BMJ Open

Gender differences between WOMAC index scores, health-related quality of life and physical performance in an elderly Taiwanese population with knee osteoarthritis

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To cite: Fang W-H, Huang G-S, Chang H-F, *et al*. Gender differences between WOMAC index scores, health-related quality of life and physical performance in an elderly Taiwanese population with knee osteoarthritis. *BMJ Open* 2015;**5**:e008542. doi:10.1136/bmjopen-2015-008542

▶ Prepublication history and additional material is available. To view please visit the journal (http://dx.doi.org/10.1136/bmjopen-2015-008542).

Received 28 April 2015
Revised 19 August 2015
Accepted 21 August 2015

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ABSTRACT

Objective: To investigate the importance of the WOMAC index score, health-related quality of life and physical performance in each domain affected by knee osteoarthritis (OA) and to identify gender differences in the importance of these domains and physical performances.

Material and methods: We performed a population-based study for radiographic knee OA among participants aged more than 65 years. Demographic data were collected and anthropometric measurement, radiographic assessment, the WOMAC index score, the short-form 12 (SF-12), the Timed and Up to Go Test (TUGT) and the Five Times Sit to Stand Test (FTSST) were performed.

Result: There were 901 individuals (409 males and 492 females) aged 74.04±6.92 (male: 76.35±7.33; female: 72.12±5.92) years included in this study. The WOMAC scores of participants with OA were higher than those without OA in males and females (male: 11.97±15.79 vs 8.23±12.84, p<0.001; female: 10.61±14.97 vs 7.59 ±3.31, p=0.032). The physical component summary (PCS) score was only significant in females with knee OA (62.14±24.66 vs 66.59±23.85, p=0.043), while the mental component summary (MCS) score was only significant in males with knee OA (78.02±18.59 vs 81.98 ±15.46, p=0.02). The TUGT and FTSST were not significant in individuals with and without OA in males and females. Moreover, the multivariate results for the WOMAC score were significant for females (3.928 (95% CI 1.287 to 6.569), p=0.004).

Conclusions: The PCS domains of SF-12 and MCS domains of SF-12 are crucial in Taiwanese females and elderly males, respectively, with knee OA. Different evaluation and treatment strategies based on gender differences should be considered in elderly Taiwanese patients with knee OA to improve their quality of life.

Strengths and limitations of this study

- To explore the gender difference in the effect on the quality of life in people who suffered from knee osteoarthritis (OA) in different cultures and environments.
- Furthermore, the results could be used to design a strategy to increase the quality of life of elderly Taiwanese patients with knee OA.
- This study utilised a self-reported disease-specific and health-related questionnaire and a physical performance test to assess quality of life.
- The cross-sectional design of this study precluded any causal inference.
- This sample had a limited age range.

INTRODUCTION

Knee osteoarthritis (OA) is characterised by the degeneration of articular cartilage, morphological changes in the subchondral bone and damage to the surrounding soft tissue.[1 2] These structural changes lead to joint pain, quadriceps muscle weakness, reduced range of motion and joint instability.[3 4] As a result, knee OA is the most common form of chronic joint disease and the leading cause of lower limb disability in elderly populations.[3–7]

The limitations in activity caused by OA seriously affect social relationships, body image, emotional well-being and quality of life (QOL), particularly at an advanced age.[8 9]

During the past few decades, many instruments have become available to measure QOL. These QOL scales are either generic or disease-specific and some have been developed as clinical tools for outcome measurements in patients with OA.[10 11]

The Western Ontario and McMaster (WOMAC) index is one of the most widely used outcome measures for this purpose. WOMAC is a disease-specific instrument for measuring the level of pain, joint stiffness and functional ability and was applied for the evaluation of knee and/or hip OA by Bellamy *et al*.[12 13]

Health-related QOL (HRQOL) is a concept which represents an individual's perceived health status and overall physical and mental well-being. Among the generic scales, the Medical Outcome Study Short Form-12 (SF-12) has been widely used to measure HRQOL in patients with OA.[14]

Although self-reported measures of function are often primary end points in clinical outcome studies, growing evidence has shown that objective performance-based assessments, such as the Timed and Up to Go Test (TUGT) and the Five Times Sit to Stand Test (FTSST), could demonstrate different aspects of clinical function.[15–18]

Some studies have shown that performance-based assessments identify limitations in physical function earlier compared with self-reported assessments.[17 19] Performance-based assessments are required to obtain a more complete picture of the functional limitations in populations with knee OA.[20 21] Therefore, both performance-based and self-reported outcome measures should be included as part of a comprehensive patient profile to accurately assess the multiple domains of physical function and disability in elderly populations with OA.

Studies in the USA and Japan have suggested that gender difference plays an important role in OA and HRQOL.[22 23] It has been suggested that ethnicity also affects the relationship between QOL, functional disability and OA.[24–26] However, studies that explore the population of Taiwan are lacking. Therefore, we hypothesised that the relationship between WOMAC, HRQOL, physical performance and knee OA would be affected by culture, environment and ethnicity. The purpose of this study was to identify the role of gender differences in QOL measures and physical performance in an elderly Taiwanese population with knee OA.

MATERIALS AND METHODS

Participants

This population-based study enrolled 901 participants (409 males and 492 females) and consisted of both healthy individuals and patients aged 65 years and older (mean (SD) age=74.04 (6.92) years), who received Taipei city senior medical check-ups between March 2010 and July 2011 at the Tri-Service General Hospital (TSGH), a medical teaching hospital of the National Defence Medical Centre in Taipei, Taiwan. The Taipei city senior medical check-up programme is a governmental welfare programme provided to people who are aged 65 or older and who have been registered residents in Taipei city for more than 1 year.

We explored the associated information at the Health Management Centre of TSGH while the participants received the check-up programme. All participants who were willing to join this study after full explanation by investigators were enrolled. Patients who had undergone knee surgery, such as total knee arthroplasty, were excluded. This study was approved by the TSGH Institutional Review Board (TSGH-100-05-023). All participants provided written informed consent. The demographic data included age, gender, body mass index (BMI: kg/m^2), occupation before retirement, years of formal education and weekly exercise level. We defined one instance of exercise as more than 30 min of moderate intensity physical activity.[27]

Measures

Radiographic assessment

All participants underwent radiographic examination of both knees using anteroposterior and lateral views with weight-bearing and foot-map positioning. Knee radiographs were read and scored by two readers, including a radiologist and a rheumatologist blinded to the patients' clinical information, using the Kellgren/Lawrence (KL) grading system.[28] In KL grading, radiographs are scored from 0 to 4. If the results yielded different K-L grades, we recruited a third interpreter to confirm the final grade. For patients with different K-L grades in each knee, the more advanced grade was taken for evaluation. We used a radiographic grade of ≥2 on the Kellgren/Lawrence scale to define knee OA.

Instruments

Western Ontario and McMaster Index

The WOMAC osteoarthritis index is a disease-specific measure of health status. It provides information on clinically important, patient-relevant symptoms in the areas of pain, stiffness and physical function in patients with knee OA.[29] WOMAC includes 5 items that measure pain, 2 items that measure stiffness and 17 items that measure physical function. We used the Likert version of the WOMAC, wherein each item is scored on a five-point scale. Scores for each scale are created by summing the points of the individual items. Higher scores represent worse health status. Both the reliability and validity of WOMAC have been established.[12 30]

Short Form-12

The SF-12 was used to assess the status of general physical health. It consists of 12 questions covering 8 health domains of physical functioning (PF), social functioning (SF), role-physical (RP), role-emotional (RE), mental health (ME), energy/vitality (VT), bodily pain (BP) and general health perception (GH).[31 32] The questions were combined, scored and weighted to create the physical component summary score (PCS) and mental component summary score (MCS) ((ranging from 0 (lowest level of health) to 100 (highest level of health)). The score of PCS is composed of PF, RP, BP and GH and the score of MCS is composed of SF, RE, ME and VT.

Timed and Up to Go Test

In this test, individuals are given verbal instructions to stand up from a chair with an armrest, walk 3 m as quickly and safely as possible, cross a line marked on the floor, turn around, walk back and sit down. The test includes the time it takes for the individual to get out of the chair after he/she is told to 'Go'. We defined times longer than 12 s as impaired lower extremity function.[33 34]

Five Times Sit to Stand Test

In this test, the patient sits with arms folded across the chest and with his/her back against a chair (43 cm high and 47.5 cm deep). The participants were instructed to stand up fully between repetitions and not to touch the back of chair, using the standard instruction, "I want you to stand up and sit five times as quickly as you can, when I say 'Go'." Timing begins at 'Go' and ends when the buttocks touch the chair after the fifth repetition. We defined a time longer than 15 s to represent impaired lower extremity function.[35–38]

Statistical analysis

Categorical and continuous variables were presented as a number (proportion) and mean±SD. We used Student t test to compare the WOMAC index score, SF-12 domains, TUGT and FTSST between elderly Taiwanese patients with and without knee OA. We also stratified the results by gender and compared the above variables with Student t test.

To test the effect of each independent variable on each dependent variable, linear regression and logistic regression were used to test their effects. To determine the independent association of radiographic knee OA and physical performance with quality measures, we used multiple regression analysis with adjustment for age, BMI, education and exercise.

Statistical significance was set at a p value of <0.05. Data analyses were performed using the R statistical program (V.3.1.1).

RESULTS

Table 1 shows the characteristics of the participants in this study. There were 901 individuals (409 males and 492 females) aged 74.04±6.92 years (male: 76.35±7.33; female: 72.12±5.92). The mean BMI was 24.29, 24.38 and 24.22 in all individuals, males and females, respectively. The occupational profile, years of formal education and weekly exercise levels are also shown in table 1.

Table 2 shows the differences between participants with and without knee OA in QOL and performance-based assessment. The WOMAC scores in patients with knee OA were higher than in those without knee OA in terms of pain, stiffness, physical function and total scores. The SF-12 scores, including PCS and MCS, were lower in participants with knee OA compared with people without it. However, some subitems had no significant difference between participants with and without knee OA (p value of role—physical=0.225; p value of general health=0.139; p value of social functioning=0.183; and p value of mental health=0.328). In addition, the differences between participants with and without knee OA were not marked for TUGT and FTSST.

Table 3 shows the difference between male participants with and without knee OA in QOL and performance-based assessment. The WOMAC scores in men with OA were higher than those in men without OA in terms of pain, stiffness and total scores, but not in physical function. The patients with OA had lower MCS scores on SF-12 than the patients without OA, but there was no marked difference between the two groups in PCS scores. Moreover, TUGT and FTSST showed no marked difference in physical performance between men with and without OA.

Table 4 shows the difference between female participants with and without knee OA in QOL and performance-based assessments. The WOMAC scores in

Table 1 Characteristics of the participants and stratification by gender

Characteristic	Overall	Male	Female
Number	901	409 (45.4%)	492 (54.6%)
Age, mean±SD	74.04±6.92	76.35±7.33	72.12±5.92
BMI (kg/m^2)	24.29±3.25	24.38±2.92	24.22±3.50
Occupation			
White collar	503 (55.8%)	273 (66.7%)	230 (46.7%)
Blue collar	203 (22.5%)	128 (31.3%)	75 (15.2%)
Not working	195 (21.6%)	8 (2%)	187 (38%)
Years of formal education			
≦12 years	574 (63.7%)	201 (49.1%)	373 (75.8%)
>12 years	327 (36.3%)	208 (50.9%)	119 (24.2%)
Weekly exercise level			
None	137 (15.2%)	49 (12.0%)	88 (17.9%)
1–3 times	226 (25.1%)	92 (22.5%)	134 (27.2%)
Everyday	538 (59.7%)	268 (65.5)	270 (54.9%)

BMI, body mass index.

Table 2 Difference of the WOMAC scores, SF-12 scores and physical performance between the participants with knee OA or without

	With OA (mean±SD) N=460	Without OA (mean±SD) N=441	p Value
WOMAC			
Pain	2.60±3.57	1.85±2.94	0.001
Stiffness	1.08±1.58	0.74±1.39	0.001
Physical function	8.29±11.71	5.74±9.57	0.001
Total	11.97±15.79	8.23±12.84	<0.001
SF-12			
Physical functioning (PF)	65.54±32.34	71.88±30.94	0.003
Role-physical (RP)	62.39±46.43	66.10±45.12	0.225
Bodily pain (BP)	86.47±20.30	89.43±18.87	0.024
General health (GH)	48.65±29.39	51.52±28.73	0.139
Vitality (VT)	63.65±27.39	68.39±25.25	0.007
Social functioning (SF)	81.52±23.18	83.50±21.42	0.183
Role-emotional (RE)	81.74±37.68	86.39±32.28	0.046
Mental health (MH)	78.33±18.80	79.52±17.90	0.328
SF-12			
PCS	65.76±24.67	69.73±23.69	0.014
MCS	76.31±19.60	79.45±16.66	0.010
TUGT (s)	9.90±3.40	9.45±4.50	0.090
FTSST (s)	13.77±5.67	13.00±6.42	0.060

FTSST, Five Times Sit to Stand Test; MCS, mental component summary; PCS, physical component summary; SF-12, Short Form-12; TUGT, Timed and Up to Go Test; WOMAC, Western Ontario and McMaster index.

females with OA were higher than those without OA in terms of pain, stiffness, physical function and total scores. It is worth noting these different results in females. The PCS score of SF-12 was markedly different in females (participants with knee OA vs without knee OA, p=0.043) compared with that in males (participants with knee OA vs without knee OA, p=0.239). However, the MCS score was inversed. In addition, physical performance was not markedly different in TUGT and FTSST in women with and without OA.

Table 3 Difference of the WOMAC scores, SF-12 scores and physical performance between the male participants with knee OA or without

	With OA (mean±SD) N=200	Without OA (mean±SD) N=209	p Value
WOMAC			
Pain	2.24±3.18	1.53±2.97	0.021
Stiffness	0.93±1.40	0.62±1.38	0.026
Physical function	7.40±11.46	5.44±10.21	0.062
Total	10.61±14.97	7.59±3.31	0.032
SF-12			
Physical functioning (PF)	70.25±31.84	77.27±29.79	0.022
Role-physical (RP)	69.25±44.74	70.33±42.80	0.802
Bodily pain (BP)	89.33±17.68	89.93±19.41	0.743
General health (GH)	53.10±28.51	55.36±28.63	0.425
Vitality (VT)	65.80±26.34	71.10±23.27	0.031
Social functioning (SF)	84.88±21.55	85.77±20.46	0.668
Role-emotional (RE)	80.25±39.12	89.23±28.02	0.008
Mental health (MH)	81.15±18.16	81.82±17.61	0.706
SF-12			
PCS	70.48±23.94	73.22±23.07	0.239
MCS	78.02±18.59	81.98±15.46	0.020
TUGT (s)	9.51±3.26	9.20±3.08	0.334
FTSST (s)	13.27±5.16	12.47±6.42	0.177

FTSST, Five Times Sit to Stand Test; MCS, mental component summary; PCS, physical component summary; SF-12, Short Form-12; TUGT, Timed and Up to Go Test; WOMAC, Western Ontario and McMaster index.

Table 4 Difference of the WOMAC scores, SF-12 scores and physical performance between the female participants with knee OA or without

	With OA (mean±SD) N=260	Without OA (mean±SD) N=232	p Value
WOMAC			
Pain	2.88±3.83	2.14±2.88	0.015
Stiffness	1.19±1.70	1.84±1.39	0.013
Physical function	8.94±11.87	6.00±8.98	0.002
Total	13.01±16.35	8.99±12.39	0.002
SF-12			
Physical functioning (PF)	61.92±32.32	67.03±31.23	0.076
Role-physical (RP)	57.11±47.09	62.28±46.87	0.224
Bodily pain (BP)	84.27±21.88	88.99±18.40	0.010
General health (GH)	45.23±29.65	48.06±28.44	0.282
Vitality (VT)	62.00±28.10	65.95±26.73	0.112
Social functioning (SF)	78.94±24.09	81.47±22.10	0.229
Role-emotional (RE)	82.88±36.57	83.84±35.55	0.770
Mental health (MH)	76.15±19.03	77.46±17.95	0.436
SF-12			
PCS	62.14±24.66	66.59±23.85	0.043
MCS	75.00±20.28	77.18±17.39	0.203
TUGT (s)	10.20±3.48	9.66±5.47	0.195
FTSST (s)	14.16±6.02	13.46±6.39	0.221

FTSST, Five Times Sit to Stand Test; MCS, mental component summary; PCS, physical component summary; SF-12, Short Form-12; TUGT, Timed and Up to Go Test; WOMAC, Western Ontario and McMaster index.

The results of sex-specific analysis show the same results as displayed in tables 3 and 4. The PCS score of SF-12 was markedly higher in females without OA, but there was no marked difference in males. In contrast, the MCS score of SF-12 was markedly higher in males without OA, but there was no marked difference in females. The TUGT and FTSST were categorised into two groups based on the timing cut-off points as follows: 12 s for TUGT and 15 s for FTSST. In addition, we analysed the association between physical-based performance tests and QOL measures. These associations were very strong in males and females (all p values were less than 0.001, please see online supplementary tables S1–S3). The impact factors analysis of WOMAC, PCS, MCS, TUGT and FTSST are shown in online supplementary tables S4–S8, respectively.

We also checked the difference in WOMAC, SF-12 score and physical performance between females and males with knee OA. The PCS domain of females with knee OA had markedly lower scores than that of males with knee OA (p≤0.001). The proportion of females with knee OA with an FTSST longer than 15 s was higher than that of males with knee OA (p=0.015). Furthermore, the WOMAC and MCS scores in females with knee OA were lower than those in males with knee OA, but no statistical significance was shown in these two variables between females and males with knee OA. The proportion of TUGT longer than 12 s in females with knee OA was greater than that in males with knee OA; however, there was no statistical significance observed.

The multivariate models are shown in table 5. After adjusting for age, BMI, education and exercise, the patients with OA had no marked difference compared with individuals without OA on PCS, MCS, TUGT and FTSST. However, the total WOMAC scores were markedly different between females with and without OA (p=0.004), but not in males (p=0.220).

DISCUSSION

This study demonstrated a gender difference in WOMAC index scores (a disease-specific scale), SF-12 (an alternative form of health-related QOL measures) and physical-based performance in an elderly Taiwanese population with knee OA. The present study shows that elderly Taiwanese females with KL ≥2 have significantly lower PCS scores than those with KL=0 or 1 (difference between them on PCS: −4.46). Samsa *et al*[39] elucidated that the Minimally Clinically Important Difference (MCID) for SF-36 is typically in the range of 3–5 points. In other words, a difference of 3 points or more in SF-36 scores is clinically important. In this study, the difference in PCS scores and similar MCID thresholds between females with KL ≥2 and those with KL=0 or 1 was 4.46, implying that PCS domains play a clinically important role in females with knee OA.

Muraki *et al*[23] showed that participants with KL=3 or 4 had significantly lower PCS scores than those with KL=0, 1 or 2. Our data also demonstrated this trend. However, their study showed that the MCS score was higher with KL=3 or 4 than that with KL=0 or 1 in men and

Table 5 The change by OA in multiple regression on WOMAC score, SF-12 score and performance-based assessment

	Men			Women		
	β	95% CI	p Value	β	95% CI	p Value
WOMAC*	1.738	(−1.041 to 4.516)	0.220	3.928	(1.287 to 6.569)	0.004
PCS*	−0.881	(−5.390 to 3.628)	0.702	−3.264	(−7.660 to 1.132)	0.146
MCS*	−3.115	(−6.413 to 0.183)	0.064	−1.627	(−5.113 to 1.860)	0.361
TUGT (12 cut)†	−0.575	(−1.234 to 0.084)	0.087	0.323	(−0.211 to 0.857)	0.236
FTSST (15 cut)†	0.024	(−0.497 to 0.546)	0.927	0.122	(−0.289 to 0.533)	0.560

All results were adjusted by age, BMI, education and exercise.
*Result of linear regression.
†Result of logistic regression.
BMI, body mass index; FTSST, Five Times Sit to Stand Test; MCS, mental component summary; PCS, physical component summary; TUGT, Timed and Up to Go Test; WOMAC, Western Ontario and McMaster index.

women.[23] Muraki *et al*[40] stated that the phenomenon was due to a so-called 'disability paradox'. Our study illustrated that the MCS score was lower in patients with KL=2 or more relative to those with KL=1 or less, especially in males, consistent with another Chinese hospital-based study from Woo *et al*.[8] The absence of a so-called 'disability paradox' in Chinese and Taiwanese populations further supports the effects of different cultures and genders on HRQOL, even in the same disease. Further investigation is needed to address this topic.

Logerstedt *et al*[22] showed the same results for PCS scores (males: 38.18–53.31=−15.13; females: 34.39–56.43=−21.94). Although the effects of OA on PCS in females and MCS in males were not marked after adjusting for age, BMI, education and exercise, their difference was still greater than MCID (PCS in females: −3.264; MCS in males: −3.115). Moreover, the difference between females with and without OA was marked on WOMAC, but the difference between males with and without OA was not marked on WOMAC. Since the three components of WOMAC were directly associated with PCS, this result confirmed the role of OA on PCS in females.

The major impact of OA on PCS in females was bodily pain (p=0.010). Moreover, the role of OA on bodily pain in males was not significant (p=0.743). This suggests that while the decline in physical function itself affects elderly Taiwanese women, elderly Taiwanese men do not think that they are physically affected. Kim *et al*[41] also found that knee pain had a greater impact in women with knee OA compared with men. Many studies indicated that women have a lower pain threshold and a lower tolerance to pain than men in the laboratory situation.[42–44] Furthermore, previous research has stated that women are vulnerable to developing and sustaining musculoskeletal pain conditions.[45 46] Therefore, major preventive strategies in females with OA should focus on the reduction of bodily pain.

Another interesting contrast between males and females can be observed in tables 3 and 4. While a significant difference in MCS exists between males with and without OA (p=0.020), there was no such difference in females (p=0.203). Specifically, the difference between males with OA and without OA comes from two subitems: vitality (p=0.031) and role-emotional (p=0.008). However, there was no significance in physical performance (TUGT and FTSST tests) in males with or without knee OA. This suggests that it is psychological stress rather than the decline in the physical performance that affects the mental health of elderly Taiwanese males.

Regarding the differences between females and males with knee OA, the PCS domains and FTSST longer than 15 s were statistically significant. Females with knee OA had lower PCS scores than males with knee OA, consistent with other studies from Logerstedt *et al* (34.39 vs 38.18) and Muraki *et al* (43.8 vs 44.7). This finding suggested that females with knee OA had more pain, greater pain sensitivity, poorer performance and worse perceived function than males with knee OA. Females with knee OA had a greater proportion of FTSST longer than 15 s compared with males with knee OA, but there was no significant difference in TUGT longer than 12 s between females and males with knee OA. Logerstedt *et al* reported a markedly significant difference in TUGT between females and males with knee OA, but there was no significant difference in TUGT between females and males with knee OA in our study. The differences in these study groups may have contributed part of this difference, because the knee OA in the patients in our study might have been less severe compared with that in their patients. Females with early knee OA are more sensitive in FTSST. We suggested that FTSST could be used in early knee OA participants to compare gender differences.

On the basis of the results in tables 3 and 4, with regard to patients with OA, we need to pay attention to mental health in males and physical function in females. Therefore, different strategies may be required in the evaluation and management of males and females with knee OA to improve their quality of life.

With increasing age, physical-based performance and QOL measures worsened. This observation was similar to those of previous studies and also clearly illustrates that increasing age is a significant risk factor in people with knee OA.[47–50] Jarvholm *et al* proposed a 'nonlinear' relationship between age and the incidence of knee OA. There is a sharp rise in the incidence of knee OA between the ages of 50 and 75, but only a limited rise above age 75.[51]

We found that physical-based performance and QOL measures deteriorated with reduced frequency of daily exercise. This finding is similar to those of White *et al*,[52] who proposed that higher levels of walking activity could protect against the development of functional limitations in people with or at risk of knee OA. In other words, the prevention of a sedentary lifestyle and encouragement of increased daily exercise in elderly populations are helpful in maintaining physical function and QOL.

The univariable analysis showed a significant association between HRQOL and knee OA. Although the result of multivariable analysis presented non-significant results, these results showed the same trend with univariable results. The non-significance may have been due to the small sample size, as statistical power is reduced by increased degrees of freedom in the model. However, the absolute changes of PCS in females and MCS in males were both greater than MCID. Thus, we considered this to still have clinical significance.

Limitations

There are several limitations to our study. First, this is a population-based cross-sectional study; therefore, it is difficult to demonstrate a causal relationship. Further follow-up on this subject may elicit clear causal relationships. Second, other weight-bearing OAs, such as OA of the hip, were not included in the analysis, although these conditions also affect QOL and physical performance. However, knee OA remains the leading cause of OA. Third, the participants in our study are all community-dwelling elderly people who are eligible to receive Taipei city senior medical check-ups. Moreover, the contents of announcement for participants included the impact of knee OA. This group may represent part of the general population, but extrapolation should be limited. Fourth, all the participants who walk into a hospital to receive medical check-ups have relatively higher physical performance and QOL measures than those who stay at home and do not receive medical check-ups. Therefore, QOL measures and physical performance in patients with OA may have been overestimated in our study population, and consequently any differences between them may be underestimated. However, this did not affect our conclusions.

CONCLUSION

This cross-sectional study indicated that elderly Taiwanese females with knee OA had relatively lower scores in the PCS domain of SF-12 than those without knee OA. At the same time, elderly Taiwanese males with knee OA had relatively lower scores in the MCS domain of SF-12 than those without knee OA. Both genders with OA of the knee had higher WOMAC index scores than those without knee OA.

It is worth noting that different strategies may be required in the management of males and females with OA, with the major objective of the management of mental health in males and physical function in females.

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Contributors W-HF and S-LS conceived and designed the experiments. W-HF and S-LS performed the experiments. W-HF and CL analysed the data. W-HF and C-CW contributed reagents/materials/analysis tools. W-HF and S-LS wrote the paper. G-SH, C-YC, C-YK, J-HY, WS and SYK were responsible for critical review and comments. S-LS and H-FC were responsible for modifying the manuscript.

Funding This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Ethics approval Tri-Service General Hospital IRB.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement The raw data can be obtained from the corresponding author on request by email: a131419@gmail.com

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Table S1 the association between PCS/MCS and TUGT/FTSST in whole population

	Overall (n=901)					
	TUGT		p value	FTSST		p value
	≤12 sec (n=409)	> 12 sec (n=83)		≤15 sec (n=334)	>15 sec (n=158)	
PCS	71.06±22.35	49.65±26.19	<0.001	72.66±21.55	54.60±26.13	<0.001
MCS	79.80±17.03	67.30±21.04	<0.001	80.58±16.50	70.62±20.67	<0.001

Table S2 the association between PCS/MCS and TUGT/FTSST in males

	Male (n=409)					
	TUGT		p value	FTSST		p value
	≤12 sec (n=409)	> 12 sec (n=83)		≤15 sec (n=334)	>15 sec (n=158)	
PCS	75.33±21.06	50.99±26.71	<0.001	75.12±21.45	60.24±26.81	<0.001
MCS	82.09±15.26	67.63±22.21	<0.001	82.23±15.38	72.18±20.67	<0.001

Table S3 the association between PCS/MCS and TUGT/FTSST in females

	Females (n=492)					
	TUGT		p value	FTSST		p value
	≤12 sec (n=409)	> 12 sec (n=83)		≤15 sec (n=334)	>15 sec (n=158)	
PCS	67.39±22.80	48.70±25.95	<0.001	70.30±21.42	51.42±25.27	<0.001
MCS	77.84±18.20	67.08±20.32	<0.001	79.00±17.38	69.74±20.68	<0.001

Table S4 The association between co-variable and WOMAC score.

	Men					Women				
	β	se	**95% CI**		**p-value**	β	se	**95% CI**		**p-value**
KL scroe (< 2 is ref.)	3.016	1.399	0.274	to 5.759	0.031	4.020	1.320	1.433	to 6.608	0.002
Age (per 1 years)	0.396	0.094	0.212	to 0.581	0.000	0.358	0.111	0.140	to 0.576	0.001
BMI (per 1 kg/m^2)	0.329	0.241	-0.143	to 0.800	0.172	0.409	0.189	0.038	to 0.780	0.031
Education (>12 is ref.)	1.941	1.443	-0.888	to 4.769	0.179	3.262	1.596	0.134	to 6.390	0.041
Exercise (everyday is ref.)	3.199	1.477	0.304	to 6.093	0.030	4.361	1.336	1.743	to 6.980	0.001

ref. = reference; dependent variable: WOMAC.

Table S5 The association between co-variable and PCS score.

	Men					Women				
	β	se	**95% CI**		**p-value**	β	se	**95% CI**		**p-value**
KL scroe (< 2 is ref.)	-2.742	2.324	-7.298	to 1.813	0.238	-4.455	2.193	-8.753	-to 0.157	0.042
Age (per 1 years)	-0.576	0.156	-0.883	-to 0.269	0.000	-0.625	0.184	-0.986	-to 0.265	0.001
BMI (per 1 kg/m^2)	-0.627	0.398	-1.406	to 0.153	0.115	-0.979	0.311	-1.588	-to 0.369	0.002
Education (>12 is ref.)	-5.345	2.349	-9.949	-to 0.741	0.023	-5.709	2.641	-10.885	-to 0.533	0.031
Exercise (everyday is ref.)	-9.908	2.418	-14.648	-to 5.169	0.000	-5.203	2.220	-9.554	-to 0.852	0.019

ref. = reference; dependent variable: PCS.

Table S6 The association between co-variable and MCS score.

	Men					Women				
	β	se	**95% CI**		**p-value**	β	se	**95% CI**		**p-value**
KL scroe (< 2 is ref.)	-3.961	1.688	-7.269	-to 0.653	0.019	-2.182	1.713	-5.539	to 1.176	0.203
Age (per 1 years)	-0.356	0.115	-0.581	-to 0.131	0.002	-0.406	0.144	-0.687	-to 0.124	0.005
BMI (per 1 kg/m^2)	-0.427	0.290	-0.996	to 0.142	0.142	-0.266	0.245	-0.745	to 0.213	0.277
Education (>12 is ref.)	-4.704	1.714	-8.064	-to 1.344	0.006	-4.389	2.071	-8.448	-to 0.330	0.034
Exercise (everyday is ref.)	-7.605	1.760	-11.055	-to 4.155	0.000	-4.239	1.727	-7.624	-to 0.855	0.014

ref. = reference; dependent variable: MCS.

Table S7 The logistic regression analysis of the association between co-variables and TUGT.

	Men					Women				
	β	se	**95% CI**		**p-value**	β	se	**95% CI**		**p-value**
KL scroe (< 2 is ref.)	-0.029	0.284	-0.585	to 0.527	0.918	0.483	0.248	-0.002	to 0.968	0.051
Age (per 1 years)	0.137	0.023	0.092	to 0.182	0.000	0.118	0.020	0.079	to 0.156	0.000
BMI (per 1 kg/m^2)	-0.048	0.049	-0.144	to 0.049	0.333	0.108	0.033	0.043	to 0.173	0.001
Education (>12 is ref.)	0.479	0.293	-0.094	to 1.053	0.101	0.566	0.324	-0.070	to 1.202	0.081
Exercise (everyday is ref.)	0.908	0.289	0.341	to 1.475	0.002	0.499	0.244	0.022	to 0.977	0.040

ref. = reference; dependent variable: 6m (cut of point = 12).

Table S8 The logistic regression analysis of the association between co-variables and FTSST.

	Men					Women				
	β	se	**95% CI**		**p-value**	β	se	**95% CI**		**p-value**
KL scroe (< 2 is ref.)	0.316	0.241	-0.156	to 0.787	0.190	0.282	0.195	-0.099	to 0.664	0.147
Age (per 1 years)	0.104	0.018	0.069	to 0.140	0.000	0.069	0.016	0.037	to 0.101	0.000
BMI (per 1 kg/m^2)	-0.045	0.042	-0.126	to 0.037	0.284	0.097	0.028	0.042	to 0.153	0.001
Education (>12 is ref.)	0.669	0.250	0.180	to 1.158	0.007	0.412	0.243	-0.063	to 0.888	0.089
Exercise (everyday is ref.)	0.444	0.247	-0.041	to 0.929	0.073	0.399	0.195	0.017	to 0.782	0.041

ref. = reference; dependent variable: 5 下 (cut of point = 15).