthening PA], and Question 3 :moving more by intentionally incorporating small changes into daily life e.g., taking stairs instead of elevators, [Q3-extra daily PA]) [18].

The assessment period was “the past week,” because it has been suggested that questionnaires that assess PA levels over a specific time frame (e.g., the past week) when compared to habitual PA (a usual week), demonstrate stronger convergent validity against direct measures [20].



Notably, there are some careful considerations when developing Q1-MVPA. The 2008 PA Guidelines recommend adults to do at least 150 minutes of moderate-intensity, or 75 minutes of vigorous-intensity aerobic PA, or a combination of both. And these activities should be performed in episodes of at least 10 minutes, and preferably, it should be spread throughout the week. However, this could be difficult for some people to remember and add up how much activity they did in a week. Thus, from a public health and nutrition education perspective, a widely used example by PA Guidelines, National Institute of Health, and the World Health Organizations to achieve this recommendation is to teach people to perform MVPA for 30 mins a day for at least 5 days.

Written and oral comments from two PA expert panels were used to evaluate the questions' content validity and the appropriateness of the questions for the target audience. The first expert panel, consisting of three PA experts who were well versed in PA interventions, evaluations, research, and questionnaire developments, had the primary role of ensuring the concepts' inclusiveness. The second expert panel, which was comprised of experts in program evaluation of EFNEP from various regions of the country, primarily sought to ensure the questions' readability and target audience interpretability. Questions were revised based on qualitative findings from the two expert panel reviews.

Between June and September 2016, EFNEP-eligible individuals (n=57) were recruited from Washington, Tennessee, and New Jersey to assess whether the revised questions

were understood as intended (i.e., face validity), and if necessary, to refine the final wording of the PA questions. Participant inclusion criteria were: 1) low-income adults who were  $\geq 18$  years; 2) primary caregivers of young child(ren); and 3) able to read, speak, and write in English. Consented participants participated in one-on-one, semi-structured cognitive interviews. During each interview, a combination of “verbal probing” and “think-aloud” techniques were used to test the appropriateness of each question and its response set [21,22]. Using the “think-aloud” procedure, participants were asked to read each question aloud and tell the interviewer what the question meant to them. Participants received \$10 compensation for completing the interviews. All interviews were tape-recorded and transcribed, with participants' nonverbal cues later added to the transcriptions. Interviews were conducted in iterative rounds, with 4-25 interviews conducted per round until data saturation was reached [23]. After resolving issues highlighted by the results from the interviews, the questions' wordings were finalized (**Table 5.1**). Detailed cognitive interview results were published elsewhere [24].

## **Phase II: Test-retest Reliability**

A convenience sample of low-income adults were recruited from Colorado, New Jersey, and Nevada between September 2016 and March 2017. Study inclusion criteria were: (1) being low-income; (2) having at least one child less than 19 years old living in the household; (3) being at least 18 years old; (4) being able to read, write, and speak English; and (5) having not previously participated in EFNEP.

Consented participants completed the BPAAT twice, 7-10 days apart. The 7-10-day time interval was chosen to decrease the likelihood that any participants would recall and repeat the answers from the first question administration, while minimizing variations in the reported PA behaviors that may occur over a longer period. Care was taken to ensure that time intervals were periods during which consistent weather patterns were predicted, as inconsistent weather has been correlated with changes in individuals' activity patterns [25]. Participants also provided demographic information, including age, gender, ethnicity, and the number of children in their care. Participants received \$25 compensation.

### **Phase III: Concurrent Validity**

Participants were recruited from 7 states (i.e., Colorado, Florida, Kansas, Ohio, New Jersey, Tennessee, and Washington). These states were deemed representative of the country in terms of geography and variable climatic conditions. At least 5 participants were enrolled from each state. Participants were required to be either EFNEP participants or EFNEP-eligible adults who spoke English and were able to walk without assistance. A sample size of 100 was needed to achieve a statistically significant spearman correlation coefficient ( $\rho=0.5$ ) with  $\alpha = 0.05$ , and the power of 80%. This calculation was determined based on the results from other studies that had validated PA questionnaires against accelerometer-based PA monitor data [26,27].

<b>Table 5.1 Questions and Revisions for the Brief Physical Activity Assessment Tool</b>			
	<b>Initial Questions</b>	<b>Major Problems Encountered during CIs*</b>	<b>Revised Questions after CIs</b>
Instructions	Questions 1 and 2 are about physical activities you do on purpose to get more activity than you get at work, doing housework or going from place to place.	Participants either did not read the instructions or misinterpreted the instructions.	Deleted
Q1-MVPA	In the past week, how many days did you get in 30 minutes of physical activity on purpose? This includes things like sports, cardio or taking fast walks. The 30 minutes could be all at once or 10 minutes or more at a time.	The word “physical activity” was not interpreted as moderate to vigorous PA. Participants interpreted as daily activities such as cleaning houses, chasing after their kids, and walking casually.	In the past week, how many days did you exercise for at least 30 minutes? This include things like jogging, playing soccer, or exercise videos. The 30 minutes could be all at once or 10 minutes or more at a time. Do not count taking care of your kids or waking to get from place to place.
	Response set: 0-7 days	N/A	Response set: 0-7 days
Q2-strengthening PA	In the past week, how many days did you do activities on purpose to make your muscle stronger?	The phrase “activities to make your muscle stronger” was confusing. Participants mentioned “any exercise would make your muscle stronger”, including walking, stretching, or doing house chores.	In the past week, how many days did you do workouts to build and strengthen your muscles? This includes things like lifting weights or doing push-ups, sit-ups or squats.
	Response set: 0-7 days	N/A	Response set: 0-7 days
Q3-extra daily PA	In the past week, how many days did you change your daily routine on purpose to get in more activity? This includes things like walking or cleaning faster than normal and taking the stairs instead of an elevator.	The phrase “change your daily routine” were not well understood. Participants were not thinking about getting in more activity.	How often do you make small changes on purpose to be more active? This includes things like getting off the bus one stop early, doing a few minutes of exercise, or moving around instead of sitting while watching TV.

	Response set: 0-7 days	Participants had problems quantifying the days they added extra activities.	Response set: “Never”- “Always”
CIs, cognitive interviews; MVPA, moderate to vigorous physical activity; PA, physical activity.			

At the enrollment visit, each participant was asked to wear an accelerometer-based PA monitor, ActiGraph GT3X-BT (Actigraph Inc., Florida, US) on an elastic band anterior to the iliac crest for seven consecutive days. ActiGraph monitor is a small tri-axial device (4.6cm x 3.3cm x 1.5cm) that can measure body accelerations in three dimensions (vertical, horizontal, and perpendicular) at a user defined sampling rate (between 30-100Hz). It has been shown to be a valid and reliable tool for measuring adults' PA [28]. These monitors were initialized at a sample rate of 30 Hz to record activities for free-living conditions.

The participants were asked to only remove the accelerometer-based PA monitors for sleep and water-based activities (e.g. showering, swimming). In addition, on each day, the participants were required to maintain a written PA log of the time they put on and took off their monitors and notations regarding any muscle-strengthening activities they did. Written and verbal instructions, as well as a phone number to call with questions, were provided. The researcher sent daily prompt texts to better ensure compliance.

At the conclusion of the seven days, the monitors were returned, and the participants completed the BPAAT. Participants received \$15 for attending the enrollment visit, \$10/day for each day the monitor was worn  $\geq 10$  hours, and \$25 for completing BPAAT at the follow-up visit.

Data from ActiGraph monitor was used to establish concurrent validity for Q1-MVPA and Q3-extra daily PA, while a PA log was used to validate Q2-strengthening PA. (i.e., written PA log).

#### **Phase IV: Responsiveness**

To examine the responsiveness of the BPAAT for use in EFNEP, the EFNEP national data set from federal fiscal year 2018 (Oct. 2017 to Sep 2018) was obtained from the program's national program leader, per the Freedom of Act. Only those EFNEP adult participants' who had both pre- and post-test responses were included.

#### **Statistical Analysis**

All statistical analyses were performed using SAS 9.4 (SAS Institute, Inc., Cary, North Carolina). Demographic characteristics of the study samples were described using frequencies, means and standard deviations. The Shapiro-Wilk test of normality was used to assess data distributions.

#### **Test-Retest Reliability**

As the data was not normally distributed, the agreement between the first and second administrations for BPAAT were assessed by Spearman's rank correlation coefficient (SCC), intraclass correlations coefficient (ICC) using two-way mixed effects models, and Cohen's weighted Kappa ( $\kappa$ ). The SCC was the most widely used method to assess reliability, however, the ICC and  $\kappa$  have been suggested as more preferred method for assessing reliability [29]. The ICCs were interpreted using the following criteria:  $<0.50 =$

poor, 0.50 to 0.74 = moderate, 0.75 to 0.9 = good/substantial,  $\geq 0.90$  = excellent [30].

The SCC and  $\kappa$  were interpreted as follow: 0.00 to 0.20 = poor; 0.21 to 0.40 = fair; 0.41 to 0.60 = moderate/acceptable; 0.61 to 0.80 = substantial; 0.81 to 1.00 = near perfect [31].

### Concurrent Validity

Data from ActiGraph monitor were downloaded and re-integrated into 60s epochs using ActiLife software version 6.13.4 (ActiGraph, Pensacola, FL, USA). PA was estimated using both the Matthews (sedentary  $\leq 100$  counts/min, light PA, 101-759 counts/min, MVPA  $\geq 760$  counts/min) and Freedson cut-points (sedentary  $\leq 100$  counts/min, LPA, 101-1952 counts/min, MVPA  $\geq 1952$  counts/min) [32,33]. Matthews cut-points were used because they have been derived from a broad range of light to moderate lifestyle-related activities [33,34]. The Freedson cut-points [32] were also analyzed for comparability since they are widely used in survey validation research, despite being derived from only ambulatory activities (i.e., treadmill walking and jogging) [11,35-37].

Data were included for all participants who had 5 valid days' data, which has been suggested to provide reliable habitual PA estimates [38]. A valid day was defined as a minimum of 10 hours (600 minutes) wear time per day. Non-wear time, was estimated using the Choi et al. algorithm that defines non wear as any period of consecutive zero-counts for a minimum of 90 minutes, with allowance for up to 2 consecutive minutes of activity counts between 0 and 100 [39].



Because Q1-MVPA assessed the previous week's activity, its validation was conducted with the subset of participants who had 7 valid days' data. To compare ActiGraph monitor data with the equivalent Q1-MVPA recall response variable, ActiGraph monitor data were summarized into both:

- 1) the number of days when time spent in MVPA was  $\geq 30$  minutes per day,  $\geq 25$  minutes per day,  $\geq 20$  minutes per day, regardless of how long each activity bout lasted. These were examined because “accumulating 30 minutes of MVPA on most days” is a widely known public health recommendation and the 2018 PA Guidelines for Americans no longer address bout lengths [2,40,41]. Multiple thresholds (i.e., 30 minutes, 25 minutes, 20 minutes) were used to address the possibility that participants may have inadvertently included activities that were slightly below the established MVPA cut-points (e.g., warm-up and cool-down activities) and to allow for slight recall errors with regards to MVPA lengths..
- 2) the number of days when time spent in MVPA in bouts ( $\geq 10$  minutes) was  $\geq 30$  minutes per day,  $\geq 25$  minutes per day,  $\geq 20$  minutes per day). This was examined as a direct comparison since Q1 asked about MVPA performed in  $\geq 10$  minutes bouts and the 2008 PA Guidelines recommends that MVPA should be performed in bouts of 10 or more minutes to achieve health benefits [18].

For Q2-strengthening PA, survey responses were correlated with the number of days participants did strength training, according to their written PA logs.

For Q3-extra daily PA validation, with the lack of a direct comparison, survey question responses were correlated with ActiGraph monitor generated data regarding time spent in sedentary behavior, LPA, MVPA, and TPA. These analyses were conducted because it was assumed those participants who had provided a higher response on the question (measured on a 6-point Likert-type scale) had incorporated more small changes into their daily lives, which may result in lower sedentary time, higher LPA (most of these small changes would be light intensity), higher MVPA (participants who were more motivated to make small changes might also be more motivated to perform MVPA), and higher TPA. Thus, a negative correlation was expected with Q3-extra daily PA and sedentary behavior and positive correlations were expected with Q3-extra daily PA and LPA, MVPA, and TPA.

SCC was used to assess the concurrent validity between responses from Q2-strengthening PA and PA log and between data from ActiGraph monitors and responses from Q1-MVPA and Q3-extra daily PA. Again, the interpretation criteria used were: 0.00 to 0.20 = poor; 0.21 to 0.40 = fair; 0.41 to 0.60 = moderate/acceptable; 0.61 to 0.80 = substantial; 0.81 to 1.00 = near perfect [31]. Significance was set at  $p \leq 0.05$ .

These analyses were repeated separately with Hispanics and non-Hispanics. This was done because, despite the fact that the study protocol required participants to be able to read, write, and speak English, the researchers noted that multiple native Spanish speakers (who technically qualified for study participation) appeared to exhibit difficulties interpreting the questions.

### Responsiveness

The responsiveness of each question was assessed using paired t-tests from pre-EFNEP to post-EFNEP intervention. Significance was set at  $p \leq 0.05$ .

## **Results**

### **Test-retest reliability**

While 85 adults were recruited, 10 were excluded from further analysis for failure to return for the second assessment. The remaining participants (n=75) were all female. Almost 50% were non-Hispanic Black and over half had a high school degree or less (**Table 5.2**). **Table 5.3** shows the ICC values, the SCCs, and kappa between the test and retest responses. SCC ranged from 0.59 to 0.84 and  $\kappa$  ranged from 0.55-0.61, suggesting a "moderate" (0.40-0.59) to "very strong" (0.80-1.00) correlation between the test and retest responses. The ICCs for the three questions were 0.84, 0.83, 0.77, respectively, which indicated "good" reliability (ICC= 0.61 to 0.80).

**Table 5.2 Descriptive Statistics of the Participants in the Test-Retest Reliability, Concurrent Validity, and Responsiveness Testings**

Variables	Reliability Sample (N=75)	Validity Sample (N=106)	Responsiveness Sample (N=53,393)
Age, years, mean (SD)	32.7 (9.8)	37.1 (11.6)	37.2 (14.2)
Gender, n (%)			
Female, n (%)	75 (100%)	87 (82.1%)	44,568 (83.5%)
Educational Level, n (%)			
Less than High School	19 (25.3%)	22 (21.0%)	11,102 (24.8%)
High School or GED	24 (32.0%)	39 (37.1%)	17,640 (39.5%)
Some College	27 (36.0%)	28 (26.7%)	11,126 (24.9%)
College or more	5 (6.7%)	16 (15.2%)	4,836 (10.8%)
Race, n (%)			
Hispanic	20 (26.7%)	35 (33.0%)	20,157 (38.3%)
Non-Hispanic White	14 (18.7%)	45 (42.5%)	15,763 (29.9%)
Non-Hispanic Black	35 (46.7%)	17 (16.0%)	11,969 (22.7%)
Other	6 (8.0%)	9 (8.5%)	4,790 (9.1%)

**Table 5.3 Test-retest Reliability of the Brief Physical Activity Assessment Tool (N=75)**

Questions	Test, Mean (SD)	Retest, Mean (SD)	Mean Difference, Mean (SD)	SCC <sup>a</sup>	ICC <sup>b</sup>	Kappa <sup>a</sup>
Q1-MVPA	2.2 (2.1)	2.0 (2.1)	-0.1 (1.5)	0.77	0.84	0.61
Q2- strengthening PA	1.6 (2.0)	1.5 (1.9)	-0.1 (1.5)	0.84	0.83	0.60
Q3-extra daily PA	3.5 (1.5)	3.4 (1.5)	-0.1 (1.3)	0.59	0.77	0.55

MVPA, moderate to vigorous physical activity; PA, physical activity; SCC, Spearman Correlation Coefficient; ICC, Intra-class correlation coefficient

<sup>a</sup> Interpretation criteria for SCC and kappa: < 0.2 (poor); 0.21-0.40 (fair); 0.41-0.60 (moderate); 0.61-0.80 (substantial); >0.80 (near perfect)

<sup>b</sup> Interpretation criteria for ICC: <0.50 (poor); 0.5-0.74 (moderate); 0.75-0.90 (good); >0.90 (excellent)

### **Concurrent Validity**

A total of 117 subjects were recruited; 7 were removed from the analysis because they had insufficient data (< 5 days of required wear time), and 4 were removed because it was determined they did not meet the eligibility criteria of being low-income. The final sample (n= 106, **Table 5.2**) were predominantly female, non-Hispanic White (42.5%), with an age ranging from 18 to 76 years (mean=  $37.1 \pm 11.6$  years). Almost 60% did not had a high school degree or less.

### **Q1-MVPA**

For Q1-MVPA validation, of the 106 participants included, 7 participants didn't have 7 valid days of ActiGraph monitor data and were excluded from the analyses of Q1-MVPA. **Table 5.4** shows the mean number of days of MVPA estimated by Q1-MVPA and ActiGraph monitor data. The means calculated from ActiGraph monitor data varied when various MVPA thresholds and different cut-points were applied. The mean number of days were lower when they were calculated based on lower MVPA threshold (i.e., 20 minutes) and time spent in bouts of MVPA. Further, using the Matthew cut-points resulted in a higher mean number of days of MVPA than using the Freedson ones.

When the number of days were calculated based on time spent in MVPA (MVPA $\geq$ 30 mins/d,  $\geq$ 25 mins/d,  $\geq$ 20 mins/d) (**Table 5.5**), there was a positive correlation between Q1-MVPA and ActiGraph monitor-generated MVPA using the Freedson cut-points, but negatively correlated when using the Matthews cut-points. Comparing among the three MVPA thresholds, the correlation was highest with MVPA  $\geq$  30 minutes using the

Freedson cut-points ( $SCC = 0.14$ ). For Hispanics, regardless of the cut-points used, the Spearman's correlations were negative and ranged from -0.37 to -0.11.







For non-Hispanics, Q1-MVPA was positively correlated with ActiGraph monitor generated PA estimates and the correlation was fair ( $SCC = 0.22-0.24$ ) when the Freedson cut-points were used; however, again the correlations using Matthews cut-points remained negative. ( $SCC = (-0.21)$  to  $-0.02$ ).

When estimating the number of days based on time spent in MVPA in bouts of 10 minutes or more (MVPA in bouts  $\geq 30$  mins/d,  $\geq 25$  mins/d,  $\geq 20$  mins/d) (**Table 5.5**), the correlations with Q1-MVPA were all positive using both cut-point (**Table 5.5**,  $SCC = 0.11-0.21$ ). Notably, the Freedson cut-points using MVPA in bouts  $\geq 20$  minutes had the highest correlations ( $SCC = 0.20$ ). For Hispanics, regardless of the bout lengths or cut-points used, the correlations were mostly negative. The strongest correlations were found among non-Hispanics (Matthews:  $SCC = 0.27-0.33$  and Freedson:  $SCC = 0.17-0.32$ ).

#### Q2-strengthening PA

The mean response was  $1.5 \pm 2.2$  days for Q2-strengthening PA and  $1.5 \pm 2.3$  days for the PA log (**Table 5.4**). Over 70% responded “0”, “1” or “2” days on Q2-strengthening PA (76.2%) and PA log (78.3%). The correlation between Q2-strengthening PA and the self-reported PA log was nearly perfect and highly significant (**Table 5.6**,  $p < 0.0001$ ). Results were similar for Hispanics and non-Hispanics (**Table 5.6**,  $p < 0.0001$ , respectively).

#### Q3-extra daily PA

In the whole sample, regardless of the cut-points used, Q3-extra daily PA responses were negatively correlated with sedentary time (**Table 5.6** SCC = -0.06), and positive correlated with LPA, MVPA and TPA (SCC ranged from 0.06-0.31), generated from ActiGraph monitors. The highest correlations were observed when the Q3-extra daily PA was compared with MVPA (SCC = 0.31 for Freedson, 0.30 for Matthews). These patterns were consistent for both Hispanics and non-Hispanics.



### **Sensitivity to Change/Responsiveness**

Due to programmatic demands, the BPAAT was used nationally in EFNEP in federal fiscal year 2018, (i.e., prior to its validation). EFNEP adult participants (N=53,393) completed the BPAAT at both pre- and post- EFNEP. Participants were predominantly female (83.5%), with a mean age of  $37.2 \pm 14.2$  years (**Table 5.2**). The average number of days participants engaged in MVPA) and muscle-strengthening activities pre-EFNEP ( $3.2 \pm 2.2$  and  $2.4 \pm 1.9$ , respectively) significantly increased by an average of  $1.2 \pm 2.3$  days and  $0.9 \pm 2.1$  days. Participants' engagement in extra daily activities post-EFNEP intervention also increased significantly ( $p < 0.0001$ ) by  $0.8 \pm 1.6$  from their pre-EFNEP means ( $2.9 \pm 1.4$ ).

### **Discussion**

Self-reported surveys are a popular choice for determining the effectiveness of national nutrition education programs, while imposing a low response burden. It is important to ensure that these tools undergo rigorous reliability and validity testing and are suitable for the populations they serve. The process used in the development of BPAAT was robust. First, the process met the development criteria set forth by both the Edinburgh Framework and the COSMIN checklists [16,17]. Further, content and face validity testing, steps which are often overlooked, were included to ensure BPAAT's understandability for low-income populations with limited literacy levels [42]. Additionally, all findings were widely generalizable for use with varied U.S. low-income populations since study participants were recruited from different regions of the U.S. for

reliability and validity testing and a national dataset was used for assessing responsiveness. Most importantly, BPAAT's reliability and validity results were within the ranges found regarding other established PA questionnaires [6,43,44].

With only three questions to assess MVPA, muscle-strengthening PA, and extra daily PA, this brief tool was developed to provide a crude estimate of low-income adults' PA levels and was not intended to provide comprehensive estimates of PA performed in different domains, intensities, and frequencies. Thus, its reliability and validity were expected to be weaker than more detailed instruments designed for more specific purposes. Yet, the results for the test-retest reliability revealed that BPAAT (ICC 0.77-0.84;  $\kappa$  = 0.55-0.61) are comparable with those reported from a systematic review that included 37 adult PA questionnaires (median ICC = 0.77-0.79;  $\kappa$  = 0.65-0.66) [45].

This BPAAT exhibited the highest correlation between PA log responses and Q2-strengthening PA (SCC = 0.87), with over 80% participants reflected the same information in the PA log that they provided in their responses to Q2-strengthening PA identical responses to the question that had been recorded in the PA log (data not shown). The high degree of validity evidenced may have resulted from comparing two self-reported measures against one another, or because most participants (>70%) reported having done muscle-strengthening PA for 2 days or less.

The authors identified only a few PA questionnaires that have specifically addressed muscle-strengthening PA (i.e., the BRFSS, the National Health Interview Survey, and the

European Health Interview Survey [12-14]. Validation studies were only available for the questions from the BRFSS and the European Health Interview Survey [13,46]. The BRFSS's concurrent validity had been tested against a detailed PA log of 43 moderate- or vigorous-intensity activities using kappa, which ranged from 0.40-0.52) [13], while the European Health Interview Survey question had been tested against grip strength, as measured by a hand dynamometer using SCC ( $\rho=0.10$ ) [46]. Since different validation methods were used, it is difficult to compare these results.

The low correlations found with Q1-MVPA and the MVPA calculated from ActiGraph monitor data using the Freedson and Matthews cut-points were expected based on previous research [44]. There might be several other reasons that explain the low correlations. First, there are inherent differences between PA measurements obtained by objective measures (e.g., accelerometer-based PA monitors ) and self-reported surveys (e.g., the BPAAT). Although accelerometer-based PA monitors are typically used to validate PA questionnaires, they only capture absolute movements [47,48]. Self-reported surveys, on the other hand, measure “behaviors.” For example, if a person did heavy yardwork for 30 minutes, which included several short breaks, an accelerometer-based PA monitor would detect only 20 minutes of MVPA, whereas the person would likely report having done 30 minutes of activities because they included several short breaks while doing yardwork.. Secondly, in this study the Q1-MVPA assessment response options were ordinal and ranged from 0 to 7. This likely resulted in far more limited variability than would have been evidenced if MVPA had been assessed in minutes or in metabolic equivalents (METs)-minutes per day. [8,9,49,50] Since correlations are higher

when there is more variability among the observations[51], it is not surprising the correlations were lower than the validity results reported from other questionnaires, such as the IPAQ and the GPAQ, which convert results into minutes and METs spent in MVPA. Lastly, the question was developed before the 2018 PA Guidelines for Americans and assesses PA performed for at least 30 minutes a day in bouts  $\geq 10$  minutes. The recommendation “to accumulate 30 min of PA in bouts of 10 minutes or more on most days” was based on previous epidemiological associations between self-reported PA and health outcomes [18]. New evidence, reflected in the 2018 U.S. PA Guidelines, suggests that PA performed in bout of less than 10 minutes also provides health benefits [2]. The validity of this question may have differed if the “the 30 minutes could be all at once or 10 minutes or more at a time” phrase had been removed.

As previously noted, the aforementioned validity results varied depending on the choice of cut-points for a given model of accelerometer-based PA monitors (in this case, the ActiGraph). This was anticipated given that several studies have shown the choice of cut-points has marked effects on accelerometer-generated PA estimates [34,35,52,53]. The Freedson cut-points have been most widely used but have shown to underestimate minutes spent doing moderate PA by 60% over a 6-hr period [32,53]. Matthews cut-points have shown slightly better estimates, but still tend to underestimate minutes spent doing moderate PA by 33.4% and total MVPA by 26.3% during the same period [33,52]. In this study, the determination of which cut-points might have under- or over-estimated the true activity levels was not possible since indirect calorimetry was not used to accurately assess the time spent in sedentary behavior, LPA, or MVPA. However, the

results suggested the mean number of days calculated using the Matthews cut-points were higher than those calculated using the Freedson cut-points (**Table 5.4**), regardless of the MVPA thresholds used and whether the MVPA was in bouts or not. This is not surprising since the Matthews cut-points use a much lower cut-off value to estimate MVPA (760 counts/mins) than Freedson (1952 counts/mins). These high mean number of days using Matthews cut-points is likely contributing to those negative correlations when compared with Q1-MVPA. Although there is no consensus regarding which cut-points should be used, researchers should keep in mind these differences. Also, most recent research suggested cut-points should have limited use because of the discrepancies.

To the authors' knowledge, the concept of "small changes to be more active" has not been previously assessed. Yet, this concept is both taught in EFNEP and is addressed in the U.S. PA guideline recommendations that suggest "Adults should move more and sit less throughout the day" and that "Some physical activity is better than none" [2]. It has been found that low-income adults face more challenges in conducting leisure PA, therefore the inclusion of more intentional activity integrated into their daily routines may be more feasibly accomplished in considering their lifestyles [54]. Notably, it was a major challenge to find an appropriate way to validate this concept, which was assessed by Q3-extra daily PA. Ideally, this question would be validated only through the assessment of participant decision making processes regarding the integration of small changes to be more active throughout the day. This could be done using a qualitative method referred to as the "think-aloud" research method, an approach whereby participants speak what is in their mind as they complete a task, in this case making



decisions about their movements throughout the day. This method has been validated [55], but would have been impractical within the scope of this research. Alternatively, this study compared Q3-extra daily PA to sedentary behavior, LPA, MVPA, and TPA, as assessed by the accelerometer-based PA monitor results. Q3-extra daily PA was negatively correlated with sedentary behavior, which suggests that those whose responses were higher on the Likert scale (i.e., usually or always) might indeed move more and have less sedentary time, and vice versa. Consistent with these results, Q3-extra daily PA was positively correlations with LPA and TPA. Interestingly, there was also a positive correlation between Q3-extra daily PA with total MVPA. This might be because people who were incorporating more small changes were also motivated to do more MVPA.

As previously noted, the BPAAT's responsiveness was assessed using a national sample of low-income EFNEP adult participants. The methodology of assessing responsiveness tends to be less well understood. Previous studies have compared the changes from surveys to the changes in accelerometer-based PA monitors post-intervention using Spearman correlation coefficient and found a low to moderate correlation between the two, yet the sample sizes in these studies are small [50,56]. In this study, we were unable to use an objective measure, yet a pre/post comparison of a large sample detected significant changes in the expected direction after EFNEP intervention.

The study also has other limitations that should be considered when interpreting its findings. First, as for any self-reported questionnaire, responses are subject to recall bias and social desirability that may lead to the overestimation or underestimation of PA

levels. Another potential limitation is that some data were collected during summer and participants were required to remove the accelerometer-based PA monitors for water-related activities. This may have resulted in the loss of PA data. Another concern is the failure to have excluded non-naïve speakers, as the negative correlations were found for Hispanics. Lastly, the responsiveness of this tool was assessed through a secondary data analysis from the EFNEP national data sets, without an objective measure comparison or a control group. However, doing so was beyond the scope of and resources available to this study.

## **Conclusions**

The BPAAT captures the three major constructs, MVPA, muscle-strengthening PA, and extra daily PA that are recommended in the Physical Activity Guidelines for Americans [2], and the guidelines for other countries [57-59]. It is the first PA assessment to have been validated in a nationally representative sample of low-income adults and the first to measure the intentional incorporation of small changes to be more active. It provides a practical method to assess PA for programs with limited time and resources. Further, this research reveals a need for further consideration regarding how the incorporation of small changes in total daily PA can be assessed throughout the day, such that the impact of interventions targeting these small behavior changes can be assessed.

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### **Availability of data and materials**

The datasets used and/or analyzed for the reliability and validity are not publicly available. However, upon formal request, the authors are willing to seek permission from Rutgers Institutional Review Board to share de-identified data. The national EFNEP datasets can be requested per Freedom of Act from the national EFNEP office.

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### **Ethical approval and consent to participant**

Ethics approvals were obtained from Institutional Review Board from Rutgers, the State University of New Jersey (#E16-321, #E16-420, #E17-667, # Pro2018002663). Informed consent was obtained in writing forms from all participants before data collection.

### **Consent for publication**

Not applicable (this manuscript does not contain any individual details, images or videos.

Only aggregate data were used in this publication).

**Competing interests**

The authors declare that they have no competing interest.

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## **Chapter 6: Conclusions and Implications**

Because increased PA is associated with a lower risk for chronic diseases, it has been added in the DGAs and identified as one of EFNEP's core educational areas. With this being a relatively new core area for EFNEP, no PA questions had been designed and rigorously tested for reliability and validity to be used to evaluate PA behaviors among low-income adult participants. Objective measures (accelerometer-based PA monitors) are considered valid and reliable in assessing PA levels.<sup>108,113</sup> However, their use is too time-consuming, costly, and difficult to administer in programs with limited time and resources like EFNEP.<sup>108,113</sup> Instead, self-report questionnaires have been determined to be the most practical and cost-effective approach for programs such as EFNEP.<sup>109,113,115</sup> Response burden and other programmatic constraints require that a small number of simple, comprehensible questions that are sensitive enough to detect behavior changes be employed. These considerations limit the use of validated and comprehensive PA questionnaires that were deemed too long and burdensome for national use with low-income populations.<sup>103,162,225</sup>

The objective of this research was to develop a PA assessment tool that was reliable, valid, and sensitive to measure physical activity behaviors among EFNEP adult participants. The 3 questions included in the BPAAT reflected the key recommendations from the Physical Activity Guidelines for American,<sup>14</sup> as well as the PA content taught in EFNEP curricula. Results pertaining to the BPAAT's psychometric properties (i.e., test-retest reliability, concurrent validity, and sensitivity to change) were described in Chapter

5. Findings confirmed the BPAAT had acceptable reliability and limited validity. The concurrent validity was high when the muscle-strengthening question was tested against a self-reported PA log but were poor to fair when the MVPA question and extra daily PA question were tested against accelerometer-based PA monitors. Reasons for these low correlations observed were discussed in detail in Chapter 5. This research also found the BPAAT is sensitivity to intervention change, which is a psychometric property often overlooked in survey development.

A relative novelty of this research is the assessment of the concept “the incorporation of small changes in daily life to be more active.” No question has been developed to measure this concept despite it is both recommended in the Physical Activity Guidelines for Americans and widely adopted by public health promotion, disease prevention, and nutrition education programs such as EFNEP.<sup>52,206,226,227</sup> Evaluation of this concept might be of particular interest for EFNEP and other programs that target low-income women. It is widely known that low-income women might not accumulate enough PA in their leisure time.<sup>89,173,228</sup> Their PA was mostly achieved through doing housework, walking for transportation, or taking care of children.<sup>89,173,228</sup> Meeting the needs of family and fulfilling their roles as mothers often comes first before self-pursuits like physical activity.<sup>229</sup> Therefore, the inclusion of more intentional activity integrated into their daily routines such as walking instead of driving, dancing with their kids while doing household chores, and moving around while doing laundry, may be more feasible to accomplish in consideration of their busy lifestyles.

There were many challenges involved with the development of the BPAAT for EFNEP evaluation. One challenge was the need to consistent balance the needs of EFNEP program administrative requirements and the BPAAT's comprehensiveness. It has been suggested that a comprehensive PA questionnaire should address all 4 domains (i.e., leisure time PA, household PA, transportation PA, occupational PA), as well as the frequencies and duration of the PA performed.<sup>110,111</sup> However, it is unrealistic for EFNEP, since PA is just one of the five educational areas that needs to be measured. Further, EFNEP needs a limited number of questions to reduce response burden since it is working with populations with low literacy levels.

Another challenge was a lack of funding/resources to support the development of the BPAAT as part of the EFNEP's 20-item Food and Physical Activity Questionnaire. While EFNEP needs a rigorously tested evaluation tool to measure its effectiveness, EFNEP program funds cannot be used for research purposes. For different phrases of the BPAAT's development, the research team had to rely largely on states who volunteered to participate; and to certain extent, this limited the generalizability. This lack of funding was also evident for other programs that seek to develop valid and reliable instrument for program evaluation purposes. For example, the Supplemental Nutrition Assistance Program-Education (SNAP-Ed) is required to use evidence-based programming which includes a better ability to evaluate programs using valid and reliable evaluation tools. However, there is no funding available to develop such tools that can be used to accurately assess SNAP-Ed participants' behavior changes, possibly due to the lengthy process involved in survey development. This lack of funding/resources resulted in

absence of full-time research personnel, difficulties to recruit potential study participants, and inability to conduct more rigorously designed studies (i.e., randomized clinical trials). Funding agencies should be aware of these constraints and provide opportunities to support the development of valid and reliable tools for program evaluation purposes.

Finding appropriate methodologies to establishing the concurrent validity of BPAAT for all three questions were also very challenging. Ideally, to validate the questions regarding the number of days spent in MVPA or muscle-strengthening PA, direct observations would be the best option. However, this would be impractical and too costly in the free-living population. In this research, accelerometer-based PA monitor was chosen to validate the MVPA question in the BPAAT due to its extensive usage as a survey validation method in the literature, however, it is not without concerns.<sup>230</sup> As discussed in Chapter 5, it is important for researchers to consider the distinction between accelerometer-based PA monitors and self-reported surveys. PA estimates derived from accelerometer-based PA monitors and self-reported surveys are not conceptually equivalent, even when they are expressed in the same outcome metrics.<sup>231</sup> Further, few efforts have been made to develop questions about muscle-strengthening PA and limited information was available for the validation of such questions. The self-reported PA log was used in this research to validate the muscle-strengthening questions; however, it is prone to social desirability and recall bias that are universally prevalent among self-reported instruments. Direct observations might be considered for further validation of this question.

The validation of the question about incorporation of small changes to be more active was even more complicated and warrants further considerations. The complication of this issue originated from the difficulty in assessing people's decision-making process (i.e., take the stairs instead of elevators), not the actual behaviors. As discussed in Chapter 5, the qualitative method referred to as the "think-aloud", where participants speak what is in their mind as they complete a task, could potentially be used as a validation method. Further research needs to study the feasibility of this approach in survey validation research.

There are two major implications that researchers should be aware of while developing a valid and reliable assessment tool for program evaluation. First, researchers should be mindful that it is crucial to ensure the questions are understandable by the target population, especially low-income populations with limited literacy levels.<sup>110</sup> For instance, it has been suggested that using PA terms that are not well understood by the target population could lead to misinterpreted instructions, difficulties in quantifying the frequency, duration, and intensity of PA, which in turn may lead to over- or under-estimation on the survey.<sup>110</sup> A widely-used PA questionnaire, the IPAQ has shown limited face validity and caused misreporting due to confusion about or misinterpretation of the questions.<sup>232-234</sup> Results from the cognitive interviews in Chapter 4 suggested low-income participants indeed had different understanding for many PA terms and concepts commonly used in the scientific literature. These findings reconfirm the need to establish face validity in developing new PA assessment tools.

Second, sensitivity to change/responsiveness is an important psychometric property that should not be overlooked, especially when the tool is developed for program evaluation or intervention purposes.<sup>117,235</sup> Though self-reported questionnaires are widely used to evaluate interventions, they are rarely validated in their ability to detect changes.<sup>236</sup> Some widely used PA questionnaires, such as IPAQ, are developed for surveillance purposes and might not be appropriate to be used for interventions since they might not be sensitivity enough to capture the changes resulted from a short-term intervention or programs like EFNEP that include PA as part of the intervention. There is no consensus regarding the best way to assess “sensitivity to change”. This study simply compared the mean differences in the BPAAT’s responses before and after the EFNEP and found statistically significant result using paired t-test. Other approaches have also been used in the literature, by comparing changes between an experiment and a control group, or by correlating changes in surveys with a criterion/”gold standard”.<sup>236-241</sup> The variabilities in determining questionnaire’s responsiveness limits the comparability among studies, different methods for measuring sensitivity to change should be reviewed and recommendations should be made regarding the most robust way to do so.

In conclusion, the synthesis of this research resulted in a rigorously tested BPAAT that both researchers and program administrators can use to evaluate EFNEP adult participants’ PA behavior changes. Other nutrition education programs or interventions may adopt this validated instrument to evaluate their programs. Further, the work in this dissertation have implications that extend beyond EFNEP, as other nutrition education programs serving low-income adults may adopt the methods used to develop their own

validated evaluation questionnaire. Future research directions include testing the BPAAT in different populations, identifying an appropriate methodology to validate the question related to extra daily PA, and using a more robust study design to assess sensitivity to change.





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## Appendix I EFNEP 10-item Behavior Checklist

### EFNEP Eating Right Survey

Name: _____
Date: _____



This is a survey about ways you plan and fix foods for your family. As you read each question, think about the recent past. This is not a test! There are not any wrong answers.

For these questions, think about how you usually do things. Please put a check in the box that best answers each question.	Not Applicable  0	Do Not Do  1	Seldom  2	Sometimes  3	Most of the Time  4	Almost Always  5
1. How often do you plan meals ahead of time?						
2. How often do you compare prices before you buy food?						
3. How often do you run out of food before the end of the month?						
4. How often do you shop with a grocery list?						
5. This question is about meat and dairy foods. How often do you let these foods sit out for more than two hours?						
6. How often do you thaw frozen foods at room temperature?						
7. When deciding what to feed your family, how often do you think about healthy food choices?						
8. How often have you prepared foods without adding salt?						
9. How often do you use the "Nutrition Facts" on the food label to make food choices?						
10. How often do your children eat something in the morning within two hours of waking up?						

<b>For Office Use Only:</b>	
Extension Staff Member: _____	Check Type of Recall: <input type="checkbox"/> Entry
Client ID #: _____	<input type="checkbox"/> Exit

## **Appendix II The Stanford Seven-Day Physical Activity Recall**

### APPENDIX 1

#### PHYSICAL ACTIVITY RECALL ITEMS

Now we would like to know about your physical activity during the past 7 days. But first, let me ask you about your sleep habits.

1. On the average, how many hours did you sleep each night during the last five weekday nights (Sunday–Thursday)? \_\_\_\_hours
2. On the average, how many hours did you sleep each night last Friday and Saturday nights? \_\_\_\_hours

Now I am going to ask you about your physical activity during the past 7 days, that is, the last 5 weekdays, and last weekend, Saturday and Sunday. We are not going to talk about light activities such as slow walking, light housework, or un strenuous sports such as bowling, archery, or softball. Please look at this list which shows some examples of what we consider moderate, hard, and very hard activities. (Interviewer: hand subject card No. 9 and allow time for the subject to read it over.) People engage in many other types of activities, and if you are not sure where one of your activities fits, please ask me about it.

3. First, let's consider moderate activities. What activities did you do and how many total hours did you spend during the last 5 weekdays doing these moderate activities or others like them? Please tell me to the nearest half hour. \_\_\_\_hours

4. Last Saturday and Sunday, how many hours did you spend on moderate activities and what did you do? (Probe: Can you think of any other sports, job, or household activities that would fit into this category?) \_\_\_\_hours

5. Now, let's look at hard activities. What activities did you do and how many total hours did you spend during the last 5 weekdays doing these hard activities or others like them? Please tell me to the nearest half hour. \_\_\_\_hours

6. Last Saturday and Sunday, how many hours did you spend on hard activities and what did you do? (Probe: Can you think of any other sports, job, or household activities that would fit into this category?) \_\_\_\_hours

7. Now, let's look at very hard activities. What activities did you do and how many total hours did you spend during the last 5 weekdays doing these very hard activities or others like them? Please tell me to the nearest half hour. \_\_\_\_hours

8. Last Saturday and Sunday, how many hours did you spend on very hard activities and what did you do? (Probe: Can you think of any other sports, job, or household activities that would fit into this category?) \_\_\_\_hours

9. Compared with your physical activity over the past 3 months, was last week's physical activity more, less, or about the same?

- 1. More
- 2. Less
- 3. About the same

Interviewer: Please list below any activities reported by the subject which you don't know how to classify. Flag this record for review and completion.



Activity (brief description)	Hours: workday	Hours: weekend day
_____	_____	_____
_____	_____	_____
_____	_____	_____

#### EXAMPLES OF ACTIVITIES IN EACH CATEGORY

##### *Moderate activity*

Occupational tasks: 1) delivering mail or patrolling on foot; 2) house painting; and 3) truck driving (making deliveries, lifting and carrying light objects).

Household activities: 1) raking the lawn; 2) sweeping and mopping; 3) mowing the lawn with a power mower; and 4) cleaning windows.

Sports activities (actual playing time): 1) volleyball; 2) Ping-Pong; 3) brisk walking for pleasure or to work (4.83 km/hour (3 miles/hour) or 20 minutes/km (mile)); 4) golf, walking and pulling or carrying clubs; and 5) calisthenic exercises.

##### *Hard activity*

Occupational tasks: 1) heavy carpentry; and 2) construction work, doing physical labor.

Household tasks: 1) scrubbing floors.

Sports activities (actual playing time): 1) tennis doubles; and 2) disco, square, or folk dancing.

##### *Very hard activity*

Occupational tasks: 1) very hard physical labor, digging or chopping with heavy tools; and 2) carrying heavy loads such as bricks or lumber.

Sports activities (actual playing time): 1) jogging or swimming; 2) singles tennis; 3) racquetball; and 4) soccer.



## Appendix III The Godin Leisure Time Exercise Questionnaire

### APPENDIX

#### LEISURE TIME EXERCISE QUESTIONNAIRE

1. Considering a 7-day period (a week), how many times on the average do you do the following kinds of exercise for more than 15 minutes during your free time (write in each circle the appropriate number).

TIMES PER  
WEEK

- a) **STRENUOUS EXERCISE**  
(HEART BEATS RAPIDLY)

(i.e. running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling)

- b) **MODERATE EXERCISE**  
(NOT EXHAUSTING)

(i.e. fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing)

- c) **MILD EXERCISE**  
(MINIMAL EFFORT)

(i.e. yoga, archery, fishing from river bank, bowling, horseshoes, golf, snowmobiling, easy walking)

2. Considering a 7-day period (a week), during your leisure-time, how often do you engage in any regular activity long enough to work up a sweat (heart beats rapidly)?

OFTEN

SOMETIMES

NEVER/RARELY

1. ☐

2. ☐

3. ☐

## Appendix IV The National Health Interview Survey (1991)

Part E - PHYSICAL ACTIVITY AND FITNESS		RT 95 3-6
These next questions are about physical exercises.		
<b>ITEM E1</b>	Mark from observation or previous information.  <b>HAND CALENDAR.</b> <b>1a.</b> In the past 2 weeks (outlined on that calendar), beginning Monday (date) and ending this past Sunday (date), have you done any exercises, sports, or physically active hobbies?  <b>1b.</b> What were they?  <i>Record in 2a on page 57, THEN 1c.</i>  <b>c.</b> Anything else?	<div style="text-align: right; font-size: x-small;">5</div> 1 <input type="checkbox"/> SP is physically handicapped (Describe in notes, THEN 1) 8 <input type="checkbox"/> Other (2 on page 57)  <div style="text-align: right; font-size: x-small;">8</div> 1 <input type="checkbox"/> Yes (1b) 2 <input type="checkbox"/> No 9 <input type="checkbox"/> DK } (3 on page 58)  <div style="text-align: right; font-size: x-small;">9</div> <input type="checkbox"/> Yes (Reask 1b and c) <input type="checkbox"/> No (Mark "No" for all remaining activities in 2a, then go to 2b)
Notes		

Part E - PHYSICAL ACTIVITY AND FITNESS - Continued		51
<b>3.</b>	<b>About how long has it been since your last medical check-up?</b>  <i>Mark (X) only one.</i>	1 <input type="checkbox"/> Less than 1 year (4) 2 <input type="checkbox"/> 1 year, less than 2 years 3 <input type="checkbox"/> 2 years, less than 3 years 4 <input type="checkbox"/> 3 years, less than 4 years 5 <input type="checkbox"/> 4+ years 6 <input type="checkbox"/> Never had a check-up 9 <input type="checkbox"/> DK (4) <div style="text-align: right; font-size: x-small;">(END interview)</div>
<b>4.</b>	<b>During your last check-up, did the doctor recommend that you BEGIN or CONTINUE to do any type of exercise or physical activity?</b>  <i>If "Yes", ask: Was that begin or continue?</i>	<div style="text-align: right; font-size: x-small;">52</div> 1 <input type="checkbox"/> Yes, to BEGIN 2 <input type="checkbox"/> Yes, to CONTINUE 3 <input type="checkbox"/> Yes, BOTH 4 <input type="checkbox"/> No 9 <input type="checkbox"/> DK <div style="text-align: right; font-size: x-small;">(END interview)</div>
Notes		

Part E - PHYSICAL ACTIVITY AND FITNESS - Continued									
NOTE: ASK ALL OF 2a BEFORE GOING TO 2b-d.				NOTE: ASK 2b-d FOR EACH ACTIVITY MARKED "YES" IN 2a.					
HAND CALENDAR.				b. How many times in the past 2 weeks did you [go/do] (activity in 2a)?		c. On the average, about how many minutes did you actually spend (doing) (activity in 2a) each time?		d. (What usually happened to your heart rate or breathing when you [did/went] (activity in 2a)? Did you have a small, moderate, or large increase, or no increase at all in your heart rate or breathing?	
2a. In the past 2 weeks (outlined on that calendar), beginning Monday, (date), and ending this past Sunday, (date), have YOU done any of the following exercises, sports, or physically active hobbies —									
YES NO 7				8-9		10-12		13	
(1) Walking for exercise? <input type="checkbox"/> 1 <input type="checkbox"/> 2				(1) _____ Times		_____ Minutes		1 <input type="checkbox"/> Small 3 <input type="checkbox"/> Large 9 <input type="checkbox"/> DK 2 <input type="checkbox"/> Moderate 0 <input type="checkbox"/> No inc.	
14				15-16		17-19		20	
(2) Gardening or yard work? <input type="checkbox"/> 1 <input type="checkbox"/> 2				(2) _____ Times		_____ Minutes		1 <input type="checkbox"/> Small 3 <input type="checkbox"/> Large 9 <input type="checkbox"/> DK 2 <input type="checkbox"/> Moderate 0 <input type="checkbox"/> No inc.	
21				22-23		24-26			
(3) Stretching exercises? <input type="checkbox"/> 1 <input type="checkbox"/> 2				(3) _____ Times		_____ Minutes (Next activity)		1 <input type="checkbox"/> Small 3 <input type="checkbox"/> Large 9 <input type="checkbox"/> DK 2 <input type="checkbox"/> Moderate 0 <input type="checkbox"/> No inc.	
27				28-29		30-32		33	
(4) Weightlifting or other exercises to increase muscle strength? <input type="checkbox"/> 1 <input type="checkbox"/> 2				(4) _____ Times		_____ Minutes		1 <input type="checkbox"/> Small 3 <input type="checkbox"/> Large 9 <input type="checkbox"/> DK 2 <input type="checkbox"/> Moderate 0 <input type="checkbox"/> No inc.	
34				35-36		37-39		40	
(5) Jogging or running? <input type="checkbox"/> 1 <input type="checkbox"/> 2				(5) _____ Times		_____ Minutes		1 <input type="checkbox"/> Small 3 <input type="checkbox"/> Large 9 <input type="checkbox"/> DK 2 <input type="checkbox"/> Moderate 0 <input type="checkbox"/> No inc.	
41				42-43		44-46		47	
(6) Aerobics or aerobic dancing? <input type="checkbox"/> 1 <input type="checkbox"/> 2				(6) _____ Times		_____ Minutes		1 <input type="checkbox"/> Small 3 <input type="checkbox"/> Large 9 <input type="checkbox"/> DK 2 <input type="checkbox"/> Moderate 0 <input type="checkbox"/> No inc.	
48				49-50		51-53		54	
(7) Riding a bicycle or exercise bike? <input type="checkbox"/> 1 <input type="checkbox"/> 2				(7) _____ Times		_____ Minutes		1 <input type="checkbox"/> Small 3 <input type="checkbox"/> Large 9 <input type="checkbox"/> DK 2 <input type="checkbox"/> Moderate 0 <input type="checkbox"/> No inc.	
55				56-57		58-60		61	
(8) Stair climbing for exercise? <input type="checkbox"/> 1 <input type="checkbox"/> 2				(8) _____ Times		_____ Minutes		1 <input type="checkbox"/> Small 3 <input type="checkbox"/> Large 9 <input type="checkbox"/> DK 2 <input type="checkbox"/> Moderate 0 <input type="checkbox"/> No inc.	
62				63-64		65-67		68	
(9) Swimming for exercise? <input type="checkbox"/> 1 <input type="checkbox"/> 2				(9) _____ Times		_____ Minutes		1 <input type="checkbox"/> Small 3 <input type="checkbox"/> Large 9 <input type="checkbox"/> DK 2 <input type="checkbox"/> Moderate 0 <input type="checkbox"/> No inc.	
69				70-71		72-74		75	
(10) Playing tennis? <input type="checkbox"/> 1 <input type="checkbox"/> 2				(10) _____ Times		_____ Minutes		1 <input type="checkbox"/> Small 3 <input type="checkbox"/> Large 9 <input type="checkbox"/> DK 2 <input type="checkbox"/> Moderate 0 <input type="checkbox"/> No inc.	
76				77-78					
(11) Playing golf? <input type="checkbox"/> 1 <input type="checkbox"/> 2				(11) _____ Times (Next activity)					
79				80-81					
(12) Bowling? <input type="checkbox"/> 1 <input type="checkbox"/> 2				(12) _____ Times (Next activity)					
82				83-84		85-87		88	
(13) Playing baseball or softball? <input type="checkbox"/> 1 <input type="checkbox"/> 2				(13) _____ Times		_____ Minutes		1 <input type="checkbox"/> Small 3 <input type="checkbox"/> Large 9 <input type="checkbox"/> DK 2 <input type="checkbox"/> Moderate 0 <input type="checkbox"/> No inc.	
89				90-91		92-94		95	
(14) Playing handball, racquetball, or squash? <input type="checkbox"/> 1 <input type="checkbox"/> 2				(14) _____ Times		_____ Minutes		1 <input type="checkbox"/> Small 3 <input type="checkbox"/> Large 9 <input type="checkbox"/> DK 2 <input type="checkbox"/> Moderate 0 <input type="checkbox"/> No inc.	
96				97-98					
(15) Skiing? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No (16)				(a) _____ Times (Next activity)					
(a) Downhill? <input type="checkbox"/> 1 <input type="checkbox"/> 2				(a) _____ Times		_____ Minutes		1 <input type="checkbox"/> Small 3 <input type="checkbox"/> Large 9 <input type="checkbox"/> DK 2 <input type="checkbox"/> Moderate 0 <input type="checkbox"/> No inc.	
99				100-101		102-104		105	
(b) Cross-country? <input type="checkbox"/> 1 <input type="checkbox"/> 2				(b) _____ Times		_____ Minutes		1 <input type="checkbox"/> Small 3 <input type="checkbox"/> Large 9 <input type="checkbox"/> DK 2 <input type="checkbox"/> Moderate 0 <input type="checkbox"/> No inc.	
106				107-108					
(c) Water? <input type="checkbox"/> 1 <input type="checkbox"/> 2				(c) _____ Times (Next activity)					
RT 96				6-7		8-10		11	
(16) Playing basketball? <input type="checkbox"/> 1 <input type="checkbox"/> 2				(16) _____ Times		_____ Minutes		1 <input type="checkbox"/> Small 3 <input type="checkbox"/> Large 9 <input type="checkbox"/> DK 2 <input type="checkbox"/> Moderate 0 <input type="checkbox"/> No inc.	
12				13-14		15-17		18	
(17) Playing volleyball? <input type="checkbox"/> 1 <input type="checkbox"/> 2				(17) _____ Times		_____ Minutes		1 <input type="checkbox"/> Small 3 <input type="checkbox"/> Large 9 <input type="checkbox"/> DK 2 <input type="checkbox"/> Moderate 0 <input type="checkbox"/> No inc.	
19				20-21		22-24		25	
(18) Playing soccer? <input type="checkbox"/> 1 <input type="checkbox"/> 2				(18) _____ Times		_____ Minutes		1 <input type="checkbox"/> Small 3 <input type="checkbox"/> Large 9 <input type="checkbox"/> DK 2 <input type="checkbox"/> Moderate 0 <input type="checkbox"/> No inc.	
26				27-28		29-31		32	
(19) Playing football? <input type="checkbox"/> 1 <input type="checkbox"/> 2				(19) _____ Times		_____ Minutes		1 <input type="checkbox"/> Small 3 <input type="checkbox"/> Large 9 <input type="checkbox"/> DK 2 <input type="checkbox"/> Moderate 0 <input type="checkbox"/> No inc.	
(20) Have you done any (other) exercises, sports, or physically active hobbies in the past 2 weeks?				(20a) _____ Times		_____ Minutes		1 <input type="checkbox"/> Small 3 <input type="checkbox"/> Large 9 <input type="checkbox"/> DK 2 <input type="checkbox"/> Moderate 0 <input type="checkbox"/> No inc.	
<input type="checkbox"/> Yes - What were they? <input type="checkbox"/> No				_____ Times		_____ Minutes		1 <input type="checkbox"/> Small 3 <input type="checkbox"/> Large 9 <input type="checkbox"/> DK 2 <input type="checkbox"/> Moderate 0 <input type="checkbox"/> No inc.	
Anything else?				_____ Times		_____ Minutes		1 <input type="checkbox"/> Small 3 <input type="checkbox"/> Large 9 <input type="checkbox"/> DK 2 <input type="checkbox"/> Moderate 0 <input type="checkbox"/> No inc.	
If activity listed above, mark "Yes" for it; otherwise, specify <input checked="" type="checkbox"/>				34-35		36-37		38-40	
(a) _____				42		45-46		47-49	
(b) _____				43-44					

## **Appendix V The International Physical Activity Questionnaire- Short Form in English**

### **INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE (August 2002)**

#### **SHORT LAST 7 DAYS SELF-ADMINISTERED FORMAT**

##### **FOR USE WITH YOUNG AND MIDDLE-AGED ADULTS (15-69 years)**

The International Physical Activity Questionnaires (IPAQ) comprises a set of 4 questionnaires. Long (5 activity domains asked independently) and short (4 generic items) versions for use by either telephone or self-administered methods are available. The purpose of the questionnaires is to provide common instruments that can be used to obtain internationally comparable data on health-related physical activity.

##### ***Background on IPAQ***

The development of an international measure for physical activity commenced in Geneva in 1998 and was followed by extensive reliability and validity testing undertaken across 12 countries (14 sites) during 2000. The final results suggest that these measures have acceptable measurement properties for use in many settings and in different languages, and are suitable for national population-based prevalence studies of participation in physical activity.

##### ***Using IPAQ***

Use of the IPAQ instruments for monitoring and research purposes is encouraged. It is recommended that no changes be made to the order or wording of the questions as this will affect the psychometric properties of the instruments.

##### ***Translation from English and Cultural Adaptation***

Translation from English is supported to facilitate worldwide use of IPAQ. Information on the availability of IPAQ in different languages can be obtained at [www.ipaq.ki.se](http://www.ipaq.ki.se). If a new translation is undertaken we highly recommend using the prescribed back translation methods available on the IPAQ website. If possible please consider making your translated version of IPAQ available to others by contributing it to the IPAQ website. Further details on translation and cultural adaptation can be downloaded from the website.

##### ***Further Developments of IPAQ***

International collaboration on IPAQ is on-going and an *International Physical Activity Prevalence Study* is in progress. For further information see the IPAQ website.

##### ***More Information***

More detailed information on the IPAQ process and the research methods used in the development of IPAQ instruments is available at [www.ipaq.ki.se](http://www.ipaq.ki.se) and Booth, M.L. (2000). *Assessment of Physical Activity: An International Perspective*. Research Quarterly for Exercise and Sport, 71 (2): s114-20. Other scientific publications and presentations on the use of IPAQ are summarized on the website.

## INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?  
 \_\_\_\_\_ **days per week**  
☐ No vigorous physical activities → **Skip to question 3**
2. How much time did you usually spend doing **vigorous** physical activities on one of those days?  
 \_\_\_\_\_ **hours per day**  
 \_\_\_\_\_ **minutes per day**  
☐ Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.  
 \_\_\_\_\_ **days per week**  
☐ No moderate physical activities → **Skip to question 5**

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

\_\_\_\_\_ **hours per day**

\_\_\_\_\_ **minutes per day**

☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

\_\_\_\_\_ **days per week**

☐ No walking → **Skip to question 7**

6. How much time did you usually spend **walking** on one of those days?

\_\_\_\_\_ **hours per day**

\_\_\_\_\_ **minutes per day**

☐ Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?


\_\_\_\_\_ **hours per day**

\_\_\_\_\_ **minutes per day**


☐ Don't know/Not sure

**This is the end of the questionnaire, thank you for participating.**

## Appendix VI The New Leaf Physical Activity Questionnaire

1. Working				
Do you work for pay or as a volunteer? <input type="checkbox"/> Yes <input type="checkbox"/> No (Go to #2)				
What Type of Work: _____				
In a usual week, how many days do you work? Number of Days Per Week <input type="text"/>				
On a usual work day, how much time do you spend doing:				
❖ Activities while <b>sitting or standing</b> : like typing, filing, preparing food, or working a cash register	<input type="checkbox"/> not much	<input type="checkbox"/> some (3–5 hr/day)	<input type="checkbox"/> a lot	goals ↓
❖ <b>Moderate</b> activities while walking: like waiting tables or walking to deliver things	<input type="checkbox"/> a lot	<input type="checkbox"/> some (1–3 hr/day)	<input type="checkbox"/> not much	
❖ Hard ( <b>vigorous</b> ) physical work: like heavy cleaning, scrubbing or mopping floors, lifting or carrying heavy objects, walking up hills or stairs	<input type="checkbox"/> a lot	<input type="checkbox"/> some (20–30 min/day)	<input type="checkbox"/> not much	

See Work Tips, page C-9.

2. TV and Seated Hobbies				
Do you watch TV or videos, read, use a computer, or do seated hobbies such as knitting or arts and crafts? <input type="checkbox"/> Yes <input type="checkbox"/> No (Go to #3)				
In a usual week, how many days do you watch TV or do seated hobbies? Number of Days Per Week <input type="text"/>				
On a usual day, how much time do you spend watching TV or doing seated hobbies?	<input type="checkbox"/> not much	<input type="checkbox"/> some (1–2 hr/day)	<input type="checkbox"/> a lot	goals

See TV and Seated Hobby Tips, page C-9.

### 3. Household Chores



Do you do chores such as laundry, sweeping, vacuuming, or mopping?

☐ Yes ☐ No (Go to #4)

In a usual week, how many days do you do **moderate** housework, like picking up toys or tidying rooms, doing laundry, sweeping, or vacuuming?

Number of Days Per Week

On a day that you do **moderate** chores, how much time do you usually spend?

☐ a lot

☐ some

☐ not much

goals

(10-29 min/day)

In a usual week, how many days do you do **vigorous** housework, like mopping, heavy scrubbing, or carrying?

Number of Days Per Week

On a day that you do **vigorous** chores, how much time do you usually spend?

☐ a lot

☐ some

☐ not much

goals

(10-19 min/day)

See Household Chore Tips, page C-10.

### 4. Child and Elder Care



Are you a caregiver for children or older adults? ☐ Yes ☐ No (Go to #5)

In a usual week, how many days do you do **moderately** active things, like active play, clean-up, or pushing a stroller or wheelchair?

Number of Days Per Week

On a day that you do **moderate** child or elder care, how much time do you usually spend?

☐ a lot

☐ some

☐ not much

goals

(10-29 min/day)

In a usual week, how many days do you do **vigorous** work or play, like heavy lifting, or active sports with children?

Number of Days Per Week

On a day that you do **vigorous** child or elder care, how much time do you usually spend?

☐ a lot

☐ some

☐ not much

goals

(10-19 min/day)

See Child and Elder Care Tips, page C-10.



## 5. Yardwork/Gardening/Outside House Care



Do you do activities like gardening, raking, pushing a lawn mower, pushing a wheelbarrow, or chopping firewood? ☐ Yes ☐ No (Go to #6)

In a usual week, how many days do you do **moderate** yardwork or outside house care, like sweeping, raking, or push mowing?

Number of Days Per Week

On a day that you do <b>moderate</b> yardwork or outside house care, how much time do you usually spend?	<input type="checkbox"/> a lot	<input type="checkbox"/> some (10-29 min/day)	<input type="checkbox"/> not much	goals
--	--------------------------------	--	-----------------------------------	-------

In a usual week, how many days do you do **vigorous** yardwork or outside house care, like heavy lifting, chopping firewood, or spade work?

Number of Days Per Week

On a day that you do <b>vigorous</b> yardwork or outside house care, how much time do you usually spend?	<input type="checkbox"/> a lot	<input type="checkbox"/> some (10-19 min/day)	<input type="checkbox"/> not much	goals
--	--------------------------------	--	-----------------------------------	-------

See Yardwork and Gardening Tips, page C-10.

## 6. Church and Social Group Activities



Do you do activities with a church and/or social group? ☐ Yes ☐ No (Go to #7)

In a usual week, how many days do you do church or social group activities?

Number of Days Per Week

On a usual day, when you do church or social group activities, how much time do you spend doing:

❖ Sitting or standing activities: like listening, talking, eating, or playing games	<input type="checkbox"/> not much	<input type="checkbox"/> some (1-2 hr/day)	<input type="checkbox"/> a lot	goals ↓
❖ <b>Moderate</b> activities: like active singing in the choir, dancing, setting up or cleaning up	<input type="checkbox"/> a lot	<input type="checkbox"/> some (10-29 min/day)	<input type="checkbox"/> not much	
❖ Hard ( <b>vigorous</b> ) physical work: like heavy set-up or clean-up work, moving tables and chairs, mopping, or loading	<input type="checkbox"/> a lot	<input type="checkbox"/> some (10-19 min/day)	<input type="checkbox"/> not much	

See Church and Social Group Tips, page C-11.

## 7. Walking or Bicycling for Transportation



Do you walk or bicycle to get to places like work, school, shopping, or to get to the bus stop? ☐ Yes ☐ No (Go to #8)

In a usual week, how many days do you walk, bicycle, or use a wheelchair to get to places?

Number of Days Per Week

On a usual day when you walk or bicycle to get to places (**moderate activity**), how much time do you spend?

☐ a lot

☐ some  
(10-29 min/day)

☐ not much

goals

See Walking or Bicycling for Transportation Tips, page C-11.

## 8. Exercise and Sports



Do you exercise or play sports? ☐ Yes ☐ No (Go to #9)

In a usual week, how many days do you do **light** exercise, like walking at a leisurely pace that doesn't make you sweat or breathe hard?

Number of Days Per Week

On a usual day when you do **light** exercise, how much time do you spend?

☐ a lot

☐ some  
(10-29 min/day)

☐ not much

goals

In a usual week, how many days do you do **moderate** exercise or sports (fast enough to make you breathe harder), like brisk walking, bicycling, dancing, shallow water aerobics, or outdoor games?

Number of Days Per Week

On a usual day when you do **moderate** exercise, how much time do you spend?

☐ a lot

☐ some  
(10-29 min/day)

☐ not much

goals

In a usual week, how many days do you do **vigorous** exercise or sports (fast enough to make it hard to talk), like fast walking, jogging, bicycling, swimming laps, hiking uphill, tennis, or deep water aerobics?

Number of Days Per Week

On a usual day when you do **vigorous** exercise, how much time do you spend?

☐ a lot

☐ some  
(10-19 min/day)

☐ not much

goals

See Exercise and Sports Tips, page C-12.

## 9. Strength Training



Do you do **strength training** exercises such as lifting weights, stretch band exercises, sit-ups, push-ups, leg-lifts, or squats? ☐ Yes ☐ No (Go to #10)

In a usual week, how many days do you do **strength training** exercises?

Number of Days Per Week

And on a usual day when you do **strength training** exercises, how much time do you spend?

☐ a lot

☐ some  
(10-29 min/day)

☐ not much

goals

See Strength Training Tips, page C-12.

## 10. Stretching



Do you do **stretching** exercises, such as yoga, Pilates, chair stretching, or standing stretches? ☐ Yes ☐ No (End of Physical Activity Assessment)

In a usual week, how many days do you do **stretching** exercises?

Number of Days Per Week

On a usual day when you do **stretching** exercises, how much time do you spend?

☐ a lot

☐ some  
(10-29 min/day)

☐ not much

goals

See Stretching Tips, page C-12.

total  
score

# What Makes It Hard to Keep Active? (Assessment)



Being physically active includes **everyday activities**—like cleaning house, raking the yard, grocery shopping, gardening, or walking to the bus stop. Being active can also include **exercise activities**—like walking, swimming, lifting weights, or aerobics. But sometimes it can be hard to be active.

**For each of the following statements, please pick the answer that best describes you.**

<b>1. After a full day's work, it's hard to find the energy to do any kind of extra activity.</b>		
<input type="checkbox"/> not at all like me	<input type="checkbox"/> a little like me	<input type="checkbox"/> a lot like me
<b>2. Being overweight makes it hard for me to be more active.</b>		
<input type="checkbox"/> not at all like me	<input type="checkbox"/> a little like me	<input type="checkbox"/> a lot like me
<b>3. When my heart beats faster or I get out of breath, I get anxious and worry about overdoing it.</b>		
<input type="checkbox"/> not at all like me	<input type="checkbox"/> a little like me	<input type="checkbox"/> a lot like me
<b>4. With all the things I have to do and take care of, finding time for more physical activity is low on my list of things to do.</b>		
<input type="checkbox"/> not at all like me	<input type="checkbox"/> a little like me	<input type="checkbox"/> a lot like me
<b>5. Because I have a health condition, I am concerned that physical activity may do me more harm than good.</b>		
<input type="checkbox"/> not at all like me	<input type="checkbox"/> a little like me	<input type="checkbox"/> a lot like me
<b>6. I would be more physically active if the activities I wanted to do didn't cost so much.</b>		
<input type="checkbox"/> not at all like me	<input type="checkbox"/> a little like me	<input type="checkbox"/> a lot like me

<b>7.</b>	<b>Every time I try to become more active, I get sore and uncomfortable and feel like quitting.</b>		
<input type="checkbox"/>	not at all like me	<input type="checkbox"/>	a little like me
<input type="checkbox"/>			a lot like me
<b>8.</b>	<b>Most physical activities are just plain boring, so it's hard to make myself do anything.</b>		
<input type="checkbox"/>	not at all like me	<input type="checkbox"/>	a little like me
<input type="checkbox"/>			a lot like me
<b>9.</b>	<b>Most of my friends and family members are not physically active, and it's hard for me to be active on my own.</b>		
<input type="checkbox"/>	not at all like me	<input type="checkbox"/>	a little like me
<input type="checkbox"/>			a lot like me
<b>10.</b>	<b>I do pretty well with starting a physical activity program, but the hardest part is sticking with it for a long time.</b>		
<input type="checkbox"/>	not at all like me	<input type="checkbox"/>	a little like me
<input type="checkbox"/>			a lot like me
<b>11.</b>	<b>When the weather is bad, I get less physical activity.</b>		
<input type="checkbox"/>	not at all like me	<input type="checkbox"/>	a little like me
<input type="checkbox"/>			a lot like me
<b>12.</b>	<b>Sometimes I avoid physical activity because I don't want to sweat or mess up my hair.</b>		
<input type="checkbox"/>	not at all like me	<input type="checkbox"/>	a little like me
<input type="checkbox"/>			a lot like me

See Being More Active, page C-15.



# What Limits Your Activity? (Assessment)



Would you say that the following physical concerns are no problem, somewhat of a problem, or a severe problem?

<b>1. Ability to walk (permanent walking disability)</b>		
<input type="checkbox"/> No problem	<input type="checkbox"/> Somewhat of a problem	<input type="checkbox"/> A severe problem (wheelchair bound)
<b>2. Ability to use your arms (permanent upper body disability)</b>		
<input type="checkbox"/> No problem	<input type="checkbox"/> Somewhat of a problem	<input type="checkbox"/> A severe problem
<b>3. Arthritis</b>		
<input type="checkbox"/> No problem	<input type="checkbox"/> Somewhat of a problem	<input type="checkbox"/> A severe problem
<b>4. Painful tingling, numbness, or loss of feeling in your hands or feet</b>		
<input type="checkbox"/> No problem	<input type="checkbox"/> Somewhat of a problem	<input type="checkbox"/> A severe problem
<b>5. Breathing problems (such as asthma or emphysema)</b>		
<input type="checkbox"/> No problem	<input type="checkbox"/> Somewhat of a problem	<input type="checkbox"/> A severe problem
<b>6. Balance problems or frequent falls</b>		
<input type="checkbox"/> No problem	<input type="checkbox"/> Somewhat of a problem	<input type="checkbox"/> A severe problem
<b>By yourself (without help from another person or special equipment), how much difficulty do you have:</b>		
<b>7. Raising your arms over your head</b>		
<input type="checkbox"/> Little or no difficulty	<input type="checkbox"/> Some difficulty	<input type="checkbox"/> A lot of difficulty or unable to do

<b>8. Turning your head to look behind you</b>		
<input type="checkbox"/> Little or no difficulty	<input type="checkbox"/> Some difficulty	<input type="checkbox"/> A lot of difficulty or unable to do
<b>9. Lifting or carrying something as heavy as 10 lbs (like a bag of groceries)</b>		
<input type="checkbox"/> Little or no difficulty	<input type="checkbox"/> Some difficulty	<input type="checkbox"/> A lot of difficulty or unable to do
<b>10. Using your fingers to grasp or handle things</b>		
<input type="checkbox"/> Little or no difficulty	<input type="checkbox"/> Some difficulty	<input type="checkbox"/> A lot of difficulty or unable to do
<b>11. Stooping, crouching, or kneeling</b>		
<input type="checkbox"/> Little or no difficulty	<input type="checkbox"/> Some difficulty	<input type="checkbox"/> A lot of difficulty or unable to do
<b>12. Climbing a short flight of stairs</b>		
<input type="checkbox"/> Little or no difficulty	<input type="checkbox"/> Some difficulty	<input type="checkbox"/> A lot of difficulty or unable to do
<b>13. Walking across a small room</b>		
<input type="checkbox"/> Little or no difficulty	<input type="checkbox"/> Some difficulty	<input type="checkbox"/> A lot of difficulty or unable to do
<b>14. Walking for a quarter of a mile (about 2-3 blocks)</b>		
<input type="checkbox"/> Little or no difficulty	<input type="checkbox"/> Some difficulty	<input type="checkbox"/> A lot of difficulty or unable to do

See Being Active with Physical Limitations, page C-21.

## Appendix VII The Modifiable Activity Questionnaire

A.M. KRISKA AND ASSOCIATES

### APPENDIX: PHYSICAL-ACTIVITY QUESTIONNAIRE AND INTERVIEWER'S INSTRUCTIONS FOR ADMINISTRATION\*

#### Physical-activity questionnaire

Age \_\_\_\_\_ Sex \_\_\_\_\_ Date \_\_\_\_\_  
 Weight (kg) \_\_\_\_\_ Interviewer code \_\_\_\_\_

1. In general, about how many hours per week did you regularly participate in sports and other vigorous physical activities (excluding walking and time spent in school physical education classes)?

- During junior high school (JHS) or high school (HS) years—ages 12–18 yr (ask if 14 or older) \_\_\_\_\_
- ages 19–34 yr (ask if 21 or older) \_\_\_\_\_
- ages 35–49 yr (ask if 37 or older) \_\_\_\_\_
- ages 50+ yr (ask if 52 or older) \_\_\_\_\_
- past year \_\_\_\_\_
- past week \_\_\_\_\_

2. Did you ever compete in an individual or team sport (not including any time spent in sports performed during school physical education classes)? If yes, \_\_\_\_\_

- How many total years did you participate in competitive sports? \_\_\_\_\_

3. Have you ever had a job that required physically demanding work? If yes, \_\_\_\_\_

- How many physically active jobs have you ever held? \_\_\_\_\_
- What is the total number of years that you have worked in these physically demanding jobs? (sum of years spent in jobs mentioned above) \_\_\_\_\_

4. Have you ever spent any time confined to a bed or a chair for greater than 1 month as a result of an injury or an illness? If yes, \_\_\_\_\_

- How old were you when you first became confined to a bed or chair? \_\_\_\_\_
- How many months did this confinement to a bed or chair last? \_\_\_\_\_

5. In general, about how many hours per day did you spend watching television? \_\_\_\_\_

- During your childhood years \_\_\_\_\_
- JHS/HS years—ages 12–18 yr (ask if 14 or older) \_\_\_\_\_
- ages 19–34 yr (ask if 21 or older) \_\_\_\_\_
- ages 35–49 yr (ask if 37 or older) \_\_\_\_\_
- ages 50+ yr (ask if 52 or older) \_\_\_\_\_
- past year \_\_\_\_\_
- past week \_\_\_\_\_

Reliable test? (1, yes; 0, no) \_\_\_\_\_

#### Activity survey—occupational activities

Occupational activity— past year	Age at start of job	Walk or bike to work?  min/day	Job schedule (average of past year)			Job activities At work, is most of your time spent sitting or performing light activities? If not, how is it usually spent?		
			mo/ yr	days/ wk	h/ day	Hours per day spent in		
Job title* List all jobs held over past year for more than 1 mo (account for full 12 mo)						Light activity	Moderate activity	Hard activity

\*If unemployed/retired or housewife during all or part of the past year, list as such, and probe for job activities of a normal 8-hour day (excluding activities).

\*More detailed instructions for questionnaire administration are available from A.M.K.





## **Appendix VIII Residential Environment Questionnaire**

You are welcome to use, but we would be grateful if you use the following citation.

Giles-Corti B, Cutt H, Timperio A, Pikora TJ, Bull FL, Knuiman M, Bulsara M, Van Niel K, Shilton T. Development of a reliable measure of walking within and outside the local neighborhood: RESIDE's Neighbourhood Physical Activity Questionnaire Preventive Medicine (In press, accepted January 26, 2006).

### **Neighborhood Physical Activity Questionnaire**

#### **WALKING**

In the next section, we ask you about walking in and around your neighbourhood, then in section B, we ask about walking outside your neighbourhood.

In both sections we ask you about two types of walking: walking for transport (e.g. to the shop), *then* walking for recreation, health and fitness. If the walking that you do for transport is also for recreation, health or fitness, please record it only once.

#### **For example:**

Linda lives 20 minutes away from work. She chooses to walk there rather than drive mainly because she wants to improve her fitness. If Linda records that she walks for transport (3 times per week for a total of 120 minutes), she would not repeat that information under walking for recreation, health, or fitness.

**Section A:** This section is about walking **IN AND AROUND** your new neighbourhood or local area - we mean everywhere within a 10-15 minute walk of your home. **Section B** is about walking **OUTSIDE** your neighbourhood.

- 1 In a **USUAL WEEK**, do you walk in or around your new neighbourhood or new local area to get to or from somewhere (such as walking to a shop or to public transport) or for recreation, health or fitness (including walking your dog)?

No ☐<sub>2</sub>      ⇒ **GO to question 8**  
 Yes ☐<sub>1</sub>

#### **WALKING FOR TRANSPORT IN AND AROUND YOUR NEW NEIGHBOURHOOD**

- 2 In a **USUAL WEEK**, how many times do you walk **as a means of transport**, such as going to and from work, walking to the shop or walking to public transport in your neighbourhood or local area?

**Write in number of times**

*if 0 ⇒ GO to question 5*

- 3 Please estimate the total time you spend walking **as a means of transport** in your neighbourhood or local area in a **USUAL WEEK**. (eg. 5 times by 10 minutes = 50 minutes).

Hours

Minutes

- 4 Tick all the places where you walk to as a means of **transport** in or around your neighbourhood or local area in a **USUAL WEEK**.

Places you might walk to as a means of transport IN your neighbourhood or local area in a USUAL week	Tick ALL the places you walk to in a USUAL week
E.g.To or from shops	<input checked="" type="checkbox"/> 1
To or from work [or study]	<input type="checkbox"/> 1
To or from public transport	<input type="checkbox"/> 1
To or from shops (1)	<input type="checkbox"/> 1
To or from shops (2)	<input type="checkbox"/> 1
To or from school	<input type="checkbox"/> 1
To or from café or restaurant	<input type="checkbox"/> 1
To or from friend's house	<input type="checkbox"/> 1
Somewhere else (1) :Please write where _____	<input type="checkbox"/> 1
Somewhere else (2) :Please write where _____	<input type="checkbox"/> 1

**WALKING FOR RECREATION, HEALTH OR FITNESS IN AND AROUND YOUR NEW NEIGHBOURHOOD.** If you have included recreational walking in the previous section, please do not repeat it in this section.

- 5 In a **USUAL WEEK**, how many times do you walk for **recreation, health or fitness** (including walking your dog) in or around your neighbourhood or local area?

Write in number of times

if 0  $\Rightarrow$  GO to question 8

- 6 Please estimate the total time you spend walking for **recreation, health or fitness** in or around your neighbourhood or local area in a **USUAL WEEK**. (Eg. 5 times by 20 minutes = 100 minutes).

Hours

Minutes

- 7 Please tick all the places where you walk for **recreation, health or fitness** in or around your neighbourhood or local area in a **USUAL WEEK**.

Places you might walk for recreation, health or fitness <b>IN</b> your neighbourhood or local area in a <b>USUAL</b> week	Tick <b>ALL</b> the places you walk in a <b>USUAL</b> week
E.g. Park, oval or bushlands (1)	<input checked="" type="checkbox"/> 1
Beach	<input type="checkbox"/> 1
Park, oval or bushlands (1)	<input type="checkbox"/> 1
Park, oval or bushlands (2)	<input type="checkbox"/> 1
Park, oval or bushlands (3)	<input type="checkbox"/> 1
Around the neighbourhood using the streets/footpaths (no specific destination)	<input type="checkbox"/> 1
Walking trails/paths NOT in a park or beach	<input type="checkbox"/> 1
To or from café or restaurant	<input type="checkbox"/> 1
To or from a shop	<input type="checkbox"/> 1
Somewhere else (1) (Please write where) _____	<input type="checkbox"/> 1
Somewhere else (2) (Please write where) _____	<input type="checkbox"/> 1

**Section B:** This section is about walking **OUTSIDE** your new neighbourhood or local area - we mean *everywhere further than a 15 minute walk from your home*. (For example, somewhere you walk to in the next suburb, or somewhere you drive to)

- 8 In a **USUAL WEEK**, do you walk outside your neighbourhood or local area to get to or from somewhere (such as walking to a shop or to public transport) or for recreation, health or fitness (including walking your dog)?

No ☐<sub>2</sub> ⇒ **GO to Section C.**

Yes ☐<sub>1</sub>

### WALKING FOR *TRANSPORT* OUTSIDE YOUR NEW NEIGHBOURHOOD

- 9 In a **USUAL WEEK**, how many times do you walk as a **means of transport**, such as going to and from work, walking to the shop or walking to public transport outside your neighbourhood or local area?

Write in number of times

if 0  $\Rightarrow$  GO to question 12

- 10 Please estimate the total time you spend walking as a **means of transport** outside your neighbourhood or local area in a **USUAL WEEK**. (Eg. 5 times by 10 minutes = 50 minutes).

Hours

Minutes

- 11 Tick all the places where you walk to as a means of **transport** outside your neighbourhood or local area in a **USUAL WEEK**.

Places you might walk to as a means of transport OUTSIDE your neighbourhood or local area in a USUAL week	Tick ALL the places you walk to in a USUAL week
E.g. To or from shops (1)	<input checked="" type="checkbox"/> 1
To or from work [or study]	<input type="checkbox"/> 1
To or from public transport	<input type="checkbox"/> 1
To or from shops (1)	<input type="checkbox"/> 1
To or from shops (2)	<input type="checkbox"/> 1
To or from school	<input type="checkbox"/> 1
To or from café or restaurant	<input type="checkbox"/> 1
To or from friend's house	<input type="checkbox"/> 1
Somewhere else (1) (Please write where) _____	<input type="checkbox"/> 1
Somewhere else (2) (Please write where) _____	<input type="checkbox"/> 1

**WALKING FOR RECREATION, HEALTH OR FITNESS OUTSIDE YOUR NEW NEIGHBOURHOOD.** If you have included recreational walking in the previous section, please do not repeat it in this section.

- 12 In a **USUAL WEEK**, how many times do you walk for **recreation, health or fitness** (including walking your dog) outside your neighbourhood or local area?

Write in number of times

if 0  $\Rightarrow$  GO to Section C.

- 13 Please estimate the total time you spend walking for **recreation, health or fitness** outside your neighbourhood or local area in a **USUAL WEEK**. (Eg. 1 time for 30 minutes = 30 minutes).

Hours

Minutes

- 14 Tick the places where you walk for **recreation, health or fitness** outside your neighbourhood or local area in a **USUAL WEEK**

Places you might walk for recreation, health or fitness OUTSIDE your neighbourhood or local area in a USUAL week	Tick ALL the places you walk in a USUAL week
E.g. Park, oval or bushlands (1)	<input checked="" type="checkbox"/> 1
Beach	<input type="checkbox"/> 1
Park, oval or bushlands (1)	<input type="checkbox"/> 1
Park, oval or bushlands (2)	<input type="checkbox"/> 1
Park, oval or bushlands (3)	<input type="checkbox"/> 1
Around another neighbourhood using the streets/footpaths (no specific destination)	<input type="checkbox"/> 1
Walking trails/paths NOT in a park or beach	<input type="checkbox"/> 1
To or from café or restaurant	<input type="checkbox"/> 1
To or from a shop	<input type="checkbox"/> 1
Somewhere else (1): <b>Please write where</b> _____	<input type="checkbox"/> 1
Somewhere else (2): <b>Please write where</b> _____	<input type="checkbox"/> 1

## CYCLING

**Section C:** This section is about cycling **IN AND AROUND** your new neighbourhood or local area - we mean everywhere within a 10-15 minute walk of your home. Section D is about cycling **OUTSIDE** your new neighbourhood.

**NB:** Repeat previous questions substituting walking for cycling.

## OTHER LEISURE TIME PHYSICAL ACTIVITIES

**Section E:** The next set of questions is about other leisure time physical activities that you do **IN A USUAL WEEK**, besides what you have already mentioned. Do not include walking or cycling.

- 1 In a **USUAL WEEK**, do you do any other vigorous or moderate intensity leisure time physical activities? Do not include any walking or cycling.

No ☐<sub>2</sub> ⇒ **GO to questions in next section**  
 Yes ☐<sub>1</sub>

- 2 In a **USUAL WEEK**, do you do any vigorous intensity leisure time physical activities like jogging, aerobics or competitive tennis? Do not include walking or cycling or moderate intensity physical activities. Vigorous intensity physical activities make you breathe harder or puff and pant.

No ☐<sub>2</sub> ⇒ **GO to question 5**  
 Yes ☐<sub>1</sub>

- 3 In a **USUAL WEEK**, how many times do you do vigorous intensity leisure time physical activities which makes you breathe harder or puff and pant?

**Write in number of times**

- 4 What do you estimate is the total time you spend doing vigorous intensity leisure time physical activities in a **USUAL WEEK**?  
 (Eg. 3 times for 20 minutes = 60 minutes)

**Hours Minutes**

- 5 Apart from what you have already mentioned, in a **USUAL WEEK** do you do any other moderate intensity leisure time physical activities like gentle swimming, social tennis, golf or heavy gardening? Moderate intensity physical activities do not make you breathe harder or puff and pant.

No ☐<sub>2</sub> ⇒ Go to next section

Yes ☐<sub>1</sub>

- 6 In a **USUAL WEEK**, how many times do you do moderate intensity leisure time physical activities which do not make you breathe harder or puff and pant?

**Write in number of times**


- 7 What do you estimate is the total time you spend doing moderate intensity leisure time physical activities in a **USUAL WEEK**? (Eg. 1 time for 1 hour = 1 hour)

**Hours**

**Minutes**



## Appendix IX Modified Cross Cultural Activity Participation Study Physical Activity Questionnaire for Multi-Ethnic Study of Atherosclerosis

<p style="text-align: center;">Multi-Ethnic Study of Atherosclerosis</p> <div style="text-align: center;">  </div> <p style="text-align: center; font-weight: bold;">Physical Activity</p>	<p style="text-align: right;">Id#: IDNO</p> <p>Acrostic: <u>ACROSTIC</u></p> <p>Date: <span style="border: 1px solid black; padding: 2px 5px;">  </span> <span style="border: 1px solid black; padding: 2px 5px;">  </span> <span style="border: 1px solid black; padding: 2px 5px;">  </span> <span style="border: 1px solid black; padding: 2px 5px;">  </span> <span style="border: 1px solid black; padding: 2px 5px;">  </span> <span style="border: 1px solid black; padding: 2px 5px;">  </span></p> <p style="text-align: center;">PACTDT1</p> <p style="text-align: center; font-size: small;">Month      Day      Year</p>
---	--

Think about the types of activities you did in a **typical week in the past month**. For each activity, note which of these activities you did in a typical week by filling in the circle for YES or NO. For each item you mark as YES, fill in the circle for the number of DAYS in a typical week you did these activities and the AVERAGE TIME per day in hours and minutes you did these activities.

**Intensity Levels:**  
 Light → easy effort  
 Moderate → harder than light but not all-out effort  
 Heavy → all-out effort

**Example:**

**Conditioning Activities**  
Moderate Effort:

Low impact aerobics,  
 slow bicycling, rowing,  
 leisurely swimming,  
 health club machines -  
 moderate intensity

		Days/Week							Hours/Day						Minutes/Day			
Y	N	1	2	3	4	5	6	7	1	2	3	4	5	5+	5	15	30	45
<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
1	0	1	2	3	4	5	6	7	1	2	3	4	5	6	5	15	30	45

*In this example, the activity was done 3 days per week, 1 hour and 30 minutes per day.*

In a typical week in the past month, did you do:

Household chores	Days/Week	Hours/Day	Minutes/Day
<b>1</b> <u>Light Effort:</u> Such as cooking, dishes, ironing, straightening up, laundry, shopping <div style="text-align: right; font-weight: bold;">HHCHL1</div> <div style="text-align: right;">Y N</div> <div style="text-align: right;">○ ○</div>	<div style="text-align: right; font-weight: bold;">HHLDY1</div> <div style="text-align: right;">1 2 3 4 5 6 7</div> <div style="text-align: right;">○ ○ ○ ○ ○ ○ ○</div>	<div style="text-align: right; font-weight: bold;">HHLHR1</div> <div style="text-align: right;">1 2 3 4 5 5+</div> <div style="text-align: right;">○ ○ ○ ○ ○ ○ ○</div>	<div style="text-align: right; font-weight: bold;">HHLMN1</div> <div style="text-align: right;">5 15 30 45</div> <div style="text-align: right;">○ ○ ○ ○</div>
<b>2</b> <u>Moderate or Heavy Effort:</u> Such as heavy cleaning, scrubbing, mopping, home repairs, washing car, vacuuming <div style="text-align: right; font-weight: bold;">HHCHMH1</div> <div style="text-align: right;">Y N</div> <div style="text-align: right;">○ ○</div>	<div style="text-align: right; font-weight: bold;">HHMH DY1</div> <div style="text-align: right;">1 2 3 4 5 6 7</div> <div style="text-align: right;">○ ○ ○ ○ ○ ○ ○</div>	<div style="text-align: right; font-weight: bold;">HHMH HR1</div> <div style="text-align: right;">1 2 3 4 5 5+</div> <div style="text-align: right;">○ ○ ○ ○ ○ ○ ○</div>	<div style="text-align: right; font-weight: bold;">HHMH MN1</div> <div style="text-align: right;">5 15 30 45</div> <div style="text-align: right;">○ ○ ○ ○</div>

## Physical Activity - 2

Id#:

In a typical week in the past month, did you do:

Lawn/Yard/Garden/Farm	Days/Week	Hours/Day	Minutes/Day
<b>3 Moderate Effort:</b> Such as weeding, mowing grass, raking, cleaning garage, sweeping <b>YARDM1</b>	<b>YARDMDY1</b> 1 2 3 4 5 6 7 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<b>YARDMHR1</b> 1 2 3 4 5 5+ <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<b>YARDMMN1</b> 5 15 30 45 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
<b>4 Heavy Effort:</b> Such as digging dirt, shoveling snow, mending fences, chopping wood <b>YARDH1</b>	<b>YARDHDY1</b> 1 2 3 4 5 6 7 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<b>YARDHHR1</b> 1 2 3 4 5 5+ <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<b>YARDHMN1</b> 5 15 30 45 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
<b>Care of Children/Adults</b> <b>5 Light Effort:</b> Such as bathing, feeding, changing diapers, playing with child <b>CAREL1</b>	<b>CARELDY1</b> 1 2 3 4 5 6 7 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<b>CARELHR1</b> 1 2 3 4 5 5+ <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<b>CARELMN1</b> 5 15 30 45 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
<b>6 Moderate Effort:</b> Such as lifting and carrying, pushing wheelchair or stroller <b>CAREM1</b>	<b>CAREMDY1</b> 1 2 3 4 5 6 7 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<b>CAREMHR1</b> 1 2 3 4 5 5+ <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<b>CAREMMN1</b> 5 15 30 45 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
<b>Transportation</b> <b>7 Drive or ride in car, ride the bus/subway, including travel to work</b> <b>DRIVE1</b>	<b>DRIVEDY1</b> 1 2 3 4 5 6 7 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<b>DRIVEHR1</b> 1 2 3 4 5 5+ <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<b>DRIVEMN1</b> 5 15 30 45 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
<b>Walking (not at work)</b> <b>8 Walking to get places - to the bus, car, work, into the store</b> <b>WALK1</b>	<b>WALKDY1</b> 1 2 3 4 5 6 7 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<b>WALKHR1</b> 1 2 3 4 5 5+ <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<b>WALKMN1</b> 5 15 30 45 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
<b>9 Walking for exercise, pleasure, social reasons, walking during work breaks, walking the dog</b> <b>WALKEX1</b>	<b>WLKEXDY1</b> 1 2 3 4 5 6 7 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<b>WLKEXHR1</b> 1 2 3 4 5 5+ <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<b>WLKEXMN1</b> 5 15 30 45 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
<b>Dancing/Sport Activities</b> <b>10 Dancing in church, ceremonies or for pleasure</b> <b>DANCE1</b>	<b>DANCEDY1</b> 1 2 3 4 5 6 7 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<b>DANCEHR1</b> 1 2 3 4 5 5+ <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<b>DANCEMN1</b> 5 15 30 45 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>

# Physical Activity - 3

Id#:

In a typical week in the past month, did you do:

<b>11</b> Team sports - softball, volleyball, basketball, soccer <b>TEAMSP1</b>		<b>Days/Week</b> <b>TMSPDY1</b>							<b>Hours/Day</b> <b>TMSPHR1</b>					<b>Minutes/Day</b> <b>TMSPMN1</b>				
	Y N	1	2	3	4	5	6	7	1	2	3	4	5	5+	5	15	30	45
	<input type="radio"/> <input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<b>12</b> Dual sports - tennis, racketball, paddleball <b>DUALSP1</b>		<b>DLSPDY1</b>							<b>DLSPHR1</b>					<b>DLSPMN1</b>				
	Y N	1	2	3	4	5	6	7	1	2	3	4	5	5+	5	15	30	45
	<input type="radio"/> <input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<b>13</b> Individual activities - golf, bowling, yoga, T'ai Chi <b>INDACT1</b>		<b>INDACDY1</b>							<b>INDACHR1</b>					<b>INDACMN1</b>				
	Y N	1	2	3	4	5	6	7	1	2	3	4	5	5+	5	15	30	45
	<input type="radio"/> <input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<b>Conditioning Activities</b>																		
<b>14</b> Moderate Effort: Low impact aerobics, slow bicycling, rowing, leisurely swimming, health club machines - moderate intensity <b>CONDMOD1</b>		<b>CONDMDY1</b>							<b>CONDMHR1</b>					<b>CONDMMN1</b>				
	Y N	1	2	3	4	5	6	7	1	2	3	4	5	5+	5	15	30	45
	<input type="radio"/> <input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<b>15</b> Heavy Effort: High impact aerobics, fast bicycling, running, jogging, fast swimming, health club machines - vigorous intensity, judo, kickboxing, karate <b>CONDHVY1</b>		<b>CONDHDY1</b>							<b>CONDHHR1</b>					<b>CONDHMN1</b>				
	Y N	1	2	3	4	5	6	7	1	2	3	4	5	5+	5	15	30	45
	<input type="radio"/> <input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<b>Leisure Activities</b>																		
<b>16</b> Sit or recline and watch TV <b>WATCHTV1</b>		<b>WCHTVDY1</b>							<b>WCHTVHR1</b>					<b>WCHTMN1</b>				
	Y N	1	2	3	4	5	6	7	1	2	3	4	5	5+	5	15	30	45
	<input type="radio"/> <input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<b>17</b> Read, knit, sew, visit, do nothing, non-work recreational computer <b>READ1</b>		<b>READDY1</b>							<b>READHR1</b>					<b>READMN1</b>				
	Y N	1	2	3	4	5	6	7	1	2	3	4	5	5+	5	15	30	45
	<input type="radio"/> <input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

## Occupational Activities

**18** Do you work to earn money?

**WORK1** ☐ No → Go to VOLUNTEER ACTIVITIES  
☐ Yes → Continue to #19

**19** How many days per week and hours per day do you work in all jobs?

Days/Week								Hours/Day															
1	2	3	4	5	6	7	<1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>WORKDY1</b>								<b>WORKHR1</b>															

## Physical Activity - 4

Id#: 

Fill in the circles for the time you spent in each activity at work. The hours per day for all activities should equal the total hours per day you work.

At work, did you do:

<b>20</b> <u>Light Effort:</u> While sitting (e.g. in an office, laboratory, child care, etc.)  <div style="display: flex; justify-content: space-between;"> <div> <b>WRKLSIT1</b>            Yes <input type="radio"/>            No <input type="radio"/> </div> <div> <b>Hours/Day</b>            &lt;1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16  <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> </div> </div>	<b>WKSITHR1</b> <1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
<b>21</b> <u>Light Effort:</u> While standing (e.g. filing, copying, clerking, assembly, nursing, farming, etc.)  <div style="display: flex; justify-content: space-between;"> <div> <b>WRKLSTD1</b>            Yes <input type="radio"/>            No <input type="radio"/> </div> <div> <b>Hours/Day</b>            &lt;1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16  <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> </div> </div>	<b>WKSTDHR1</b> <1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
<b>22</b> <u>Moderate Effort:</u> While standing and/or walking (e.g. nursing, custodian, housekeeping), lifting & pushing, sustained walking (e.g. making deliveries)  <div style="display: flex; justify-content: space-between;"> <div> <b>WRKMOD1</b>            Yes <input type="radio"/>            No <input type="radio"/> </div> <div> <b>Hours/Day</b>            &lt;1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16  <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> </div> </div>	<b>WKMODHR1</b> <1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
<b>23</b> <u>Heavy Effort:</u> Manual labor, ranch hand, farm labor, loading/unloading trucks  <div style="display: flex; justify-content: space-between;"> <div> <b>WRKHVY1</b>            Yes <input type="radio"/>            No <input type="radio"/> </div> <div> <b>Hours/Day</b>            &lt;1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16  <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> </div> </div>	<b>WKHVYHR1</b> <1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>

### Volunteer Activities

**24** In a typical week in the last month did you work as a volunteer and/or at church in activities you have not yet mentioned on this survey?

**VOLNTR1** ☐ No → Skip to #28  
☐ Yes Continue to #25

Did your volunteer work include:

<b>25</b> <u>Light Effort:</u> Sitting or standing <b>VOLLT1</b>	Y	N	<b>Days/Week</b> <b>VOLLBY1</b>							<b>Hours/Day</b> <b>VOLLHR1</b>							
			1	2	3	4	5	6	7	1	2	3	4	5	5+		
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>26</b> <u>Moderate Effort:</u> Standing or walking <b>VOLMOD1</b>	Y	N	<b>Days/Week</b> <b>VOLMDY1</b>							<b>Hours/Day</b> <b>VOLMHR1</b>							
			1	2	3	4	5	6	7	1	2	3	4	5	5+		
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>27</b> <u>Heavy Effort:</u> Pushing, lifting, carrying, climbing <b>VOLHVY1</b>	Y	N	<b>Days/Week</b> <b>VOLHDY1</b>							<b>Hours/Day</b> <b>VOLHHR1</b>							
			1	2	3	4	5	6	7	1	2	3	4	5	5+		
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Physical Activity - 5**

Id#:

**28** When you walk outside of your home, what is your usual pace?

- ☐ No walking at all  
☐ Casual strolling (up to 2 mph)  
☐ Average or normal (2 - 3 mph)  
☐ Fairly briskly (4 - 5 mph)  
☐ Brisk or striding (more than 5 mph)

**WLKPAC1**

For MESA Field Center Use Only:

**PACTADM1**Completed by: ☐ Self-Administered ☐ Interviewer-AdministeredInterviewer or Reviewer ID: **PACTTID1**Data Entry ID: **PACTDID1**

## **Appendix X List of experts on the expert panels**

### **List of experts on the first expert review panel**

**Barbara Ainsworth**, PhD, MPH, Professor, exercise and Wellness, Arizona State University. Dr. Ainsworth is a well-known leader in the areas of physical activity and public health, the assessment of physical activity among varied populations, the evaluation of physical activity questionnaires, and physical activity among women.

**Kay Hongu**, PhD, MEd, RD, , Nutritional Sciences Associate Extension Specialist, University of Arizona Dr. Hongu's research foci is testing new approaches to obesity prevention designed to induce physical activity in multiple settings in a manner sustainable beyond intervention periods while also reaching more of those otherwise unlikely to participate in traditional education programs. She came to the group with both Extension experience, as well as experience in the use of technologies and surveys typically used in activity assessment.

**Scott Going**, PhD, Professor, Head of Department of Nutritional Sciences, Co-Director, the Collaborator for Metabolic Disease, Prevention and Treatment, University of Arizona. Dr. Going is known for his many activity and exercise interventions, as well as the means of assessing the interventions' successes.

### **List of experts on the second expert review panel**

**Garry Auld**, PhD, RD, Professor, Colorado State University

**Susan Baker**, EdD, Professor/State EFNEP Coordinator, Colorado State University

**Karen Barale**, MS, RD, Associate Professor/State EFNEP Coordinator, Washington State University

**Nancy Betts**, PhD, RD, Professor, Oklahoma State University

**Stephanie Blake**, Former Program Coordinator, Institute of Food Safety and Nutrition, USDA, National Institute of Food and Agriculture (NIFA)

**Linda Boeckner**, PhD, Professor, University of Nebraska-Lincoln Extension

**Scottie Misner**, PhD, RD, Full Extension Specialist/State EFNEP Coordinator, University of Arizona Cooperative Extension

**Sandy Procter**, PhD, RD, Assistant Professor/State EFNEP Coordinator, Kansas State University

**Marilyn Townsend**, PhD, RD, Nutrition Specialist, University of California, Davis

**Jennifer Walsh**, PhD, RD, Former State EFNEP Coordinator, University of Florida

**Mary Kay Wardlaw**, Associate Director, University of Wyoming Extension

**Mary Wilson**, MS, RD, Former Nutrition Specialist, University of Nevada Cooperative Extension

**Beth Olson**, PhD, Associate Professor/Extension Specialist, University of Wisconsin-Madison



**Kathryn Yerxa**, MS, RD, State EFNEP Coordinator, University of Maine Cooperative Extension

## **Appendix XI Cognitive Interview Recording Forms**

VERSION D

### Cognitive Interview Recording Form Cover Page

Participant ID \_\_\_\_\_

Interviewer \_\_\_\_\_

Date: \_\_\_\_\_

No. of EFNEP classes attended:

0    1    2    3    4    5    6    7    8

Please test the questions in this order:

1-2-3

***[NOTE FOR INTERVIEWER] (Not to be read to the participants):***

***[Say:]*** Before we start, I would like you to keep in mind that our goal here is to get a better idea of how some questions we created are working. There are no right or wrong answers. So don't hesitate to tell me whenever something seems unclear or hard to answer.

***[Ask the participants to fill out the three question survey which you should give them on a single sheet. Record the time it takes to complete all three questions, participants' nonverbal cues indicating any difficulties or hesitations, and any other factors that might affect the process (e.g. background noise, child present, etc.).]***

***[If participant have questions about how to answer them, say: "Just imagine I am not in the room, answer the questions the way you would if you were here all by yourself?"]***

Start Time:

End Time:

---

Nonverbal cues:

Any other factors (i.e. interruption, background noise, recorder problem)

---



**Start Time:** \_\_\_\_\_

**[Say:]** For the next part of the interview, I will ask you to read the questions out loud and to tell me what you believe the question is asking you. Now could you please read question 1 aloud.

**[Have the participants keep their survey while they answer the following questions.]**

*Q1. In the past week, how many days did you exercise for at least 30 minutes? This includes things like jogging, playing soccer, jumping jacks or exercise videos. The 30 minutes could be all at once or 10 minutes or more at a time. DO NOT COUNT housework, taking care of your kids, or walking to get from place to place.*

**[Ask:]**

- ★ 1. Could you tell me, in your own words, what do you think the question is asking?
  
  - ★ 2. **[SKIP this question if they mentioned “The 30 minutes could be all at once or 10 minutes or more at a time”]**  
When you first answered the question, did you notice “THE 30 MINUTES COULD BE ALL AT ONCE OR 10 MINUTES OR MORE AT A TIME”? What do you think this part is telling you?
  
  - ★ 3. You picked [X], how did you come up with that answer?
  
  - ★ 4. **[SKIP this question if they already mentioned the exercise they did previously]**  
When answering question 1, what exercises that you did were you thinking about?
-

5. How sure/certain were you of your answer? Was it easy or hard to remember the exercises you did during the past week? *(If the participant says it was hard ask about what made it difficult.)*
  6. What do you think of the answer choices? Do the answer choices match the question? Was it easy or hard to choose an answer? *(If the participant says it was hard ask about what made it difficult.)*
  7. In general, are there any words in this question that are confusing or strange to you? *(If participant said something was confusing or strange, ask why and how they would change it)*
  8. What do you think of the examples listed?
  9. Is the question too long?
  - ★ 10. What we really want to get at here is to find out how often people do exercises that increase their heart rate, make them breath harder or out of breath, such as running, jogging, playing basketball, doing jumping jacks, Zumba, jumping ropes, etc. What would you call this type of exercise?
  11. Afterwards, probe about whether they know about aerobic exercise or cardio exercise, ask them to explain the meaning.
  12. Is there a better way to ask this question?
-

**Start Time:** \_\_\_\_\_

***[Tell participants that you now want them to read question 2]***

*Q2. In the past week, how many days did you do muscle toning workouts on purpose? This includes things like lifting weights or doing push-ups, sit-ups or squats.*

***[Ask:]***

- ★ 1. Could you read question 2 aloud?  
Now in your own words, could you please tell me what do you think the question is asking?
  
- ★ 2. When answering this question, what does the term “muscle toning workouts” mean to you? *(Ask participants to give examples of activities)*  
  
We provided some examples here, are there any other muscle toning activities you do more often that’re not included?
  
- ★ 3. ***[SKIP this question if participants mentioned “on purpose” in any way, such as intentionally, meant to do, consciously]***  
  
We underlined the phrase ‘on purpose’ here. Did you noticed that term while you were answering the questions? What did that mean to you?
  
- ★ 4. You picked [X], how did you come up with that answer?
  
- ★ 5. ***[SKIP this question if they already mentioned the muscle workouts they did]***  
When you were deciding what answer to choose, what workouts that you did were you thinking about?)

6. How sure were you of your answer? Was it easy or hard to remember the muscle toning activities you did during the past week? *(If the participant says it was hard ask about what made it difficult.)*
7. I know the answer choices for question 2 are the same as question 1, so do you have any other comments about the answer choices? Do you think the answer choices match question 2? Was it easy or hard to choose an answer? *(If the participant says it was hard ask about what made it difficult.)*
8. In general, are there any words in this question that are confusing or strange to you? *(If participant said something was confusing or strange, ask why and how they would change it)*
- ★ 9. ***[If the participant understand the question, then ask: ]***  
Is there a better way to ask this questions? How would you reword it so that it will be easier to understand by other people?

***[If the participants did not understand the question, then ask]***

What we really want to get here is to find out how often people do exercises that really work out your muscles, such as lifting weights or doing push-ups. If we would like to measure this, what would you call this type of workouts? How would you reword the question?

---

Start Time: \_\_\_\_\_ End Time: \_\_\_\_\_

***[Tell the participants that you now want them to read question 3]***

*Q3. How often do you make small changes on purpose to be more active?  
This includes things like getting off the bus one stop early, doing a few  
minutes of exercise, or moving around instead of sitting while watching TV.*

***[Ask:]***

- ★ 1. Could you read question 3 aloud?  
Now tell me, in your own words, what do you think question 3 is asking?
- ★ 2. What do you think of the examples provided? Are there any other small changes that you did in order to be more active that are not included?
- 3. Are there any words in this question that are confusing or strange to you?
- ★ 4. You picked [X], how did you come up with that answer?
- 5. ***[SKIP this question if they already mentioned what they did]***  
When you were answering question 3, what small changes did you make to be more active?)
- 6. How sure were you of your answer?
- ★ 7. The answer choices are a little different for question 3. What do you think of the answer choices? Do they match the question? Do you rather like to have 0-7 days like the previous questions?



8. ***[If the participant understand the question, then ask]***

Is there a better way to ask this questions? How would you reword it so that it will be easier and understandable by other people?

***[If the participant does not understand the question, then ask]***

What we really want to get here is to find out how often people make an effort or do things differently or make a conscious choice to be more active in their daily lives, even though it is not strict exercise. If we would like to measure this, how would you reword the question?

[Probe for their wording, but if all they will say is, "I don't know" ask them if the words "do things differently" or "make a choice" were better at making them understand what was meant by "*make small changes on purpose*". Write down all they say and which helped most.

**Appendix XII Physical Activity Readiness Questionnaire (Screeners)**

Name:

Age:

YES	NO	
		1. Has your doctor ever said that you have a heart condition <u>and</u> that you should only do physical activity recommended by a doctor?
		2. Do you feel pain in your chest when you do physical activity?
		3. In the past month, have you had chest pain when you were not doing physical activity?
		4. Do you lost your balance because of dizziness or do you ever lost conscious?
		5. Do you have a bone or joint problem (for example, back, knee, or hip) that could be made worse by a change in your physical activity?
		6. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?

		7. Do you know of <u>any other reason</u> why you should not do physical activity?
--	--	--



## **Appendix XIII Participant Information Sheet**

### **How to Use the Activity Device**

- ✓ **WEAR** the device every day **all day** for the next 7 days.  
From \_\_\_\_\_  
to \_\_\_\_\_.
- ✓ **REMOVE** the belt just before going to bed. Leave it on a table or dresser where you will be sure to see it and put it on first thing the next morning.
- ✓ **PUT** your belt on each morning when you get out of bed.



- ✓ **BE SURE** the device is on the right side of your waist right above your hip bone. The black button should be facing up.
- ✓ **BE SURE** the belt fits tightly around your waist. You can wear it under or above your clothes.
- ✓ **DO NOT** drop it.
- ✓ **DO NOT** let it get wet. Remove the belt when you get into the shower or bathtub, when you swim and if you play any sports that could get it wet.
- ✓ **BE SURE** to put it back on when you are out of the water.
- ✓ If you forget to put it on for any part of the **day put it on as soon as you remember**.
- ✓ Please **note** in your diary why you take the belt off and what time you take it off.
- ✓ Please **do not forget** to bring it back in 7 days to the place you agreed at the time you are to be there. You will not receive your payment if it is not returned.

Note: You do not need to worry about turning it on or off. The activity monitor runs on a battery. It runs all the time. Please do not try to open it.

## **Appendix XIV Activity Monitor FAQs**

✓ **What's an activity monitor?**

An activity monitor is a small device that records information about peoples' movements, like walking. It allows us to get a better idea of your overall activity level.



✓ **Is it safe?**

The device is safe and uses a battery similar to a watch. It is **NOT** a GPS tracking device, so it does not track where you are. Many studies with children and adults have used this device.

✓ **How to wear the activity monitor?**

Wear the monitor attached to the belt around your waist, just above your right hip bone. You can wear it either under or on top of your clothing, but it should fit snugly around your waist. Wear the belt tight enough that the device does not move when you are moving. At first, the belt may feel slightly awkward, but after a few hours, you will get used to it and not notice it as much.

✓ **How long and when to wear the activity monitor?**

We ask that you wear the monitor for 7 days, during all waking hours. Please put it on first thing in the morning- either just after you get out of bed or just after you shower or take a bath in the morning. It is **NOT** waterproof and should be removed during bathing or swimming. Please remember to fill in the dairy to write the exact time to put on and off the monitor and the activities you did during non-wear time.

✓ **Who do I contact if I have questions?**

If you have any questions or concerns regarding the study, please do not hesitate to call Cheng Li at 732-259-0947 or email [cl852@scarletmail.rutgers.edu](mailto:cl852@scarletmail.rutgers.edu)!

Subject ID: \_\_\_\_\_

**Appendix XV Activity Monitor Log**

Date Assigned:

*(Please return this form with your activity monitor)*

Accelerometer ID: \_\_\_\_\_

\_\_\_\_/\_\_\_\_/\_\_\_\_ (mm/dd/yyyy)

At the table below, you see an example of how to fill in the log. Write down the dates and days on which you wear the activity monitor.

Note the times that you put it on and take it off during each day (e.g., for getting up in the morning and going to bed for sleeping). If you put it off for more than 5 minutes please write this down below and for what reason (e.g. showering, etc.)

Date	6-19-2017	6-20-2017	6-21-2017	6-22-2017	6-23-2017	6-24-2017	6-25-2017	6-26-2017
Weekdays	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday
Time On	7:30 AM	8:00 AM	7:45 AM	8:00 AM	7:45 AM	10:00 AM	9:30 AM	8:00 AM
Time Off	5:30 PM take shower	6:00 PM take shower	5:45 PM take shower	5:30 PM take shower	6:10 PM shower	1:00 PM swim with kids & shower	12:00 PM shower	2:30 PM (give back to researchers)
Time On	5:45 PM	6:30 PM	6:00 PM	6:00 PM	6:30 PM	3:00 PM	12:30 PM	
Time Off	10:30 PM go to bed	11:00 PM go to bed	10:30 PM go to bed	10:45 PM go to bed	10:50 PM sleep	11:00 PM sleep	5:00 PM shower	
Time On							5:30 PM	
Time Off							11:00 PM go to bed	
Muscle strengthening activities (e.g., push-ups, sit-ups, lifting weights)	push-ups.	sit-ups	planks	none.	N/A	N/A	N/A	N/A.

**DON'T FORGET TO FILL THIS TABLE IN DURING THE NEXT 7 DAYS ON THE BACK!**

Date								
Weekdays	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday
Time On								
Time Off								
Time On								
Time Off								
Time On								
Time Off								
Muscle strengthening activities (e.g., push-ups, sit-ups, lifting weights)								
Extra activities (e.g., taking the stairs instead of elevators, parking further in the parking lot.)								

## **Appendix XVI Data Request Approval**



United States Department of Agriculture

Research, Education, and Economics  
Agricultural Research Service

December 19, 2018

*Sent via email*  
C1852@scarletmail.rutgers.edu

Cheng Li, MS  
Graduate Assistant  
Department of Nutrition Sciences  
Expanded Food and Nutrition Education Program

Dear Ms. Li,

This letter is in response to your Freedom of Information Act (FOIA) request, dated November 27, 2018, for "EFNEP's annual data from REEport for fiscal year 2018."

Your request was received by the Research, Education, and Economics (REE) FOIA office of USDA on November 27, 2018. Your request was assigned tracking number 2019-REE-01158-F, and processed under the FOIA, 5 U.S.C. § 552.

A search for responsive records was conducted in the National Institute of Food and Agriculture (NIFA). The search located the EFNEP Food and Physical Activity Questionnaire data for FY18, which consists of one Excel file. The record is being released in full, with no FOIA exemptions applied.

If you have any questions or would like to discuss any aspect of your request, please contact this office at 301-504-1655. You may also reach our FOIA Public Liaison or FOIA Requester Service Center at 301-504-1743 or REEfoia@ars.usda.gov.

Sincerely,

*JD Wyllie*

JD Wyllie  
Director  
Office of Communications

Enclosure: Responsive Record

Office of the Director  
Office of Communications  
5601 Sunnyside Avenue, Mail Stop 5128, Beltsville, MD 20705-5128  
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