

## Physical activity and health-related quality of life in former cricketers with persistent upper-limb or lower-limb joint pain

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**Purpose:** Upper and lower-limb osteoarthritis (OA) has a high incidence and burden. Former sport participants with joint pain may be unable to participate in desired forms of activity with potential negative impacts on quality of life (QOL). Most research investigating OA burden has focused on the lower-limb, consequently upper-limb joint pain burden in former sport participants is poorly understood. It is also unclear whether the impact of upper-limb and lower-limb joint pain on physical activity and QOL differs in former sport participants.

The purpose of this study was to investigate the relationship between upper-limb (shoulder, elbow, wrist, hand) or lower-limb (hip, knee, ankle) persistent joint pain and i) physical activity levels, and ii) health-related QOL (HRQoL), in former sport participants.

**Methods:** 28,152 current and former cricketers of all playing standards who were registered on a national database were invited via email to complete a survey. 2,598 people responded and consented to the survey. To be eligible for this study, people must have played  $\geq 1$  cricket season, be aged  $\geq 18$  years and no longer participate in cricket (due to potential confounding of acute injury on joint pain). Persistent joint pain was evaluated by asking individuals if they had joint-specific pain on 'most days of the last month.' Subjects were included if they had persistent pain in one or more joints in the upper-limb (shoulder, elbow, wrist or hand) or the lower-limb (hip, knee or ankle), or had no persistent joint pain. Subjects were excluded if they had persistent pain in the upper and lower-limb, or persistent back pain. Outcomes included i) meeting vs. not meeting the physical activity guidelines ( $< 600$  METS per week assessed with the International Physical Activity Questionnaire Short-Form), and ii) HRQoL assessed with Short-Form 8 Health Survey (SF-8), Physical Component Scores (PCS) and Mental Component Scores (MCS) were calculated using norm based scoring (population norm 50 SD 10, high scorer = better HRQoL). PCS and MCS scores were dichotomised to low HRQoL (score  $< 50$ , below the population norm) vs. high HRQoL (score  $\geq 50$ , above the population norm).

Logistic regression investigated the relationship between joint pain, physical activity and HRQoL. Unadjusted and adjusted odds ratios (95% confidence intervals) were calculated. Odds ratios were adjusted for age, body mass index, and the presence of comorbidities. All assumptions for logistic regression were evaluated and satisfied.

**Results:** A total of 570 former cricketers, aged 58 (SD 13) years, BMI of 28.2 (SD 5.4) kg/m<sup>2</sup>, who had played on average 29 (SD 14) cricket seasons, were included in the analyses. 83 (15%) former cricketers had only upper-limb pain, 170 (30%) had only lower-limb pain, and 317 (55%) had no joint pain. 79 (16%) former cricketers did not meet the physical

activity guidelines, 190 (36%) reported PCS scores worse than the population norm and 134 (25%) reported MCS scores worse than the population norm.

Upper-limb pain was not associated with meeting the physical activity guidelines (OR 2.3; 95% CI 0.9 to 5.8). Former cricketers with lower-limb pain had a 2.9 (95% CI 1.0 to 3.6) times greater odds of not meeting the physical activity guidelines compared to those with no pain (Table 1). The MCS means per group were: upper-limb pain: 48.75 (SD 7.79); lower-limb pain: 45.99 (SD 8.12); no pain: 52.52 (SD 6.79). The PCS mean scores were: upper limb pain: 53.44 (SD 7.76); lower-limb pain: 53.37 (SD 7.46); no pain: 52.29 (SD 8.05). Former cricketers with upper-limb pain had a 2.5 (95% CI 1.4 to 4.3) times greater odds of reporting a PCS score worse than the population norm, compared to those with no pain. Former cricketers with lower-limb pain had a 4.4 (95% CI 2.8 to 6.9) times greater odds of reporting a PCS score worse than the population norm, compared to those with no pain (Table 2). Joint pain was not associated with MCS scores (Upper-Limb: 0.7; 95% CI 0.4 to 1.4); Lower-Limb: 0.9; 95% CI 0.6 to 1.5) (Table 3).

**Conclusions:** Individuals with lower-limb joint pain were more likely to have reduced physical activity levels compared to those with no joint pain, however this relationship was not observed for individuals with upper-limb joint pain. Both upper-limb and lower-limb joint pain was associated with worse physical components of HRQoL compared with no joint pain. In contrast, mental components of HRQoL were not associated with joint pain. Further research is needed to better understand physical activity impairments and factors influencing HRQoL in former sport participants with upper-limb and lower-limb OA.

**Key Words:** Shoulder, Knee, Ankle, Hip, Hand, Sport, Retired Athletes

Table 1: Logistic regression analysis investigating the relationship between persistent joint pain and physical activity level

	Not Meeting the physical activity guidelines		
	Count (%)	Unadjusted OR (95% CI)	Adjusted <sup>a</sup> OR (95% CI)
Persistent upper-limb joint pain	7 (10%)	2.2 (0.9, 5.0), p=0.69	2.3 (0.9, 5.8), p=0.074
Persistent lower-limb joint pain	19 (13%)	1.5 (0.9, 2.7), p=0.136	1.9 (1.0, 3.6), p=0.044
No persistent joint pain	53 (19%)	<i>Reference group</i>	

<sup>a</sup>Estimates are adjusted for age, body mass index, and comorbidities

<sup>b</sup>Comorbidities were dichotomised to no presence (0) and presence of a comorbidity (1).

Comorbidities included were diabetes, stroke, osteoporosis, kidney problems, memory impairment, skin cancer, other cancer, or other medical problems

<sup>c</sup> Compared to cricketers without persistent pain, former cricketers with only lower-limb joint pain had a 2.9 (95% CI 1.0, 3.6) greater odds of not meeting the physical activity guidelines (<600 METs)

Physical activity guidelines were assessed via the International Physical Activity Questionnaire Short-Form (IPAQ-SF); meeting physical activity guidelines required performing at least 600 METs per week through walking, moderate and/or vigorous exercise; IPAQ scores were converted to a binary variable, coded as not meeting physical activity guidelines <600 METs (1), and meeting the physical activity guidelines (0); Upper-limb (shoulder, elbow, wrist or hand) and lower limb (hip, knee or ankle) persistent pain were assessed by asking individuals if they had joint-specific pain on ‘most days of the last month.’

Table 2. Logistic regression analysis investigating the relationship between persistent joint pain and the physical components of health-related quality of life

Worse SF-8 Physical Component Score (score below the population norm of 50)			
	Count (%)	Unadjusted OR (95% CI)	Adjusted <sup>a</sup> OR (95% CI)
Persistent upper-limb joint pain	34 (44%)	2.7 (1.6, 4.5), p<0.0001	2.5 (1.4, 4.3), p=0.002
Persistent lower-limb joint pain	90 (58%)	4.7 (3.1, 7.1), p<0.0001	4.4 (2.8, 6.9), p<0.0001
No persistent joint pain	66 (23%)	<i>Reference group</i>	

<sup>a</sup>Estimates are adjusted for age, body mass index, and comorbidities

<sup>b</sup> Comorbidities were dichotomised to no presence (0) and presence of a comorbidity (1).

Comorbidities included were diabetes, stroke, osteoporosis, kidney problems, memory impairment, skin cancer, other cancer, or other medical problems.

<sup>c</sup> Compared to cricketers without persistent pain, former cricketers with upper-limb or lower limb persistent pain had a 2.5 (95% CI 1.4 to 4.3) greater odds and lower-limb persistent pain had a 4.4 (95% CI 2.8 to 6.9) greater odds of having a PCS score below the population mean (<50). SF-8: Short-Form 8 Health Survey; Physical Component Scores (PCS) were calculated using norm based scoring (population norm 50 SD 10, high scorer = better health-related quality of life); PCS scores were converted to a binary variable, coded as below the population mean <50 (=1) vs. achieving the population mean or better  $\geq$  50 (=0); Upper-limb (shoulder, elbow, wrist, or hand) and lower limb (hip, knee, or ankle) persistent pain were assessed by asking individuals if they had joint-specific pain on ‘most days of the last month.’

Table 3. Logistic regression analysis investigating the relationship between persistent joint pain and the mental component of health-related quality of life

Worse SF-8 Mental Component Score (score below the population norm of 50)			
	Count (%)	Unadjusted OR (95% CI)	Adjusted <sup>a</sup> OR (95% CI)
Persistent upper-limb joint pain	16 (21%)	0.7 (0.4, 1.3), p=0.223	0.7 (0.4, 1.4), p=0.281
Persistent lower-limb joint pain	38 (24%)	0.8 (0.5, 1.3), p=0.427	0.9 (0.5, 1.5), p=0.658
No persistent joint pain	80 (28%)	<i>Reference group</i>	

<sup>a</sup>Estimates are adjusted for age, body mass index, and comorbidities

<sup>b</sup> Comorbidities were dichotomised to no presence (0) and presence of a comorbidity (1).

Comorbidities included were diabetes, stroke, osteoporosis, kidney problems, memory impairment, skin cancer, other cancer, or other medical problems.

SF-8: Short-Form 8 Health Survey; Mental Component Scores (MCS) were calculated using norm based scoring (population norm 50 SD 10, high scorer = better health-related quality of life); MCS scores were converted to a binary variable, coded as below the population mean <50 (=1) vs. achieving the population mean or better  $\geq 50.00$  (=0); Upper-limb (shoulder, elbow, wrist, or hand) and lower limb (hip, knee, or ankle) persistent pain were assessed by asking individuals if they had joint-specific pain on 'most days of the last month.'