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APPLIED PSYCHOLOGY | RESEARCH ARTICLE

Development and Confirmatory Factor Analysis of the Golf Participation Questionnaire for Older Adults (GPQOA)

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Abstract: A series of four studies were conducted to develop and psychometrically evaluate a questionnaire to assess older adults' reasons for participating in golf (Golf Participation Questionnaire for Older Adults: GPQOA). In the first study, a 30-item questionnaire was developed using a Delphi process in collaboration with industry partners and academic leaders. In the second study, Confirmatory Factor Analysis was used to identify the best model fit based on data from 402 adults aged 55–74. A revised version was then tested in a third study using an independent sample of 419 adults and provided support for a nine-factor 30-item model. In the final study, measurement invariance across gender was evaluated and supported. The GPQOA is an empirically driven questionnaire with psychometric support that can be used to investigate the reasons for and benefits of participating in regular golf for older adults.

Subjects: Applied Sport Science; Physical Activity and Health; Sport and Gender; Community Sport Development; Golf

Keywords: sport; psychometrics; aging; invariance; older golfers

1. Introduction

Participation rates in golf (Golf Australia, 2014), and in organised sport in general (Hajkowicz, Cook, Wilhelmseder, & Boughen, 2013), have declined in Australia in recent decades. Similar changes are also occurring in other countries, including the United States of America (National Golf Foundation, 2014)

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PUBLIC INTEREST STATEMENT

Engagement in physical activity, particularly sport, is declining. As people age, they are less likely to participate in sport in general. This trend is troublesome as physical activity can have a significant effect on health and well-being. Despite the overall decline in sport participation, participation by older adults in golf is increasing and remains a popular sporting activity.

However, despite the popularity of golf among older adults, little is known about their reasons for participation. This study describes the development and evaluation of a golf-specific questionnaire that can be used to investigate why older people play golf. Psychometric evaluation of the questionnaire supports score validity and reliability. Data obtained using this questionnaire could be used to develop and target intervention strategies to increase golf and physical activity more generally.

and England (Sport England, 2015). In contrast, golf participation rates for older adults have remained relatively stable (Golf Australia, 2014). Why older people engage in sport in general has been studied extensively (Dionigi, Baker, & Horton, 2011; Kirkby, Kolt, Habel, & Adams, 1999; Kolt, Driver, & Giles, 2004; Newson & Kemps, 2007) but, despite golf participation in this group defying the declines seen in other sports, there has been little evaluation of the reasons why older adults play golf.

Stenner and colleagues recently explored the reasons for participation in older golfers through an exploratory qualitative study (Stenner, Mosewich, & Buckley, 2016). Through a process of focus groups and thematic analysis they identified eight themes that characterised why older adults play golf. Those themes were (1) the physical demands of golf allowed it to continue to be played into older age, providing a source of exercise that did not feel like exercise, (2) golf allowed older people to maintain a sense of sporting competition, (3) golf provided time for an individual focus and time for self, (4) golf was fun to play, (5) golf provided benefits for physical fitness and health, (6) golf benefited cognitive function, (7) golf provided a form of stress relief and benefited mental health and (8) golf allowed participation in both the physical and social aspects of the environment. While that study provided some initial insight regarding reasons for participation, in order to more fully understand why golf participation is so popular in this age group, with a view to increasing participation further or perhaps applying knowledge to inform promotion efforts in other sports and physical activity, more in-depth investigation in a larger and more representative sample is required.

Questionnaires are regularly used to determine the motives for participation in exercise and/or sport in general. Two of the most widely used are the Participation Motivation Questionnaire for Older Adults (PMQOA; Kolt et al., 2004) and the Sports Motivation Scale II (SMS II) (Pelletier, Rocchi, Vallerand, Deci, & Ryan, 2013). While reliability and factorial validity support has been established for the PMQOA in relation to general physical activity and/or sport (Apaydin Kaya et al., 2013; Kirkby, Kolt, & Habel, 1998; Kolt et al., 2004; Newson & Kemps, 2007), it has not been used, or psychometrically evaluated, with older golfers. Similarly, while the scores from the SMS II have validity support (Pelletier et al., 2013), it has not been used with older golfers. Significantly, when the themes of the existing questionnaires were compared with the eight related to participation in golf identified by Stenner et al. (2016), there were a number of factors unique to playing golf which are not evaluated by the PMQOA or SMS II. In particular, the enjoyment of playing in an aesthetically pleasing outdoor environment was a unique aspect of golf participation. The PMQOA and SMS II do not evaluate the playing environment, and as a result, if used to evaluate golf participation, would exclude an important factor relevant to regular golf participation. Given the lack of golf-related research, it is important that the questionnaire used to evaluate the reasons for participation in golf encompasses the known existing data related to the topic. Based on the gaps in both the PMQOA and SMS II in relation to golf-specific topics, there is no appropriate instrument available for evaluating why older adults play golf and a golf-specific tool is needed to be developed.

The aim of the series of studies reported here were to develop and evaluate the factor structure of a questionnaire specific to the golf context (Golf Participation Questionnaire for Older Adults; GPQOA) that could be used to evaluate the reasons why older adults play golf.

2. Study 1—questionnaire development

Development of the questionnaire commenced with the principal researcher (BS) developing statements related to each of the eight themes related to why older adults play golf that had been previously identified by Stenner et al. (2016). This involved reviewing topics identified within each theme, and developing specific statements based on those topics. The initial draft of the questionnaire was comprised of 30 statements. A five-point Likert scale was used to indicate the level of agreement with each statement (strongly disagree—disagree—neutral—agree—strongly agree). A five-point Likert scale was chosen to reduce participant burden (Krosnick & Presser, 2010), given their ease of use in allowing participants to more quickly complete the questionnaire, while maintaining appropriate levels of reliability and validity (Preston & Colman, 2000). It has also been proposed that a five-point scale is appropriate for scale development (Weijters, Cabooter, & Schillewaert, 2010) and for use in Confirmatory Factor Analysis or structural equation modelling (Dawes, 2008).

The 30 statements were then reviewed by the research team, and discussed until consensus was reached, with all statements retained at this stage. A senior colleague with extensive experience in questionnaire development and survey administration then reviewed the statements and provided further feedback. A draft questionnaire was then developed and subjected to a Delphi process (Hasson, Keeney, & McKenna, 2000) to obtain stakeholder feedback.

Stakeholders who participated in the Delphi process were (1) managers of local golf clubs who were invited to provide insights from the perspective of those responsible for the management and running of golf clubs, (2) representatives from Golf South Australia and Golf Australia who are responsible for the administration of the golf industry at a state and national level, (3) a professional golfer from the Professional Golf Association of Australia (PGA) and (4) an academic colleague with a deep understanding of, and extensive experience in, human ethics and a keen interest in golf who could provide feedback from an ethical perspective and from the perspective of a recreational golfer. Thus, stakeholders covering a variety of roles relevant to golf provided feedback on the questionnaire during the Delphi process. There were a small number of minor changes made to the items as a result of the Delphi process. Changes to the wording were made to ensure the items were clear, concise and related to the topics. No items were excluded as a result of the feedback.

2.1. Pilot phase

Following the Delphi process, a pilot study was conducted in a small sample of the target population to identify potential issues with interpretation and/or completion of the questionnaire (Polgar & Thomas, 2000; van Teijlingen & Hundley, 2002).

Participants were recruited using purposeful sampling from golf clubs in the Adelaide metropolitan area and two country regions of South Australia. Participants comprised of golfers who played regularly (i.e. ≥ once every two weeks) in a private metropolitan club, a semi-private metropolitan club or in a country region. Participation was not limited by type of golf club, type of membership or handicap. They were invited to participate via email, or were directly recruited through information flyers that were placed at each of the golf clubs. Participants were provided with a paper copy of the questionnaire, and asked to provide feedback on its length, language, ease of interpretation and any other factors they felt may improve the questionnaire. Participants returned the questionnaire in provided reply paid envelopes. A sample size of 24–40 was targeted for pilot testing of the questionnaire based on recommendations for pilot studies of questionnaire development (Hertzog, 2008; Johanson & Brooks, 2010; Lancaster, Dodd, & Williamson, 2004). All participants provided written informed consent prior to participation.

2.2. Pilot study results

Participants (N = 32; 15 male, 17 female) provided feedback suggesting changes to the wording of some of the questionnaire items and to the layout of the Likert scale (i.e. formatting) to improve clarity. Table 1 provides further demographic information about participants in the pilot study. The layout of the questionnaire was revised and some statements clarified according to the suggestions made during the pilot study prior to it being evaluated in the next phase.

3. Study 2—questionnaire evaluation

The revised questionnaire was converted to an electronic format (Survey Monkey, surveymonkey.net) and administered to a larger sample of older golfers to evaluate model fit and validity of the items.

3.1. Method

Participants met the same criteria as described for the pilot study and were recruited from golf clubs in South Australia via a random sample of 30 of the 163 registered golf clubs available from the Golf

Table 1. Summary of participant demographics for Pilot and CFA studies

	Pilot study					8-factor CFA					9-factor CFA				
Characteristic	**All**	**Men**	**Women**	**Metro**	**Country**	**All**	**Men***	**Women**	**Metro****	**Country**	**All**	**Men***	**Women**	**Metro****	**Country**
	***N* = 32**	***n* = 15**	***n* = 17**	***n* = 23**	***n* = 9**	***N* = 402**	***n* = 309**	***n* = 89**	***n* = 377**	***n* = 19**	***N* = 419**	***n* = 329**	***n* = 83**	***n* = 265**	***n* = 150**
Age (years)	64.9	65.3	64.6	66.2	61.6	64.8	65.1	63.7	64.9	64.4	63.9	64.0	63.3	63.8	64.1
	(5.5)	(5.5)	(5.7)	(4.7)	(6.4)	(5.2)	(5.2)	(5.1)	(5.2)	(5.8)	(5.6)	(5.6)	(5.7)	(5.6)	(5.7)
Years playing golf	26.7	36.8	17.8	28.1	23.0	28.7	31.7	18.5	28.9	24.6	31.5	34.7	18.9	31.9	30.5
	(17.3)	(13.7)	(15.3)	(18.9)	(12.2)	(15.3)	(14.9)	(12.0)	(15.2)	(16.3)	(15.9)	(14.9)	(13.6)	(15.7)	(16.1)
Handicap	19.9	15.5	23.9	20.1	19.4	19.0	17.7	23.5	18.9	17.5	16.0	14.8	20.9	16.4	15.4
	(8.3)	(3.2)	(9.4)	(9.4)	(4.7)	(7.9)	(6.8)	(9.7)	(7.9)	(7.1)	(8.3)	(7.4)	(9.1)	(8.5)	(7.8)
Rounds of golf played per week (average)	2.0	1.7	2.3	2.2	1.7	1.9	1.8	1.9	1.9	1.8	1.9	1.9	1.9	1.9	2.1
	(0.8)	(0.8)	(0.8)	(0.8)	(0.7)	(0.7)	(0.7)	(0.7)	(0.7)	(1.0)	(0.8)	(0.9)	(0.7)	(0.7)	(1.0)

Note: Data are presented as mean (standard deviation).

8-Factor CFA—* Four participants did not report gender. ** Six participants did not report location.

9-Factor CFA—* Seven participants did not report gender. ** Four participants did not report location.

South Australia website (www.golfsa.org.au). An email was sent to the club manager and/or secretary that included a brief overview of the purpose of the research, an information sheet and an electronic link to the survey, with a request to distribute the information to their members so that any who were interested could participate. A follow up phone call was conducted approximately two weeks later to clarify any issues.

A sample size of 400 was targeted based on recommendations by Tabachnick and Fidell (2013) who suggested sample sizes of ≥300 for questionnaire development. The required sample size was not achieved during the first round of invitations so a second round of invitations was sent to another 30 randomly selected golf clubs.

Participants were asked to confirm they were providing informed consent by clicking on a button at the start of the electronic questionnaire. No payment or incentive was offered for completion of the questionnaire.

3.2. Test questionnaire

Participants were asked to complete the questionnaire, which included questions about demographics, including: age, employment status, relationship status, educational achievement, as well as golf-specific information including: the region where they play golf, playing handicap, frequency of playing golf and time spent playing golf each week.

3.3. Data analysis

The model tested was based on the a priori hypothesis that the reasons for playing golf would be represented by an eight-factor model, consisting of the eight themes identified previously (Stenner et al., 2016); i.e. (1) the physical demands of golf allowed it to continue to be played into older age, providing a source of exercise that does not feel like exercise (Exc), (2) golf allowed people to maintain a sense of sporting competition (Comp), (3) golf provided time for an individual focus and time for self (TFS), (4) golf was fun to play (Fun), (5) golf provided benefits for physical fitness and health (PH), (6) golf kept the brain active and benefited cognitive function (CH), (7) golf provided a form of stress relief and benefited mental health (MH) and (8) golf allowed one to be part of a community, participating in the physical and social aspects of that environment (POC).

Confirmatory Factor Analysis (CFA) was performed using Lisrel 9.1 (Scientific Software International, USA; Jöreskog & Sörbom, 2015) to evaluate the factor structure of the questionnaire. CFA was chosen in the first instance, as the questionnaire and subsequent a priori model were based on empirical data (Stenner et al., 2016) and Brown (2006) suggested that CFA rather than Exploratory Factor Analysis (EFA) can be performed where prior research evidence has informed the proposed model. Further to this, Hurley et al. (1997) discussed at length the issues related to use of EFA vs CFA, and clearly articulated that CFA would be preferred where “models have an underlying theory for hypothesised patterns of loadings” and should be performed where an a priori *hypothesis* is stated and is to be tested, as was the case in the present study.

Individual factor loadings were calculated for each item, and the model fit was interpreted using a combination of absolute and incremental fit indices. A combination approach is suggested as the most appropriate strategy for reviewing model fit (Brown, 2006; Hooper, Coughlan, & Mullen, 2008), and the comparative fit index (CFI) were used, the standardised root mean residual (SRMR), the root mean square error of approximation (RMSEA) and the Tucker–Lewis Index (TLI) were used. Cut-offs for each fit index were adopted according to recommended values (Hooper et al., 2008; Hu & Bentler, 1999; Yuan, 2005). RMSEA values of 0.06 or less were taken to indicate a close fit and less than 0.07 an adequate fit. SRMR values less than 0.08 indicated adequate fit (Hu & Bentler, 1999), and values between 0.00 and 0.05 suggested a well-fitting model (Byrne, 2013). CFI and TLI values of 0.95 and above were considered indicative of an excellent fit, and above 0.9 as acceptable (Hu & Bentler, 1999).

Prior to analysis, the data were screened for missing data and checked for accuracy and format. Less than 1.0% of data points were missing and any missing data were imputed using maximum likelihood during the analysis.

3.4. Results

A total of 447 participants completed the questionnaire following the two rounds of recruitment. Data for 36 of these participants could not be included in the analysis because three did not provide consent for their data to be used, 25 did not meet the eligibility criterion of participating in golf at least once every two weeks, and eight were not within the participant age range required. A further nine participants did not complete any of the questions. Thus, the sample size for data analysis was 402 and the demographics of these participants are provided in Table 1.

3.5. Factor loadings and fit indices

Factor loadings are presented in Table 2. Fit indices are presented in Table 3. Absolute model fit using chi square (x^2) for the eight-factor model was statistically significant ($p < 0.001$), suggesting a poor overall fit to the data. Likewise, comparative model fit was shown to be poor when referencing accepted comparative fit indices. Individual factor loadings varied, including one statement under the physical environment theme (Item 15—"I enjoy the physical environment on the course".) with factor loadings below the recommended cut-off limit of 0.30 (Brown, 2006). While this statement could have been removed from the questionnaire to improve factor loadings and fit indices, it was not considered appropriate to do so as it related to a distinct and important reason for participation in golf that had been identified previously (Stenner et al., 2016) . Accordingly, instead of omitting the statement and losing the ability to assess and capture the element of the physical environment, the questionnaire and model was modified by making the physical environment its own factor and adding an additional statement relating to this factor. The questionnaire was then re-evaluated using an independent sample in Study 3.

4. Study 3. Evaluation of revised questionnaire—30-item nine-factor model

4.1. Test questionnaire

The model tested in this study was based on the revised a priori hypothesis that the reasons for playing golf would be based on a nine-factor structure, composed of the previous eight factors plus an additional ninth factor- that golf is played in a pleasant physical environment (Env). Statements included in the modified nine-factor version of the questionnaire are provided in Table 2.

4.2. Method

Participants were invited to participate via a large-scale direct electronic mail out using the GolfLink platform (golflink.com.au, Sydney, Australia). GolfLink is the sole handicap maintenance provider for registered golfers in Australia and, in conjunction with Golf Australia, manages handicapping information for over 400,000 golfers. An introductory email with a link to the electronic survey was emailed directly to over 30,000 registered golfers aged 55–74 via GolfLink, encouraging them to complete the questionnaire.

4.3. Data analysis

Confirmatory Factor Analysis (CFA) was performed using Lisrel 9.1 (SSI, USA) (Jöreskog & Sörbom, 2015) to evaluate the structure of the questionnaire. Factor loadings were calculated for each item, and interpreted using the same cut off values as for the eight-factor model. Internal reliability was assessed using Cronbach's alpha.

Less than 0.1% of data points were missing, and missing data were imputed using maximum likelihood estimation.

Table 2. Factor loadings and error variances for both 8-factor and 9-factor models

Factor	Item number and statement	8-factor model			9-factor model		
		N = 402			*N* = 419		
		Factor loading	Error variance	Mean score (SD)	Factor loading	Error variance	Mean score (SD)
1. Exercise and activity for older age	1. I am no longer able to play other sports that I had previously enjoyed	0.39	0.85	3.30 (0.81)	0.35	0.88	3.40 (0.83)
	2. I can play despite getting older	0.52	0.73		0.50	0.75	
	3. It gives me a reason to get out of the house	0.76	0.42		0.76	0.42	
	4. It provides me with some routine	0.78	0.39		0.81	0.35	
	5. It provides a way of being physical active without it seeming like I am exercising	0.61	0.62		0.63	0.60	
2. Competition with self and others	6. I enjoy engaging in competition	0.69	0.53	3.98	0.66	0.57	4.11
	7. There is opportunity for me to improve my ability despite ageing	0.63	0.60	(0.57)	0.60	0.64	(0.53)
	8. I enjoy the challenge	0.78	0.39		0.80	0.35	
	9. It gives me a thrill when I play well	0.68	0.54		0.65	0.58	
	10. I like trying to win	0.66	0.56		0.54	0.71	
	11. I enjoy the recognition from others when I play well	0.49	0.76		0.34	0.88	
3. Time for self	12. I enjoy spending time by myself on the course	0.48	0.77	2.9	0.53	0.72	3.05
	13. I use the time as a release from other stressors in my life	0.64	0.59	(0.74)	0.70	0.50	(0.83)
	14. It gives me time to think	0.83	0.32		0.81	0.35	
4. Good fun	16. It is an extremely enjoyable activity	0.76	0.42	4.38	0.52	0.73	3.43
	17. It is interesting as each round is always different and ever changing	0.76	0.42	(0.54)	0.67	0.55	(0.66)
5. Physical health	18. It helps me manage an existing injury or illness	0.56	0.69	2.97	0.45	0.80	3.32
	19. It helps to prevent physical injury or illness	0.80	0.36	(0.82)	0.80	0.36	(0.79)
	20. It reduces the effects of ageing	0.75	0.44		0.74	0.45	
6. Cognitive health	21. It improves my ability to concentrate	0.72	0.48	3.09	0.72	0.49	3.06
	22. It improves my memory	0.84	0.30	(0.77)	0.85	0.29	(0.83)
	23. It improves my ability to solve problems	0.86	0.26		0.86	0.27	
7. Mental health	24. It improves my mental health while I am playing	0.89	0.20	3.27	0.88	0.23	3.05
	25. It improves my mental health after I have finished playing	0.84	0.30	(0.81)	0.87	0.24	(0.88)

(Continued)

Table 2. (*Continued*)

Factor	Item number and statement	8-factor model			9-factor model		
		N = 402			*N* = 419		
		Factor loading	Error variance	Mean score (SD)	Factor loading	Error variance	Mean score (SD)
8. Part of community	15. I enjoy the physical environment on the course	0.23	0.95	3.81	-	-	3.61
	26. It allows me to meet new friends	0.55	0.70	(0.46)	0.83	0.31	(0.55)
	27. It strengthens existing relationships/friendships	0.57	0.67		0.77	0.41	
	28. I enjoy the company of my playing partners	0.46	0.79		-	-	
	29(a). I can offer personal support to others in times of needs or hard times	0.72	0.48		0.36	0.87	
	30(a). I can ask other golfers for support when I need it	0.64	0.59		0.31	0.91	
9. Environment	29(b). I play golf because I enjoy the pleasant, natural surroundings	-	-	-	0.92	0.16	4.36
	30(b). I play golf because I enjoy the natural beauty and features of the course	-	-		0.78	0.38	(0.54)

4.4. Results

A total of 483 participants completed the questionnaire. Data for 54 participants were excluded as 3 did not provide consent for the data to be used, 2 indicated that they did not participate in golf at least once every two weeks, and 49 were not within the prescribed age range. A further 10 participants logged into the questionnaire but did not complete any of the questions. Thus, data from 419 participants were included in the analysis. Table 1 contains a summary of demographic information for these participants.

4.4.1. Factor loadings and fit indices

Tables 2 and 3 provide information on the factor loadings and fit indices for the nine-factor model. Factor loadings ranged from 0.31 to 0.92. Comparative fit indices (Hooper et al., 2008; Hu & Bentler, 1999; Yuan, 2005) were improved from the eight-factor model.

4.4.2. Internal reliability

Internal reliability for each subscale was acceptable (Bland & Altman, 1997; Tavakol & Dennick, 2011) (EP $\alpha = 0.74$, C $\alpha = 0.76$, TFS $\alpha = 0.71$, GF α 0.51, PH $\alpha = 0.67$, CH $\alpha = 0.84$, MH $\alpha = 0.87$, POC $\alpha = 0.67$ and Env $\alpha = 0.83$).

4.7. Discussion

Development of the GPQOA was an evidence-based process, informed by the reasons older adults play golf identified by previous research (Stenner et al., 2016). The nine-factor version of the GPQOA provided acceptable factor loadings and fit indices, indicating that it is an appropriate questionnaire to be used to investigate the reasons why older people play golf. All factor loadings were above the recommended 0.30 cut off (Brown, 2006; Hair, Tatham, Anderson, & Black, 1998) and the fit indices for the nine-factor model were acceptable (Hooper et al., 2008; Hu & Bentler, 1999; Yuan, 2005). When the factor loadings were viewed in conjunction with the fit indices, the nine-factor model was superior to the eight-factor model. Thus, there is support for using the nine-factor version of the GPQOA to examine the reasons why older people play golf.

5. Study 4—Measurement Invariance

Both men and women play golf, so it was important to determine whether both genders interpreted the questions in the GPQOA similarly. Measurement invariance proposes that individual scores do not depend on membership of a group (Meredith, 1993), and where measurement invariance is upheld, between group comparisons of latent scores can be supported (van de Schoot, Lugtig, & Hox, 2012).

Multi-group Confirmatory Factor Analysis (MG-CFA) is used for investigating measurement invariance, where each step is more constrained than the previous. In the first instance, a configural model is tested (Cheung & Rensvold, 2002; Wu, Li, & Zumbo, 2007), followed by progressively testing for weak, strong and strict invariance. Weak invariance constrains the factor loadings between groups, but allows intercepts and error variances to be free. Strong invariance constrains both the intercepts and the factor loadings, allowing the error variances to be free, while strict invariance constrains the factor loadings, intercepts and error variances (Cheung & Rensvold, 2002; Wu et al., 2007).

5.1. Method

Participants were again invited to participate via a large-scale direct electronic mail out using the GolfLink platform (golflink.com.au, Sydney, Australia) using the same method as the previous study.

Table 3. Fit indices for 8-factor and 9-factor models

Fit index	8-factor 30-item instrument	9-factor 30-item instrument
	Value	Value
SRMR	0.109	0.075
TLI	0.806	0.929
CFI	0.831	0.940
RMSEA	0.122, 90% CI = 0.117–0.126	0.064, 90% CI = 0.059–0.068
	$p < 0.001$	$p < 0.001$

Note: Absolute fit of the eight-factor model χ^2 (377, N = 402) = 1,012.80, $p < 0.0001$. Absolute fit of the nine-factor model χ^2 (369, N = 419) = 993.91, $p < 0.0001$.

5.2. Participants
Recruitment continued until approximately 500 participants of each gender completed the questionnaire, consistent with general sample size guidelines (MacCallum, Widaman, Zhang, & Hong, 1999). Participants comprised the first 533 men and 533 women who responded. Participants were from metropolitan and country locations (n = 622 and n = 425, respectively; *19 did not indicate location), and were required to meet the same inclusion criteria as Study 1, 2 and 3. Demographic data are presented in Table 4.

5.3. Data analysis
Invariance testing was completed using a four stage approach as proposed by Wu et al. (2007), with analysis performed and results reported according to the recommendations of Brown (2006). Missing data were imputed using maximum likelihood estimation and Confirmatory Factor Analysis (CFA) was completed using Lisrel 9.1 (SSI, USA; Jöreskog & Sörbom, 2015) to determine the level of measurement invariance between genders. Internal reliability was determined using Cronbach's alpha.

5.4. Results
Table 5 presents the results of measurement invariance testing. Configural invariance was supported, based on the values of RMSEA, CFI, TLI and SRMR being within the reported acceptable ranges (Hooper et al., 2008; Yuan, 2005). Invariance testing then progressed to more constrained levels, and the values of the configural model used as the baseline for comparison of the nested models. A ΔCFI of less than 0.01 for each level of invariance testing indicated support for the model across genders (Cheung & Rensvold, 2002; Hu & Bentler, 1999; Wu et al., 2007; weak ΔCFI = 0.001, strong ΔCFI = 0.005, strict invariance ΔCFI = 0.006).

Internal reliability was also supported (EP α = 0.75, C α = 0.79, TFS α = 0.70, GF α = 0.59, PH α = 0.69, CH α = 0.85, MH α = 0.85, POC α = 0.69 and Env α = 0.85).

Table 4. Summary of participant demographics for Measurement Invariance (N = 1,066)

Characteristic	All	Men	Women	Metro*	Country*
	N= 1,066	n = 533	n = 533	n = 622	n = 425
Age	64.7	65.3	64.2	64.9	64.9
	(5.2)	(5.3)	(5.1)	(5.3)	(5.1)
Years playing	27.2	35.1	19.3	26.7	28.0
	(15.6)	(14.2)	(12.7)	(15.4)	(15.8)
Handicap	18.2	15.2	21.2	18.2	18.1
	(7.7)	(6.2)	(7.9)	(7.9)	(7.5)
Rounds of golf played per week (average)	2.1	2.2	2.1	2.1	2.2
	(0.8)	(0.8)	(0.7)	(0.8)	(0.8)

Note: Data are presented as mean (standard deviation).

Table 5. Results of measurement invariance testing

Model	Δ x^2	Δ *df*	RMSEA	CFI	TLI	SRMR
Configural (base model) x^2 (783, N = 1,066), 2,330.303*			0.061	0.949	0.943	0.069
Weak	48.25	21*	0.061	0.948	0.944	0.080
Strong	201.39	51*	0.062	0.944	0.942	0.079
Strict	262.37	81*	0.061	0.943	0.943	0.082

* $p < 0.001$, x^2 Chi Square, *df* degrees of freedom, RMSEA root mean square error of approximation, CFI comparative fit index, TLI Tucker–Lewis index, SRMR standardised root mean square residual.

5.5. Discussion
Invariance testing supported invariance across genders. Configural invariance implies that both men and women were interpreting the questionnaire in the same manner (Wu et al., 2007). The support of weak invariance suggests that a one unit increase in factor score for men was equivalent to a one unit increase in factor score for women (Wu et al., 2007). Strong invariance was also upheld, indicating that men and women who had the same value on the factor score had the same value on the observed variable (Wu et al., 2007), indicating it was possible to compare means for the latent variables between men and women. Strict invariance was upheld and suggests there was no difference in the reliability of the item scores, and that variables functioned in the same way to affect the latent variable(s) across gender (Wu et al., 2007). As all levels of invariance were upheld, it can be assumed the questionnaire was being interpreted in the same manner by both men and women, and that the item scores and mean scores for the latent variables were independent of gender. Therefore, comparisons between gender using the GPQOA can be conducted with confidence.

6. General discussion
The studies described in this paper provide evidence for validity of the GPQOA for investigating the reasons why older golfers play golf. In Study 1, questions were developed and refined using existing theory, and then piloted with golfers aged 55–74 years. Studies 2 and 3 used Confirmatory Factor Analysis to provide support for validity of a nine-factor 30-item model. Finally, Study 4 demonstrated that the GPQOA was interpreted similarly by men and women. The GPQOA can now be used to investigate why older golfers play golf, and improve understanding of why golf participation in this group is defying the trend for decreased participation in golf in general and in most organised sports. Research using this questionnaire has the potential to contribute to the development and implementation of targeted, population-specific marketing and recruitment activities aimed at increasing participation in golf, and might possibly also be translated to assist in increasing participation in other sports.

The questionnaire was developed based on existing research regarding older people and golf, and as such addressed specific areas of interest related to golf participation. It was subject to extensive peer critique and review, as well as a Delphi process to incorporate industry-based feedback. A separate, independent sample was used for each stage of the analysis, and these separate samples were both relatively large and representative of the population of interest. Each of the independent samples showed adequate support for the model, which again suggests the model and questionnaire has evidence of validity and can be used in this population. The relative brevity of the questionnaire is a strength as it will reduce participant burden when administered.

It is also important to acknowledge the limitations of the present studies. The studies described here did not compare other sports participation tools with the GPQOA, to determine concurrent validity, but other tools were limited in that they did not address golf-specific aspects of participation, such as the pleasant environment within which golf is played, which was identified in previous research (Stenner et al., 2016). While the GPQOA may be useful in regard to identifying why older adults play golf, it is limited to this population in one sport only at this stage. It has not yet been validated for younger golfers, nor is it clear whether it will be relevant for golfers from cultures other than Australia who might play golf for different reasons, and this could form the basis of future work in this area. Regardless, the data obtained using this tool will provide valuable insights into the game of golf and contribute to both the golfing industry and literature related to both participation in sport and participation in golf.

The internal reliability of the questionnaire needs to be considered. Six of the nine subscales had Cronbach's alpha values greater than the 0.7 acceptable level proposed by Nunnally and Bernstein (1994), and George and Mallery (2003). However, three of the subscales (Fun, Physical Health and Part of Community) had values less than 0.70. Fun and Physical health had only two and three items, respectively, and as the alpha value is largely determined by the number of items in each subscale (Tavakol & Dennick, 2011), these results could have been influenced by a low number of items in each of these subscales. Others propose that for two item scales, Cronbach's alpha is meaningless (Eisinga, Grotenhuis, & Pelzer, 2013). "Part of community" ($\alpha = 0.69$) had four items within the subscale, and the relatively low score may be instead related to the range of the different constructs within this subscale, albeit still within the broader theme of being part of the community. Apparent differences in constructs within the same subscale has been reported as a possible reason for lower values of Cronbach's alpha (Tavakol & Dennick, 2011), and this may have been the case here as the items in this subscale related to a number of subtly different aspects of the theme "Part of the community". The usefulness of Cronbach's alpha is debated in the literature (Sijtsma, 2009; Tavakol & Dennick, 2011), and is provided here as just one indication of the GPQOA's internal reliability. Further to this, while it is acknowledged that factors should have three or more items, the factors within this questionnaire with two items performed satisfactorily in this population, and as such, were included. Likewise, the use of the questionnaire could involve the randomisation of questions to assist in improving the psychometric integrity of the GPQOA.

Since the GPQOA was developed from Australian data, further investigation with golfers from other countries would provide interesting opportunities for comparisons of the reasons why older adults play golf and inform future physical activity participation efforts.

7. Conclusion

The results of this study provide evidence of validity and internal reliability of the subscale scores within the GPQOA, supporting its use for investigating the reasons why older adults participate in golf. The primary application of this questionnaire will be to determine the relative importance of each of the factors assessed by the GPQOA for older golfers in future large-scale surveys. Despite the decline in participation in organised sport, golf remains a popular sport in older people, and gaining a better understanding of the drivers for participation in this population utilising the GPQOA will provide information that could be used to better inform strategies to increase and/or maintain golf participation in the future, and perhaps also inform strategies to increase participation in other sports.

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Competing interests

The authors declare no competing interest.

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BJS conceived the study, participated in its design, collected and analysed the data and drafted the manuscript. JDB and ADM participated in the design, assisted with statistical analysis and helped draft the manuscript. All authors have read and approved the final version of the manuscript and agree with the order of presentation of the authors.

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