Original Article

Translation and cross-cultural adaptation of the Pregnancy Physical Activity Questionnaire (PPAQ) to Japanese

Masayo Matsuzaki[1,*], Megumi Haruna[1], Erika Ota[1], SeonAe Yeo[2], Ryoko Murayama[1], Sachiyo Murashima[3]

[1] *Department of Midwifery and Women's Health, Division of Health Sciences & Nursing, Graduate School of Medicine, The University of Tokyo, Tokyo, Japan;*
[2] *The University of North Carolina at Chapel Hill, School of Nursing, Chapel Hill, USA;*
[3] *Department of Community Health Nursing, Division of Health Sciences & Nursing, Graduate School of Medicine, The University of Tokyo, Tokyo, Japan.*

Summary **The aim of this study was to conduct a translation and cross-cultural adaptation of the Japanese version of the Pregnancy Physical Activity Questionnaire (PPAQ) that consisted of 36 items. We translated and adapted the PPAQ to the Japanese culture. This procedure included a forward step (stages I and II, translations and synthesis), quality control (stage III, back translation, and stage IV, expert committee review), and pre-testing (stage V). In the pre-test, the preliminary Japanese version was tested on ten Japanese pregnant subjects. The content, semantic, technical, conceptual, and experiential equivalents of cultural adaptation were discussed by the research members at each step. In the results section, one new item was added to address "riding a bicycle in order to go to a certain place other than for recreation or exercise", because many Japanese women often use a bicycle. The average age of the pregnant subjects in the pre-test was 32.7 years of age. The response time ranged from 5 to 15 min. Two subjects responded that they rode a bicycle under the new item. The preliminary Japanese version of the questionnaire was revised to reflect the opinions of pregnant subjects for cross-cultural adaptation, including the semantic, experiential, and technical equivalents. The consensus of content and conceptual equivalents of the pre-final version of PPAQ by discussion among the research members was obtained throughout these processes. The original developer approved all revisions. In conclusion, the pre-finalized Japanese version of the PPAQ was indicated to have cross-cultural equivalency with the original English version.**

Keywords: Cultural adaptation, instrument, pregnancy, physical activity, translation

1. Introduction

Physical activity has received significant attention in public health policies. Healthy pregnant women also are encouraged to exercise daily for 30 min at a moderate intensity by the American College of Obstetricians and Gynecologists or least at 120 min a week by the American College of Sports Medicine (*1,2*). A previous study reported that physical activity reduces the risk of maternal complications (*e.g.* gestational diabetes, preeclampsia, and postpartum weight retention) (*3-7*).

However, the prevalence of physical activity participation, which is defined as more than 30 min a time, twice a week and more than one year was found to be 14.6% and 14.0% among subjects of reproductive age, which is defined to be 20-29 and 30-39 years of age in the Japanese population (*8*). Although this prevalence is the lowest among other age groups, encouraging exercising has been not the rule in clinical obstetrics during subjects' gestation period. In addition, the appropriate amount of physical activity required for preventing pregnancy complications remains unknown, and no intervention studies have yet measured the physical activity among pregnant women subjects in

**Address correspondence to:*
Dr. Masayo Matsuzaki, Department of Midwifery and Women's Health, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan.
e-mail: msumi-tky@umin.ac.jp

Japan. Because there were no feasible tools in the form of a validated questionnaire that measures the physical activity of pregnant women in Japan.

The questionnaire is a simple tool for assessing physical activity in large populations for various applications, including epidemiologic research or public health surveillance. It is easy to administer, cost-effective, non-invasive, and allows the accurate estimation of the intensity of physical activity. Physical activities include both occupational, sports and exercise activities, and household and caregiving duties. Most married couples do not equally share the household and caregiving duties in Japan. A previous study showed that 67% of 7,771 wives performed all of the household duties, and 65.2% of 6,991 subjects performed all of the caregiving (*9*). Therefore, an accurate physical activity questionnaire for pregnant Japanese women must include the household and caregiving activities. Although the CARDIA physical activity, Minnesota Leisure-Time Physical activity and YEAL Physical activity questionnaires include household activity, these questionnaires do not include items that address caregiving activity, and they are furthermore not designed to assess the physical activity in pregnant women (*10*).

The pregnancy physical activity questionnaire (PPAQ) is the only widely available tool for assessing a pregnant woman's physical activity (*11*,*12*). The PPAQ is a semi-quantitative questionnaire that asks the respondents to report on the time spent participating in 32 activities, including household/caregiving activities (13 activities), occupational (5 activities), sports/ exercise (8 activities), transportation (3 activities), and inactivity (3 activities) (*11*). The respondents are asked to select a category for each activity to the nearest amount of time spent per day or week. The duration ranges from 0 to 6 or more hours per day, and from 0 to 3 or more hours per week during the subject's current trimester. An open-ended section at the end of the PPAQ allows each respondent to add activities not already listed. Self-administration of the PPAQ in English takes approximately 10 min. The PPAQ is short in length, self-administered, and easily understood by respondents in a variety of settings, making it useful for epidemiologic research and health education during pregnancy. The original English version of PPAQ has been also used in an intervention trial to measure the physical activities among pregnant women for preventing pregnancy complications such as gestational diabetes (*13*). Therefore, the goal of measuring physical activity among pregnant women was to clarify the intensity and amount of physical activity for preventing pregnancy complications in Japan, and to provide initial information for health care providers about the current activity levels in pregnant women.

The aim of the present study was to develop a Japanese version of the PPAQ, which was originally designed to measure the physical activity of pregnant women with a careful cross-cultural adaptation of the assessment content, semantic, technical, conceptual, and experiential equivalents.

2. Methods

2.1. *Translations and cross-cultural adaptation*

Lisa Chasan-Taber, one of the original authors of the PPAQ, granted permission for the development and use of a Japanese version of PPAQ. A discussion of the conceptual equivalence, which ensures that the measuring instrument is the same in each culture and the technical equivalents and that the method of assessment (*e.g.* pencil and paper, interview) is comparable in each culture, was performed by the research members before the forward translation. The research team included an expert in prenatal care, midwifery researchers and graduate students of midwifery (MM, MH, EO, and SY).

Table 1 shows the Japanese version of PPAQ based on the methods proposed by Acquadro (*14*), Guillemin (*15*), Beaton (*16*), and Frayers (*17*) with a slight modification. These included a forward step (stages I and II, translations and synthesis), quality control (stage III, back translation; and stage IV, expert committee review), and pre-test (stage V, pre-testing). The content, semantic, technical, conceptual, and experiential equivalents of cultural adaptation were discussed by the research members at each step (*18*). The recommendations of these steps and stages throughout the cross-cultural adaptations were as follows. The forward step: stage I, which recommends that two Japanese translations be made by informed and uninformed translators. Stage II recommends the merging of the two translations from stage I. In stage II, any discrepancies are resolved with the translators reports. The next step is the quality control stage III, which requires back-translation into English. Two translators whose first language is English created the two back-translations. Stage IV requires an expert committee review. For the committee, a methodologist, developer, language professional, and several translators are recommended. All reports of the translators are reviewed to reach a consensus on discrepancies, and to produce a pre-final version. The final step is the pre-test, or stage V, which indicates the pre-testing. The Japanese version of the PPAQ is completed and tested to obtain a proper understanding of the items. Between 10 and 40 persons are recommended to be tested (*16*,*17*).

2.1.1. *Forward step*

A Japanese graduate student (MM) who was aware of the purpose of study performed one translation in Stage I of the forward step (T1). The translator was provided supervision from an associate professor (SY) in a

Table 1. The step and stage of cross-cultural adaptation recommended and adaptation our process

	Recommendation	Our process
Forward step*	Stage I: Translation**	Stage I: Translation
	Two translations (T1 & T2) into target languege informed + uninformed translator	T1: Japanese graduate student (informed translator) T2: supervised T1 from an associate professor of a university in the United States
	Stage II: Synthesis**	Stage II: Synthesis
	synthesis T1 & T2 into T-12 resolve any discrepancies with translators reports	synthesis T1 & T2 into T-12 resolve any discrepancies with translators reports discussion quality of T-12 by reseach members interview one pregnant woman and two postpartum women about T-12
Quality control*	Stage III: Back translation**	Stage III: Back translation
	two English first-language native to outcome measurement	BT1: one English first-language in translation agency BT2: Japanese graduate student who had stayed for 7 years in America (uninformed translators)
	work from T-12 version create 2 back translations BT1 & BT2	work from T-12 version synthesis BT1 & BT2 into BT-12
	Stage IV: Expert committee review**	Stage IV: Expert committee review
	review all reports methodologist, developer, language professional, translators reach consensus on discrepancies produce pre-final version	review all reports midwives and researchers reach consensus on discrepancies produce pre-final version
Pre-test*	Stage V: Pre-testing**	Stage V: Pre-testing
	n = 10-40 complete questionnaire probe to get at understanding of item	*n* = 10 complete questionnaire probe to get at understanding of item

The recommendations were proposed by * Acquadro (2008), and ** Guillemin (1993), Beaton (2000), and Frayers (2000).

university in the United States (T2).

The research members then discussed the brief, clearly worded, easily understood, unambiguous, and easy responses to the questionnaire, and combined the T1 and T2 into T-12 during Stage II. Thereafter, one Japanese pregnant subject and two postpartum subjects who were not aware of the purposes of the study were interviewed to determine whether they unambiguously understood and could easily respond to T-12, and if the PPAQ addressed their physical activities during pregnancy. The research members reached a consensus on T-12 based on those results. The quality of T-12 on the conceptual equivalence and the semantic equivalence ensured that the meaning of each item was the same in each culture after the translation into the language and idioms (written or oral) of each culture. Proper instruction ensured that the questionnaire was applicable to pregnant women. The included items and the response choices were verified to have maintained equivalent content, ensuring that the content of each questionnaire item was relevant to the practices of each culture.

2.1.2. *Quality control*

Back-translation (BT1) was performed in Stage III by a native English speaking professional in a translation agency. In addition, a Japanese graduate student (CI) who had lived for 7 years as a graduate student in the United States performed another back-translation (BT2). BT1 and BT2 were combined into BT-12. These translators were not aware of the purpose of the study and were blinded from the English version of the PPAQ.

The original version and BT-12 were compared and the content, semantic, technical, conceptual, and experiential equivalents were discussed by the research members during Stage IV. The preliminary Japanese version of the PPAQ was produced by the research members who participated in this study.

2.1.3. *Pre-test*

The preliminary Japanese version of PPAQ was pre-tested by ten Japanese pregnant women in stage V to assess the degree of cultural adaptation and to address any potential problems. Ten pregnant subjects who visited a hospital in Tokyo for a checkup from 17 to 20 October 2006 were recruited. All of the subjects participated in this study. During their hospital visit, participants were asked to complete the preliminary Japanese version of the PPAQ, and the researchers collected it in person.

The researchers interviewed the subjects to document any problem that occurred during the administration of the preliminary Japanese version of the PPAQ. These included any ambiguities or difficult phrasing of the questions and responses, or the layout and flow of the questions. Abstract problems were discussed by the research members and the original developer to produce the pre-final Japanese version of the PPAQ.

2.2. *Ethical considerations*

The study protocol was approved by the Institutional Review Board of the University of Tokyo. Written informed consent was obtained from all participants.

2.3. *Data analysis*

A quantitative and qualitative analysis of the data of the pre-test was conducted, including the subject response time, the distribution of the item responses and the contents of the interviews. A quantitative analysis was used to identify practical equivalents, such as the participants' workload. A qualitative analysis was used to identify the semantic, experiential, technical, and practical equivalents.

3. Results

The original developer and the research team included an expert in prenatal care, midwifery researchers and graduate students of midwifery (MM, MH, EO, and SY), who discussed the results of the forward step, quality control, and the pre-testing.

3.1. *Forward step*

The concepts of the subscale were confirmed by the research members before the forward step. The content and experiential equivalents of T1, T2, and T-12 were discussed. Some of the language was altered to improve the experiential equivalence. The only significant changes involved conversion from English measurements (gallons, pounds) to the metric equivalents (liters, kg) for item 33.

Items 18 and 19 in the original PPAQ refer to the use of a lawnmower, which is not commonly used in Japan. However, it was not deleted or altered, because there are times when a lawnmower is used such as in local regions or in luxury housing. Next, an item (20-2) was added, which addressed "riding a bicycle for reasons other than for recreation or exercise (to catch a bus, to go to work, or to visit a place, *etc.*)", since Japanese women often use a bicycle for basic transportation.

An interview of one Japanese pregnant subject and two postpartum subjects revealed that the wording of questions in T-12 were not ambiguous, difficult or poorly worded and appropriately assessed physical activity. Research members decided that the PPAQ has sufficient content equivalence, because the content of each item of the instrument was relevant to the specific aspects of Japanese culture. PPAQ has sufficient technical equivalents for data collection with the original version which was self-administered, because this method is widely used in Japan.

3.2. *Quality control*

The content, semantic, technical, concept, and experiential equivalents of the back translated Japanese version of PPAQ (BT-12) were discussed by the research members. BT-12 was determined to have sufficient content equivalence, because the items that addressed physical activities were relevant to and consistent with Japanese culture. The responders described the time spent on each activity relevant to household/caregiving tasks, occupational, and sports/exercise in BT-12. BT-12 did not address the feelings or thoughts of pregnant subjects (*19*). Therefore, there were no items that had different meanings in the original and Japanese versions of the PPAQ. BT-12 was determined to have sufficient semantic equivalency. The layout and format of the instruments in the English version were maintained in the BT-12 for the technical equivalent.

Item 10 of the original version read, "Taking care of an older adult". This concept also includes nursing. However, research member asked whether "taking care of" included communication, such as conversations, with the older adult. The concept of "taking care" varied with individual subjects, since Japanese women often live with healthy elderly relatives. Item 10 was determined to have an insufficient conceptual equivalent. This item was modified to "Taking care (nursing) of an older adult".

The instructions were found to have a problem of experiential equivalence. The original instructions referred to "During this trimester", which was difficult to understand. Pregnant subjects did not accurately recognize the separation of each of the trimesters. Therefore, this was changed to "during the last month". These considerations yielded a preliminary Japanese version of the PPAQ.

3.3. *Pre-test*

3.3.1. *Characteristics of pregnant women*

The ten pregnant subjects had a mean age of 32.7 (range: 25-38) years of age, a mean gestational age of 27.3 (range: 16-37) weeks, and a mean pre-pregnancy BMI of 19.5 (range: 16.8-22.2; Table 2). Five pregnant subjects had an educational background beyond a college degree. Five of the subjects had undergone fertility treatment.

Table 2. Patients characteristics (*n* = 10)

	n	Mean ± S.D. (range)
Age		
25-30	4	32.7 ± 4.5 (25-38)
31-35	2	
36-40	4	
Gestational weeks		
< 16	0	27.3 ± 7.2 (16.5-37.0)
16-27	6	
28-37	4	
Pre-pregnancy BMI* (kg/m^2)		
12-20	7	19.5 ± 1.7 (16.8-22.2)
21-25	3	
Parity		
0	9	
2	1	
Regular exercise**		
Yes	3	
No	7	
Residence		
Big city	7	
Urban area	1	
Rural area	1	
No information	1	
Occupation		
Full-time house wife	3	
On maternal leave	1	
Currently employed	6	
Education		
High school graduate	1	
Junior college graduate	3	
College graduate	4	
Post grad or professional degree	1	
No information	1	

* BMI: body mass index; ** Regular exercise: exercise of more than 30 min a time, twice a week.

3.3.2. *Quantitative assessment of the pre-final Japanese version*

Pregnant subjects completed all items of the questionnaire. There were no missing data on any items. All pregnant women responded "not at all" for item 10: Take care (Nursing) of elderly person, item 18: Mowing grass and weeds using a ride-on lawnmower, item 26: Jogging, item 29: Dance, and item 31: an open-ended section which allows each respondent to add activities not already listed. These items were left in the questionnaire by research members to internationally compare the physical activity. Two of ten pregnant women responded that they rode a bicycle other than for recreation or exercise, in order to go somewhere (to catch a bus, to go to work, or to visit a place, *etc.*) as a new item. The remaining eight pregnant women responded "not at all".

The response time for the questionnaire was approximately 5 to 10 min. All pregnant subjects reported that it was easy to complete the responses to the preliminary Japanese version of the PPAQ.

3.3.3. *Qualitative analysis of the pre-final Japanese version*

Several difficulties in answering the items were present in the pre-test. The difficulties may have arisen from the wording of items or other causes, mainly a confusing situation; sitting, standing, running, walking slowly, and walking fast. Table 3 summarizes the difficulties that were identified in the pre-test, and the items that were changed following the committee review.

Item 16 presented a problem in semantic equivalent. The word "Shopping (for food, clothes, or other items)" appeared in item 16. Pregnant women reported that shopping was different every day. They spent a significant amount of time shopping during the holidays. Instructions concerning "average physical activity" were added: "We would like to know some information about your average physical activities during the last month".

Item 2 presented a problem in experiential equivalents. Item 2 in the original version read, "When was the first day of your last period?" This question was included to determine the pregnancy trimester. Japanese pregnant women are aware of gestational weeks. Most pregnant women initially undergo an early dating ultrasound scan at 10 to 12 weeks' gestation to accurately determine gestational dating in Japan. The item was modified to "As of today, how many weeks have you been pregnant?"

The response method presented a problem in the technical equivalent. The original instructions stated "Fill in the circles completely". However, pregnant women found that "Fill in the circles completely" was difficult. The instructions were modified to "Please check the box of the corresponding answer".

Several pregnant women reported that they were confused due to the decision branches, which were a day or a week. Consequently, researchers provided an explanation that each item has a different branch prior to administering the preliminary Japanese version of the PPAQ. Other subjects found some items confusing because of similar wording: walking slowly to go somewhere, walking quickly to go somewhere, and so on. Similar wordings were highlighted by underlining to prevent confusion. The original developer approved all revisions, and the pre-final Japanese version of the PPAQ was completed.

4. Discussion

The present study described the cross-cultural

Table 3. Items in original wording, number of patients who commented on the item, expressed difficulties due to wording of items or other causes in the pretested version, and an indication of whether items were changed after the pre-test

Number	Item with the original wording	Commented on the item	Difficulties due to wording of items	Difficulties due to other causes	Changed after pre-test
Instruction	**It is very important you tell us about yourself honestly. There are no right or wrong answers. We just want to know about the thing you are doing during this trimester.**				Yes
1	Today's date	0	0	0	Yes
2	What was the first day of your last period?	0	0	0	No
3	"When is your baby due? (month/day/year) ○I don't know."	0	0	0	Yes
Instruction	**During this trimester, when you are NOT work, how much time do you usually spend:**	0			Yes
4	Preparing meals (cook, set table, wash dishes)	0	0	0	No
5	Dressing, bathing, feeding children while you are sitting	2	0	0	No
6	Dressing, bathing, feeding children while you are standing	1	0	0	No
7	Playing with children while you are sitting or standing	1	0	0	No
8	Playing with children while you are walking or running	1	0	0	No
9	Carrying children	1	0	0	No
10	Taking care of an older adult	1	0	0	Yes
11	Sitting and using a computer or writing, while not at work	1	0	1	No
12	Watching TV or a video	1	0	1	No
13	Sitting and reading, talking or on the phone, while not at work	1	0	1	No
14	Playing with pets	0	0	0	No
15	Light cleaning (make beds, laundry, iron, put things away)	0	0	0	No
16	Shopping (for food, clothes, or other items)	2	0	2	No
17	Heavier cleaning (vacuum, mop, sweep, wash windows)	0	0	0	No
18	Mowing lawn while on riding mower	0	0	0	No
19	Mowing lawn using a walking mower, raking, gardening	0	0	0	No
Instruction	**Go places (to catch a bus, to go to work, or to visit a place, *etc.*):**				
20-1	Walking, slowly to go places (such as to the bus, work, visiting) Not for fun or exercise	4	4	0	No
20-2	Riding a bicycle for reasons other than for recreation or exercise	4	4	0	No
21	Walking, quickly to go places (such as to the bus, work, or school) Not for fun or exercise	0	0	0	No
22	Driving or riding in a car or bus to go places (such as to the bus, work, or school)	3	0	3	No
Instruction	**For fun or exercise:**				
23	Walking slowly for fun or exercise	1	1	0	No
24	Walking more quickly for fun or exercise	0	0	0	No
25	Walking quickly up hill for fun or exercise	0	0	0	No
26	Jogging	0	0	0	No
27	Prenatal exercise class	1	1	0	No
28	Swimming	0	0	0	No
29	Dance	0	0	0	No
30	Doing other things for fun or exercise? Please tell us what they are.	4	3	1	No
31	Name of activity	0	0	0	No
Instruction	**Please fill out the next section if you work for wages, as a volunteer, or if you are student. If you are a home maker, out of work, unable to work, you do not need to complete this last section. At work….**				
32	Sitting at working or in class	3	0	3	No
33	Standing or slowly walking at work while carrying things (heavier than a 1 gallon milk jug)	4	0	4	No
34	Standing or slowly walking at work not carrying anything	3	0	3	No
35	Walking quickly at work while carrying things (heavier than a 1 gallon milk jug)	3	0	3	Yes
36	Walking quickly at work not carrying anything	3	0	3	No
"Decision branch"	○None	0	0	0	No
	○Less than 1/2 hour per week	0	0	0	No
	○1/2 to almost 1 hour per week	0	0	0	No
	○1 to almost 2 hours per week	0	0	0	No
	○2 to almost 3 hours per week	0	0	0	No
	○3 or more hours per week	0	0	0	No
	○None	0	0	0	No
	○Less than 1/2 hour per week	0	0	0	No
	○1/2 to almost 2 hours per week	0	0	0	No
	○2 to almost 4 hours per week	0	0	0	No
	○4 to almost 6 hours per week	0	0	0	No
	○6 or more hours per week	0	0	0	No
	○None	0	0	0	No
	○Less than 1/2 hour per day	0	0	0	No
	○1/2 to almost 1 hour per day	0	0	0	No
	○1 to almost 2 hours per day	0	0	0	No
	○2 to almost 3 hours per day	0	0	0	No
	○3 or more hours per day	0	0	0	No
	○None	0	0	0	No
	○Less than 1/2 hour per day	0	0	0	No
	○1/2 to almost 2 hours per day	0	0	0	No
	○2 to almost 4 hours per day	0	0	0	No
	○4 to almost 6 hours per day	0	0	0	No

adaptation process of the revised PPAQ from English into Japanese. Experts in prenatal research produced a pre-final Japanese version of the PPAQ after translation and cross-cultural adaptation.

One item (20-2) was added, which addressed "riding a bicycle for reasons other than for recreation or excise (to catch a bus, to go to work, or to visit a place, *etc.*)", since Japanese women often use a bicycle for basic transportation. Two out of ten pregnant women responded that they rode a bicycle. A previous study reported that 50% of 141 Japanese pregnant women responded that they were "not riding a bicycle" and less than 10% responded "easily riding a bicycle" (*20*). Therefore, few pregnant women appeared to regularly ride a bicycle in Japan. In addition, the amount of energy expenditure of bicycling is 8 metabolic equivalents (METs), the same as water jogging. The question on bicycling was included to assess the comprehensive activity of pregnant Japanese women. Item 33 of the original PPAQ was changed from "1 gallon milk jug" to "3 kg bag of rice". This change was appropriate because all pregnant women understood it. There were no missing data in any items in the pre-test, and the response time was very short. These results suggest that the Japanese version of the PPAQ was easily understood and was easy to respond to.

All pregnant women selected identical answers in five items; item 10, 18, 26, 29 and 31. All of these responses were "not at all". The presence of floor effects with an excess of minimum values indicates that the item or scales will have a poor level of discrimination. Therefore, the overall sensitivity and responsiveness is reduced (*17*). However, the cause of these floor effects was thought to be that the participants are more limited. Most of the pregnant women in this study living in an urban area, were primiparous, and had an occupation. A more varied population would have yielded a greater variation in the responses.

The Japanese recommendations for Maternity Safekeeping of exercise or sports during pregnancy is that healthy pregnant women should engage in physical activity less than twice or thrice a week at 60-min intervals at a moderate level of intensity, according to the Japanese Society of Clinical Sports Medicine (*21*). A previous study reported that approximately 90% of 648 pregnant women who had been regularly exercising simply engaged in walking (*22*). Therefore, the floor effects of the jogging and the dance items may reflect the lack of information and evidence about exercise and sports during pregnancy in Japan. Despite the recommendation of exercise during pregnancy in other countries (*1*,*2*), the levels of activity required for favorable pregnancy outcomes remain to be determined in Japan. The use of the Japanese version of the PPAQ in further research may provide evidence for the level of physical activity required during pregnancy in Japan. Several pregnant women confused their responses due to similar wording. Sudman and Bradburn (1982) focused on wording and designing questionnaires. They stated that it was important to use underlining, bold or italics to draw patients' attention to the differences when two or more questions are similar in their wording (*23*). Therefore, using underlining for similar wording is appropriate.

This study had several limitations. First, the sample size of the pre-test was small, and the participants were not representative of the national population. Second, the results of the pre-test showed the presence of floor effects in partial items. Third, to complete the Japanese version of the PPAQ, additional validation study will be necessary. Therefore, further research will establish additional validity to determine the significant associations between the PPAQ physical activity levels and a validated ActiGraph accelerometer (Fort Walton Beach, FL) or a pedometer, measuring the physical activity levels. Our project team is researching the additional validity and reliability study of the Japanese version of PPAQ among Japanese pregnant women.

5. Conclusion

The present study translated and adapted the original PPAQ to the Japanese culture. The pre-final Japanese version of the PPAQ was indicated to be functional in the pre-test. The translated and cross-culturally adapted form of this established instrument of assessing physical activity may provide an important perspective for preventing pregnancy complications and maintaining a healthy life for the fetuses and pregnant women during pregnancy.

Acknowledgements

This study was funded by the Japan Academy of Midwifery (2007). The authors would like to thank Dr. Chasan-Taber, the original PPAQ developer, the midwife staff and the participants themselves from the University of Tokyo Hospital and Chiaki Ito, who performed the back-translations.

References

1. American college of sports medicine. ACSM's Guidelines for Exercise Testing and Prescription. 6th ed., Lippincott Williams & Wilkins, Philadelphia, PA, USA, 2000.
2. American College of Obstetricians and Gynecologists. Exercise during pregnancy and the postpartum period. Clin Obstet Gynecol. 2003; 46:496-499.
3. Yeo S, Steele NM, Chang MC, Leclaire SM, Ronis DL, Hayashi R. Effect of exercise on blood pressure in pregnant women with a high risk of gestational hypertensive disorders. J Reprod Med. 2000; 45:293-298.
4. Rudra CB, Williams MA, Lee IM, Miller RS, Sorensen TK. Perceived exertion during prepregnancy physical

activity and preeclampsia risk. Med Sci Sports Exerc. 2005; 37:1836-1841.
5. Kim C, Brawarsky P, Jackson RA, Fuentes-Afflick E, Haas JS. Changes in health status experienced by women with gestational diabetes and pregnancy-induced hypertensive disorders. J Womens Health (Larchmt). 2005; 14:729-736.
6. Dempsey JC, Sorensen TK, Williams MA, Lee IM, Miller RS, Dashow EE, Luthy DA. Prospective study of gestational diabetes mellitus risk in relation to maternal recreational physical activity before and during pregnancy. Am J Epidemiol. 2004; 159:663-670.
7. Chasan-Taber L, Schmidt MD, Pekow P, Sternfeld B, Manson J, Markenson G. Correlates of physical activity in pregnancy among Latina women. Matern Child Health J. 2007; 11:353-363.
8. Ministry of Health, Labour and Welfare of Japan. The National Health and Nutrition Survey in Japan. Daiichi-shuppan, Tokyo, Japan, 2005.
9. Kōsei Jinkō Mondai Kenkyūjo. Henshū Kōseishō Gendai. Nihon no kazoku ni kansuru ishiki to jittai: Dai 3-kai zenkoku katei dōkō chōsa. Tokyo, Kōsei Tōkei Kyōkai, Tokyo, Japan, 2003.
10. LaPorte RE, Montoye HJ, Caspersen CJ. Assessment of physical activity in epidemiologic research: Problems and prospects. Public Health Rep. 1985; 100:131-146.
11. Chasan-Taber L, Schmidt MD, Roberts DE, Hosmer D, Markenson G, Freedson PS. Development and validation of a Pregnancy Physical Activity Questionnaire. Med Sci Sports Exerc. 2004; 36:1750-1760.
12. Ota E, Haruna M, Yanai H, Suzuki M, Anh DD, Matsuzaki M, Tho LH, Ariyoshi K, Yeo S, Murashima S. Reliability and validity of the Vietnamese version of the pregnancy physical activity questionaire (PPAQ). Southeast Asian J Trop Med Public Health. 2008; 39:562-570.
13. Chasan-Taber L, Marcus BH, Stanek E 3rd, Ciccolo JT, Marquez DX, Solomon CG, Markenson G. A randomized controlled trial of prenatal physical activity to prevent gestational diabetes: Design and methods. J Womens Health (Larchmt). 2009; 18:851-859.
14. Acquadro C, Conway K, Hareendran A, Aaronson N; European Regulatory Issues and Quality of Life Assessment (ERIQA) Group. Literature review of methods to translate health-related quality of life questionnaires for use in multinational clinical trials. Value Health. 2008; 11:509-521.
15. Guillemin F, Bombardier C, Beaton D. Cross-cultural adaptation of health-related quality of life measures: Literature review and proposed guidelines. J Clin Epidemiol. 1993; 46:1417-1432.
16. Beaton D, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. Spine (Phila Pa 1976). 2000; 25:3186-3191.
17. Frayers PM, Machin D. Quality of Life Assessment, Analysis and Interpretation. John Wiley & Sons, Chichester, UK, 2000; p. 149.
18. Flahert JA, Gaviria FM, Pathak D, Mitchell T, Wintrob R, Richman JA, Birz S. Developing instruments for cross-cultural psychiatric research. J Nerv Ment Dis. 1988; 176:257-263.
19. Matías-Carrelo LE, Chávez LM, Negrón G, Canino G, Aguilar-Gaxiola S, Hoppe S. The Spanish translation and cultural adaptation of five mental health outcome measures. Cult Med Psychiatry. 2003; 27:291-313.
20. Kitagawa K, Nagasaka M, Oh M, Inoue A. Behavior restriction and factor of pregnant woman and parent with baby. Journal of Architecture and Planning. 2008; 73:1243-1250. (in Japanese)
21. The Japanese society of clinical sports medicine. Ninpu sports no anzen kanri. Bunkodou, Tokyo, Japan, 2004.
22. Suzuki F, Shono A, Tomiyama T, Ono M, Taniguchi T, Taniguchi S. Exercise during pregnancy analyzed in relation to pre-pregnancy body weight. Advances in Obstetrics and Gynecology. 2006; 58:120-129. (in Japanese)
23. Sudman S, Bradburn N. Asking Questions: A Practical Guide to Questionnaire Design. Jossey-Bass, San Francisco, CA, USA, 1982.

(Received March 15, 2010; Revised May 31, 2010; Accepted June 11, 2010)