Original Article

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Cross-Cultural Adaptation of the University of Western Ontario Questionnaire for Musculoskeletal Conditions in Thai Senior Golfers

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Abstract:

Objective: This study aimed to cross-culturally adapt and evaluate the content validity and test-retest reliability of the Thai version of the University of Western Ontario Questionnaire for musculoskeletal conditions in senior golfers.

Material and Methods: The questionnaire was translated into Thai following established cross-cultural adaptation guidelines. A cognitive review with 10 senior golfers was conducted to assess content validity, focusing on the relevance, clarity, and comprehensibility of the items. Test-retest reliability was evaluated twice over a 2-week interval in 100 senior golfers. Additionally, data on playing characteristics and golf-related injuries were collected and analyzed.

Results: Cognitive review indicated that participants found the questions relevant and easy to understand, contributing to the content validity of the questionnaire. The questionnaire items showed high test-retest reliability, with intraclass correlation coefficients ranging from 0.87 to 1.00 for continuous data, and moderate to high reliability, with Kappa values ranging from 0.45 to 0.96 for dichotomous data. Thirty percent of Thai senior golfers reported golf-related musculoskeletal injuries, and 45% experienced low back pain after a round of golf. For continuous data, the standard error of measurement and minimal detectable change values were calculated to quantify the precision and smallest detectable change in the items related to golf activity, warm-up, and exercise habits.

Conclusion: The Thai version of the questionnaire has demonstrated adequate validity and reliability for assessing musculoskeletal conditions in senior golfers. Insights from playing characteristics and injury data can aid health professionals in developing targeted injury prevention strategies.

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Introduction

Golf is a sporting activity that has become popular among people of all age groups[1,2]. Accessibility to this sport is much easier than in the past, with nearly 40,000 golf courses available worldwide[3]. In Thailand, approximately 216 golf courses have been built across the country[4], making golf favored by several groups of people, especially the senior recreational population[5]. Golf is often preferred by seniors because it offers a balanced combination of light exercise and a lower risk of injury. Walking the course and striking the ball provide gentle, consistent physical activity, while the social interaction and time spent outdoors can also reduce stress and boost mood, supporting both physical and mental well-being[5,6].

In classifying the different types of golfers, the United States Golf Association considers individuals aged more than 50 years as senior golfers and recreational or amateur golfers are defined by an average individual golf score of over 72 per round or a golf handicap greater than zero[5]. Golf has been reported to provide appropriate physical activity levels, social interaction, and potential health benefits in improving musculoskeletal and cardiovascular health[2,7]. However, injuries can still occur due to factors like inappropriate playing and practicing techniques[8,9]. Previous studies have shown that injuries in senior golfers are linked to health conditions, physical characteristics, playing frequency, warm-up habits, and swing mechanics[1,10-15]. Therefore, understanding these factors is crucial for providing appropriate guidance to senior recreational golfers.

The University of Western Ontario Questionnaire for musculoskeletal conditions in senior golfers was developed originally by researchers at the School of Physical Therapy, Faculty of Health Sciences, University of Western Ontario, Canada[8]. This questionnaire consists of 37 questions covering musculoskeletal conditions, playing characteristics, frequency, and warm-up patterns. It was created using insights from previous reports and expert opinions in sports medicine and professional golf, aiming to provide a unique tool to evaluate senior golfers. The questionnaire includes items on illness history, golfing activity behavior, injury due to golf or other forms of exercise, musculoskeletal injury, and history of low back pain (LBP)[16,17].

The questionnaire offers a targeted approach to assessing musculoskeletal conditions in senior golfers, distinguishing it from general sports injury questionnaires by focusing on the unique physical demands of golf and the specific needs of the senior population. This specialized tool provides a comprehensive evaluation of the factors influencing health and performance, making it a valuable resource for identifying injury risks. It has been effectively applied in studies exploring the physical characteristics, performance, and age-related changes among senior golfers across various countries, including the United Kingdom, Australia, the United States, Canada and Portugal[9,15,17-19]. Additionally, its reliability across diverse cultural contexts has been well-documented, including successful applications in both English and Portuguese-speaking populations. For instance, Palmer et al.[17] utilized the questionnaire to assess musculoskeletal conditions in Canadian senior recreational golfers, reporting that approximately 50% of respondents experienced musculoskeletal conditions in the past 3 years, with 42% noting LBP after a round of golf. Most participants engaged in warm-up activities for less than 5 minutes before playing. The questionnaire showed high test-retest reliability with the intraclass correlation coefficients ($ICC_{2,1}$) ranging from 0.69 to 0.92 for continuous data and Kappa

values from 0.64 to 1.00 for categorical data. Additionally, Silva et al.[15] translated the questionnaire into Portuguese, achieving similarly high reliability, with $ICC_{2,1}$ values ranging from 0.63 to 0.99 for the continuous data and Kappa values from 0.71 to 1.00 for the categorical data.

Though various studies have employed different methods to survey golf-related injuries[1,8,10-14,20-23], the University of Western Ontario Questionnaire for musculoskeletal conditions in senior golfers is uniquely suited to investigate the physical characteristics and musculoskeletal conditions of senior golfers[16,17]. This study aimed to translate the questionnaire into Thai and assess its validity and reliability among Thai senior golfers, providing insights into golf-related injuries, playing characteristics, warm-up patterns, and exercise habits. We hypothesized that the Thai version of the University of Western Ontario Questionnaire for musculoskeletal conditions in senior golfers was valid and had high test-retest reliability, contributing valuable data regarding these aspects within the Thai senior golfer population.

Material and Methods

Design and ethical considerations

This study employed a cross-sectional survey design. The study protocol received full-board approval from the Mahidol University Central Institute Review Board (COA no. MU-CIRB 2021/015.1801). Prior to participation, all the participants were informed about the study's objectives, procedures, and potential risks and benefits, and they provided written informed consent voluntarily. This study was conducted in accordance with the principles outlined in the Declaration of Helsinki. The original authors and publisher granted permission for the translation of the questionnaire into Thai.

Translation and cross-cultural adaptation process

The original English version of the University of Western Ontario Questionnaire for musculoskeletal conditions in senior golfers was translated and cross-culturally adapted to the Thai version. Next, the Thai version of the questionnaire was tested for its content validity and test-retest reliability. The cross-cultural adaptation process was performed according to international guidelines[24-26]. The summary of the translation and cross-cultural adaptation process of this study is presented in Figure 1. After obtaining permission from the author and publisher, the original English version was translated into the Thai language by 2 independent forward translators with different backgrounds, including a sport physical therapist (T1) and a registered professional translator (T2). Both Thai-translated versions were discussed and blended into a preliminary Thai version (T12). The preliminary Thai version (T12) was translated back by 2 mother-tongue speakers of English who were amateur golfers (BT1) and exercise instructors (BT2). Both backward translators understood the Thai language very well. They were not allowed to look at the original version of this questionnaire and performed translations separately, which were then reviewed by 2 independent experts, one being a golf swing coach and the other a sport physical therapist. Finally, an expert committee, including the sport physical therapist, golf swing coach, and the research team, reviewed all the translated documents until a consensus was reached on discrepancies, thus producing the Thai pre-final version.

Content validity

Content validity was established through a cognitive review process of the pre-final version of the Thai version of the University of Western Ontario Questionnaire for

musculoskeletal conditions in senior golfers. This process involved conducting cognitive interviews with 10 male senior golfers in order to evaluate their understanding of the questionnaire's content and survey process. Their feedback helped identify any unclear or confusing items. Following the cognitive review, the Thai version of the questionnaire was critically examined by both the researchers and other experts in the field, leading to further modifications based on their insights and suggestions. This collaborative approach aimed to ensure that the questionnaire accurately reflected the constructs it was intended to measure and to address any remaining issues before finalizing the instrument[24].

Test-retest reliability

The test-retest reliability for the final Thai version of the University of Western Ontario Questionnaire for musculoskeletal conditions in senior golfers was performed twice by self-rating and interview methods by a well-trained researcher. Participants were informed of the study details, and the questionnaire was administered first by self-rate, with interviewer assistance provided as needed. A second administration took place 2 weeks later, via phone, at a similar time of day, ensuring consistency.

Participants

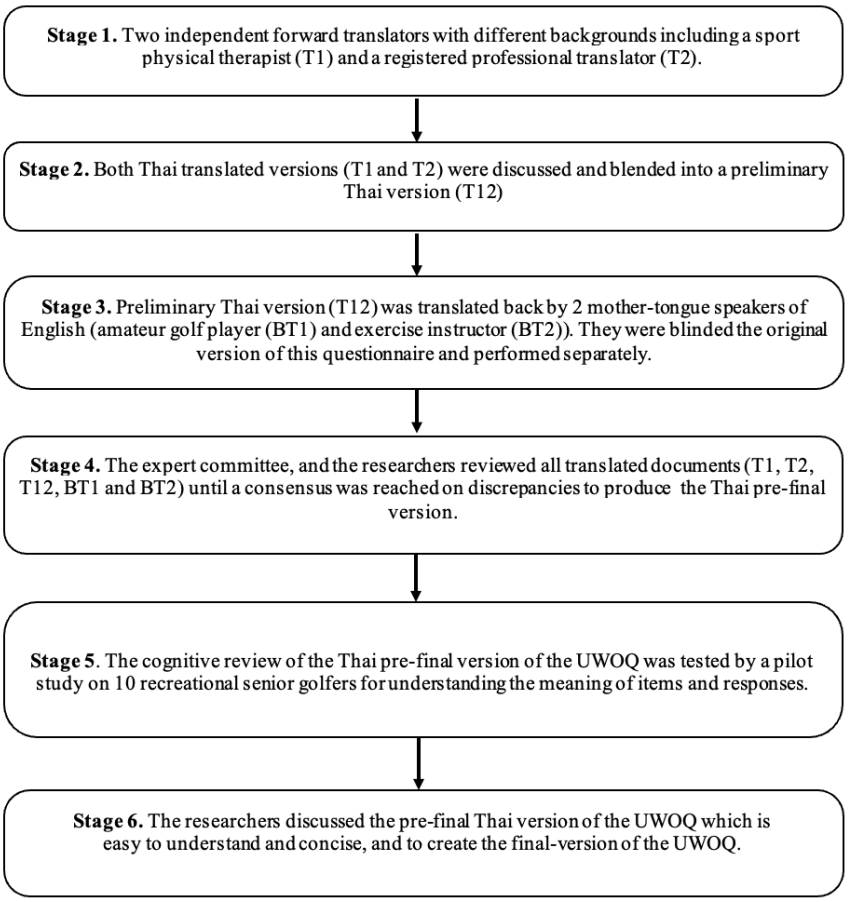
A total of 100 participants were enrolled in the study. The inclusion criteria were senior golfers aged between 50 and 80 years,[16,17] male or female, who had played or practiced golf at least once a week for at least one year. Additionally, participants were required to possess proficiency in speaking, reading, and writing Thai. Individuals with cognitive or memory impairments, as indicated by the Thai Mental State Examination score below 23, were excluded[27].

Sample size

Firstly, to investigate the validity, 10 participants were recruited following the methodology of a cross-cultural adaptation and validation questionnaire recommendation by Beaton et al[24]. Secondly, 100 participants were recruited in order to evaluate the test-retest reliability, according to the recommendations of the COSMIN study design checklist for the patient-reported outcome measurement instrument[28].

Statistical analysis

All data were analyzed using Statistical Package for the Social Sciences version 23.0 (IBM company, Chicago, USA) with a p-value less than 0.05. Descriptive statistics were used to present the demographics and golf details of the participants. Validity was evaluated on the cognitive review process in 10 senior recreational golfers. The test-retest reliability of the scoring from the questionnaire was analyzed using the ICC with the two-way mixed-effects model for quantitative data[29], and Cohen's Kappa statistic was used to test the test-retest reliability for the nominal and ordinal scales. The interpretation of the reliability levels was determined by the ICC; ICC<0.5=low, 0.5<ICC<0.75=moderate, and ICC>0.75=high[30] and the Cohen's Kappa; Kappa<0.40=low, 0.40<Kappa<0.75=moderate and Kappa>0.75=high[31]. In addition, the standard error of measurement (SEM) and the minimal detectable change (MDC) at the 95% confidence interval (CI) were reported for the quantitative data. SEM was calculated according to the following formulae: and MDC, where standard deviatoin (S.D.) represents the S.D. of the scores obtained from all individuals and ICC refers to the intra-rater reliability[32].



UWOQ=The University of Western Ontario Questionnaire

Figure 1 The translation and cross-cultural adaptation process of the Thai version of the University of Western Ontario Questionnaire for musculoskeletal conditions in senior golfers

Results

Content validity

Ten male senior recreational golfers participated in the validation process, with an average age of 61±6.3 years, 21±4.6 years of golf experience, and 18.4±5.4 scores of golf handicap. Participants completed the questionnaire using the self-rated method, answering all items without missing data and finding the questionnaire generally understandable. However, they suggested adding a third option, "never," for question item number 21, which asks "On which side of your body do you carry your clubs?" This addition would better reflect the experience of Thai golfers, as most courses in Thailand provide caddies to carry clubs. Additionally, participants recommended that items 25-28 use a numeric format for recording golf activity frequency per month. This adjustment would better suit Thailand's year-round golf season, which differs from the seasonal limitations in North America and Europe.

Test-retest reliability

One hundred senior recreational golfers, 96 males and 4 females, participated in this study. Golfer

characteristics are shown in Table 1. Test-retest reliability results for continuous and categorical items on the questionnaire are presented in Tables 2-6.

Table 2 shows the reliability of the past medical history items. Results indicated high agreement between 2 occasions (Kappa>0.75) for most items. However, item 8 "Feel pain in your chest when engaging in physical activity", item 10 "Loss of balance because of dizziness or consciousness", and item 13 "The other reason why you should not do physical activity" showed moderate reliability, with Kappa values of 0.45, 0.64, and 0.60 respectively.

Table 3 shows reliability of golf skill items. There was a high level of agreement by $ICC_{3.1}$ between 0.87–0.97. The SEM and MDC at 95% CI were between 3.90–5.57 and 10.81–15.46. The question item 18 "Are your golf clubs customized to fit your golf swing or club fitting?" showed a high Kappa value (Kappa of 0.84). Item 17 "Do you swing your golf club left or right?" showed a moderate Kappa value (Kappa of 0.66).

Table 4 shows the test-retest reliability of golf course transportation. All questions showed moderate to perfect reliability with Kappa values of 0.66–1.00, except for item 21 (clubs carrying side) showing a low level with Kappa of 0.31.

Table 5 shows the test-retest reliability of golf activity (times per month), warm-up, and exercise habits. The average frequency of golf activity in a 1-month period showed high reliability with $ICC_{3,1}$ value greater than 0.90 ($ICC_{3,1}$ of 0.91–0.97). The SEM and MDC at 95% CI were between 0.15–2.60 and 0.43–7.20, respectively. The reliability of warm-up and exercise habit items such as stretching, strengthening, and endurance programming was high with the $ICC_{3,1}$>0.90 and Kappa>0.80.

Table 6 shows the test-retest reliability of golf-related injuries. The results showed moderate reliability (Kappa values of 0.69 and 0.63) for items 35 "Have you suffered any injuries in the past 3 years while playing or practicing golf?" and 37 "Have you suffered any muscle or joint condition in the past 3 years which affected your golf game?". High reliability was found in item 36, which was related to awareness of LBP after golfing 18 holes (Kappa of 0.91).

Playing characteristics and exercise habits

The playing characteristics, golf activity and exercise habits are shown in tables 3-5. The golf activity was presented by times per month in items 25-28 (Table 5); golf play in 18 holes was 6.22±4.53 times on the first occasion and 5.30±3.70 times on the second occasion, golf practice at a driving range was 7.17±7.95 times on the first occasion and 7.00±7.78 times on the second occasion, putting practice was 5.11±8.46 times on the first occasion and 5.15±8.59 on the second occasion, and taking lessons from a golf professional was 0.13±0.53 times on the first occasion and 0.08±0.38 times on the second occasion. Warm-up and exercise habits are presented in items 29-34. More than 50% of senior golfers reported routinely performing golf stretches, strengthening exercises and cardiovascular conditioning programs apart from playing golf (items 31-34).

Golf-related injury

From Table 6, the result of the first occasion showed that 45% of senior golfers had awareness of LBP after golfing 18 holes (item 36). Ten percent of senior golfers had LBP at 100% after playing golf. Fifty-two percent demonstrated a muscle or joint condition in the past 3 years which affected their golf game (item 37). Muscle or joint conditions were observed in several parts of the body apart from the lower back. For example, 17% reported shoulder injuries, 15% reported knee injuries, and 9% reported wrist and hand injuries. Additionally, 30% of senior golfers experienced injuries while playing or practicing golf, which caused them to stop or modify their game for at least 2 weeks in the past 3 years (item 35).

Table 1 Characteristics of senior recreational golfers (n=100)

Variables	Number or mean±S.D.	Minimum	Maximum
Age (years)	62.17±7.50	50	80
Height (cm)	168.76±6.66	152	193
Weight (kg)	71.68±9.93	45	105
Gender	96 males	–	–
Years played (years)	22.60±11.11	2	55
Handedness	92 right, 8 left	–	–

S.D.=standard deviation, cm=centimeter, kg=kilogram

Table 2 Reliability of past medical history

Items	Frequency (Occasion 1)		Frequency (Occasion 2)		Kappa	95% CI	p-value
	Yes	No	Yes	No			
Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?	14	86	14	86	0.91	0.86–0.94	<0.001
Do you feel pain in your chest when you do physical activity?	4	96	8	92	0.45	0.19–0.63	0.001
In the past month, have you had chest pain when you were not doing physical activity?	2	98	2	98	1.00	0.00	<0.001
Do you ever lose your balance because of dizziness or do you ever lose consciousness?	13	87	16	84	0.64	0.47–0.76	<0.001
Do you have a bone or joint problem that could be made worse by changes in physical activity?	48	52	43	57	0.76	0.65–0.84	<0.001

Table 2 (continued)

Items	Frequency (Occasion 1)		Frequency (Occasion 2)		Kappa	95% CI	p-value
	Yes	No	Yes	No			
Is your doctor currently prescribing drugs (for example water pills) for your blood pressure or heart condition?	26	74	6	94	0.87	0.80–0.91	<0.001
Do you know of any other reason why you should not do physical activity?	14	86	6	94	0.60	0.42–0.73	<0.001

CI=confidence interval

Table 3 Reliability of golf skill items

Items	Answer Occasion 1 Mean±S.D.	Answer Occasion 2 Mean±S.D.	SEM	MDC_{95}	$ICC_{3,1}$	95% CI	p-value
How many yards do you hit your driver?	214.35±29.24	214.45±29.50	4.43	12.29	0.97	0.96–0.98	<0.001
How many yards do you hit your 7 iron?	143.50±16.04	144.00±18.87	5.57	15.46	0.87	0.82–0.91	<0.001
What is your golf handicap?	17.64±8.40	17.10±8.29	3.90	10.81	0.95	0.92–0.96	<0.001

Items	Frequency (Occasion 1)		Frequency (Occasion 2)		Kappa	95% CI	p-value
	Left	Right	Left	Right			
Do you swing your golf club left or right?	25	75	48	52	0.66	0.41–0.79	<0.001
	Yes	No	Yes	No	–	–	–
Are your golf clubs customized to fit your golf swing?	33	67	33	67	0.84	0.76–0.89	<0.001

SEM=the standard error of measurement, MDC95=the minimal detectable change at 95% confidence interval, $ICC_{3,1}$ =the intraclass correlation coefficients with the two-way mixed-effects model, CI=confidence interval

Table 4 Reliability of golf course transportation

Items	Frequency (Occasion 1)							Frequency (Occasion 2)							Kappa	95% CI	p-value
	0	15	30	50	65	80	100	0	15	30	50	65	80	100			
How often do you use a power cart around the course?	10	14	12	14	6	15	29	9	8	14	17	2	16	36	0.86	0.80–0.91	<0.001
How often do you carry your clubs around the course?	87	7	0	3	1	1	1	93	4	0	1	0	1	1	0.74	0.62–0.82	<0.001
How often do you pull your clubs around the course on a cart?	88	4	1	3	1	1	2	95	3	0	1	0	0	1	0.66	0.50–0.77	<0.001
How often do you push your clubs around the course on a cart?	97	0	2	1	0	0	0	100	0	0	0	0	0	0	1.00	–	<0.001
How often do you use an electronic cart to carry your clubs?	99	0	0	1	0	0	0	100	0	0	0	0	0	0	1.00	–	<0.001
	Lt.	Rt.	Alternate	Double	Non	Lt.	Rt.	Alternate	Double	Non							
On which side of your body do you carry your clubs?	3	9	0	1	87	1	4	2	0	93	0.31	−0.14–0.53	0.030				

Lt=left side, Rt=right side, Alternate=alternated side, Double=double strap, Non=Never carry the golf clubs, CI=confidence interval

Table 5 Reliability of golf activity, warm-up, and exercise habits

Items	Answer Occasion 1 Mean±S.D.	Answer Occasion 2 Mean±S.D.	SEM	MDC_{95}	$ICC_{3,1}$	95% CI	p-value
How many rounds of golf do you play in a single month during the following times? (times/month)	6.22±4.53	5.30±3.70	1.36	3.78	0.91	0.84–0.94	<0.001
How many times in a single month do you go to the practice range during the following times? (times/month)	7.17±7.95	7.00±7.78	1.25	3.48	0.97	0.96–0.98	<0.001
How many times in a single month do you practice putting? (times/month)	5.11±8.46	5.15±8.59	1.98	5.49	0.94	0.91–0.96	<0.001
How many times in a single month do you take lessons from a golf professional? (times/month)	0.13±0.53	0.08±0.38	0.15	0.43	0.91	0.87–0.94	<0.001
How much time do you spend warming up prior to playing or practicing? (minutes)	7.48±10.99	8.25±12.12	2.60	7.20	0.94	0.91–0.96	<0.001
How much of this warm up time is spent stretching? (minutes)	4.42±6.95	5.06±6.98	1.35	3.75	0.96	0.94–0.97	<0.001

Items	Frequency (Occasion 1)		Frequency (Occasion 2)		Kappa	95% CI	p-value
	Yes	No	Yes	No			
Once you've started a round, do you routinely perform any golf stretches while out on the course?	45	55	55	45	0.81	0.71–0.87	<0.001
Do you routinely perform any of your golf stretches away from the course/practice range?	64	36	67	33	0.80	0.70–0.86	<0.001
Do you routinely do any strengthening exercises?	54	46	45	55	0.90	0.84–0.93	<0.001
Do you routinely participate in a cardiovascular conditioning program apart from golfing?	51	49	52	48	0.82	0.73–0.88	<0.001

SEM=the standard error of measurement, MDC95=the minimal detectable change at 95% confidence interval, $ICC_{3,1}$=the intraclass correlation coefficients with a two-way mixed-effects model, S.D.=standard deviation, CI=confidence interval

Table 6 Reliability of golf-related injury

Items	Frequency (Occasion 1)							Frequency (Occasion 2)							Kappa	95% CI	p-value
	Yes				No			Yes				No					
Have you suffered ANY injuries in the past 3 years while playing or practicing golf, which caused you to stop or modify your game for at least 2 weeks?	30				70			30				70			0.69	0.53–0.79	<0.001
	0	15	30	50	65	80	100	0	15	30	50	65	80	100			
How often are you aware of low back pain after golfing 18 holes?	55	12	6	8	2	7	10	58	10	5	5	1	8	13	0.91	0.86–0.93	<0.001
	Yes				No			Yes				No					
Have you suffered ANY muscle or joint conditions in the past 3 years which affected your golf game?	52				48			45				55			0.63	0.45–0.75	<0.001

MSK=Musculoskeletal, LBP=low back pain, CI=confidence interval

Discussion

Content validity and test-retest reliability

In this study, the process of cross-cultural adaptation of the University of Western Ontario Questionnaire for musculoskeletal conditions in senior golfers to Thai was described as well as its validity and reliability. The Thai version was valid and had moderate to high reliability in all question items except for item 21 (club carrying side), which showed a low level of reliability (Kappa of 0.31). The low level of reliability for club carrying side was due to the high number of golfers in Thailand who do not regularly carry golf clubs around the course by themselves. Golf courses in Thailand have caddies who assist golfers in carrying the golf clubs. Eighty-seven percent of senior recreational golfers in the present study did not carry golf clubs, as shown with item 20 in Table 4. The swing side showed moderate reliability (Kappa of 0.66), due to the fact that the participants might not have understood clearly the distinction between the handedness side and the swing side, such as golfers with right-handedness would swing through the left side.

According to the items related to golf skill, golf activity, warm-up, exercise habit, and LBP after golf activity, the results exceeded a high level of reliability with $ICC_{3,1}$>0.75 and Kappa>0.75[30,31]. The past medical history items showed moderate to high levels of reliability with the Kappa values from 0.45 to 1. This result was similar to the previously translated questionnaires in the Portuguese versions[15]. The original version presented golf skills and course transportation with $ICC_{2,1}$ between 0.69 and 0.92[16]. For item 8, "Do you feel pain in your chest when you do physical activity?", it received the lowest score of moderate agreement (K of 0.45) among the questionnaire items. Notably, only 8 out of 100 persons provided different answers on the second occasion. This is particularly relevant for specific items such as item 8, "Do you feel pain in your chest when you do physical activity?", item 10, "Do you ever lose your balance because of dizziness or do you ever lose consciousness?", and item 13, "Do you know of any other reason why you should not do physical activity?" The phrases "pain in your chest", "lose consciousness" and "physical activity" can be subject to multiple interpretations, which may contribute to variability in responses. This variability in responses may be partly attributed to the differing methods used to answer the questionnaire on 2 occasions: self-rating during the first assessment and a phone interview during the second assessment. The process of a phone interview may have led to misunderstandings of these questions, as the absence of visual aids and the potential for ambiguity in phrasing could affect how participants interpreted and responded. However, it is important to note that previous literature suggests that structured interviews can often yield more valid responses than self-reported measures, as they allow for clarification and deeper engagement with the content[33]. Thus, while the mixed-method approach aimed to enhance understanding, the implications of these different administration methods on response reliability must be carefully considered. Future studies may benefit from employing a consistent method of administration in order to minimize any potential discrepancies in participant responses.

The items of golf skill achieved high reliability with $ICC_{3,1}$>0.75, except for item 17 "swing side", which showed moderate reliability. This may be due to potential confusion among participants regarding the distinction between "swing side" and "handedness side". The items related to golf course transportation (items 19-24) demonstrated varied reliability, with Kappa values ranging from 0.31 to 1.00. Among these results, item 23 "How often do you push your clubs around the course on a cart?" and item 24, "How often do you use an electronic cart to carry your clubs?" exhibited perfect agreement among participants. Thai senior

golfers preferred to use a power cart around the course (item 19). However, item 21, "On which side of your body do you carry your clubs?" displayed a low agreement with the Kappa value of 0.31, and item 22, "How often do you pull your clubs around the course on a cart?" displayed moderate agreement with the Kappa value of 0.66. This low to moderate reliability may be attributed to the strong preference for power carts among participants, resulting in a lack of consistent responses regarding how they carry their clubs when not using a cart. The variability in responses to this item suggests that individual habits and preferences regarding club transportation significantly influenced the results. In contrast to the findings from the original version, golf skill items showed high reliability with $ICC_{3,1}$>0.90, and reliability for golf course transportation ranged from moderate to high[16]. Comparably, the Portuguese version showed high reliability for both golf skill and course transportation with $ICC_{3,1}$>0.90, except for "the driving distance" and "the proportion of rounds clubs pushing[15]".

The reliability of the average frequency of golf activity in one month (items 25–28) showed high reliability. From the cognitive review of the pre-final version of the Thai version of the University of Western Ontario Questionnaire for musculoskeletal conditions in senior golfers, Thai senior recreational golfers were playing and practicing golf every month for the entire year. The climatic zone in Thailand is between 20 and 38 degrees Celsius[34]. This weather is suitable for playing golf in every season.

The reliability of golf-related injury items demonstrated moderate reliability, with item 35 showing a Kappa value of 0.69 and item 37 a Kappa value of 0.63: item 35, "Have you suffered any injuries in the past 3 years while playing or practicing golf that caused you to stop or modify your game for at least 2 weeks?" and item 37, "Have you suffered any muscle or joint conditions in the past 3 years that affected your golf game?". Participants provided different answers over the 2 assessments conducted 2 weeks apart for several reasons. Recall bias may have played a role, as individuals often struggle to accurately remember past experiences or symptoms, leading to inconsistencies in their responses. Additionally, changes in condition could have affected their answers; participants may have experienced new injuries or recovered from previous ones during the two-week interval. Testing effects are another consideration, as familiarity with the questionnaire might have influenced responses; participants could remember their previous answers or feel more comfortable during the second assessment, resulting in differing responses. Furthermore, inconsistencies in administration, such as the shift from a face-to-face meeting to a phone interview, may have impacted participants' comfort levels and engagement, resulting in variations in their answers. Notably, while the original version of the questionnaire did not report the reliability of the injury items[16], the Portuguese version reported high test-retest reliability for these items using a self-rated method during both occasions[15]. This difference suggests that the mode of administration may significantly impact the reliability of responses, underscoring the complexities of measuring reliability and the importance of considering participant experiences and context in the assessment process.

Playing characteristics and exercise habits

Comparing the Thai, Portuguese and Canadian versions of the survey with respect to warm-up and exercise habits, Thai golfers spent more time warming up prior to playing, with 7.48±10.99 minutes on the first occasion and 8.25±12.12 minutes on the second occasion compared to the Canadian golfers' warm-up time on the first and second occasions of 4.47±0.59 and 4.07±0.54 minutes, respectively[17]. The Portuguese golfers appeared to spend time warming up with 9.15±5.82 minutes on

the first occasion and 9.02±4.66 minutes on the second occasion[15]. However, Thai golfers spent half of the warm-up time stretching, 4.42±6.95 and 5.06±6.98 minutes for the first and second occasions, respectively. Thai golfers spent a longer time stretching during warm-up compared to the Portuguese and Canadian golfers. The stretching time for Portuguese golfers were 3.95±3.61 and 3.64±3.98 minutes for the first and second occasions, and 2.9±0.49 and 2.7±0.50 minutes for the Canadians, respectively. In the survey, some Thai senior golfers spent less than 1 minute, both on warm-up (19%) and stretching (35%), and 72% and 84% of all the participants spent less than 5 minutes on warm-up and stretching. Golfers with an injury spent less time on warm-up and stretching than those who were not injured.

Forty-five percent of Thai senior golfers engaged in stretching prior to starting a round of golf, and more than 50% regularly performed other exercises, including stretching, strengthening, and cardiovascular conditioning. Among Portuguese senior golfers, 24% participated in stretching before their golf rounds. In contrast, only 16.6% of Canadian golfers performed warm-ups and stretching before playing, with 36% reporting that they stretched for less than one minute. These patterns of play and reduced warm-up routines may contribute to the development of musculoskeletal conditions.

Golf-related injury

The golf-related injury showed that 45% of Thai senior recreational golfers had awareness of LBP after a golf round (item 36) and 52% reported musculoskeletal conditions which affected their golf game (item 37). Similarly, a Canadian study reported 42% of senior golfers had an experience of LBP after the golf round and 50% had musculoskeletal conditions by 100 respondents[17]. A Thai epidemiology study reported that 44.9% of amateur golfers aged 41.81 years reported a golf-related injury, which was commonly a lower back injury[35].

In the Asia-Oceania region, a survey study in India found that 46% of amateur golfers experienced musculoskeletal injuries, with LBP being the most common[23]. In Australia, golfers aged over 40 years reported that 55.2% had suffered from musculoskeletal injuries that caused them to stop playing golf for 2 to 3 weeks[22]. Additionally, a study in the United Kingdom reported that 57% of amateur golfers had experienced musculoskeletal injuries, most commonly affecting the lower back[36]. These results highlight that senior amateur golfers frequently report musculoskeletal injuries, with LBP being the most prevalent and often leading to a temporary cessation of play.

This study may have limitations in its representation of gender characteristics, with a participant pool consisting of 96 males and only 4 females, reflecting the current demographics of senior recreational golfers in Thailand. Additionally, the various data collection methods could have affected the reliability of the findings. Another limitation is that the study focused only on content validity and test-retest reliability for the translated questionnaire. Future studies should conduct other types of psychometric assessments, such as convergent validity, discriminative validity, and internal consistency, in order to provide a more comprehensive evaluation. To enhance the generalizability of future studies, it is essential to include a larger and more balanced participant sample that better represents the senior golf population in Thailand.

Conclusion

The Thai version of the University of Western Ontario Questionnaire for musculoskeletal conditions in senior golfers achieved validity and high test-retest reliability for senior recreational Thai golfers aged between 50 and 80 years. The questionnaire was successfully translated and

culturally adapted. Items 21 and 25 to 28 were adapted from the original version to suit Thai senior golfers.

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Conflict of interest

The authors state that there is no conflict of interest. No author has any financial interest or received any financial benefit from this research.

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