| **Supplementary Table 1.** Main contents of the 10 studies included in the present systematic review. | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Author (year) | Location of laboratory or recruitment area | Wearable devices | Positioning | Measures | Comparator | Population | Mean age (SD) in years | Mean BMI (SD) in kg/m2 | Inclusion criteria | Validity results |
| Semanik (2011) | Chicago, Illinois, USA | ActiGraph GT1M accelerometer | Waist | Counts per day; minutes/day of light intensity, bouted and non bouted MVPA | YPAS | 171 RA patients; 139 KOA patients | 55 (14) (RA);  63 (13) (KOA) | 28 (6) (RA); 31 (6) (KOA) | RA group: the 1987 the ACR criteria for RA.  KOA group: 1. symptomatic radiologic KOA; 2. age ≥ 18 years old; 3. no primary diagnosis of fibromyalgia; 4. no functionally limiting comorbidities such as spinal stenosis, peripheral vascular disease, or residual effects of stroke; 5. able to ambulate at least household distances (50 feet); 6. BMI < 35 kg/m2; 7. cognitively intact and able to speak and understand English; 8. no contraindication to PA intervention due to comorbid conditions; 9. no total joint replacement surgery within the past 12 months and no plans for total joint replacement in the next 24 months; 10. no plans to relocate from the metropolitan area in the next 24 months. | In RA groups YPAS subscales were all modestly but positively correlated to objective measures (r between 0.00 and 0.51). In OA group the Y-ADSI presented modest but significant correlations with accelerometer measures of average daily minutes of bouted MVPA (r = 0.36), average daily minutes of unbouted MVPA (r = 0.31), and average daily accelerometer counts (r = 0.24) |
| Backhouse (2013) | Leeds, UK | Step-N-tune,  A4L, and IDEEA accelerometers | Waist (Step-N-tune); Hip (A4L); Foot, thigh and sternum (IDEEA) | Steps per day (Step-N-tune; A4L; IDEEA); high intensity and low intensity activities (A4L); Temporal and Spatial Gait Parameters (IDEEA); Energy expenditure (IDEEA) | GAITrite instrumented walkway (temporal and spatial gait parameters); Three manual step count of half-speed video replay (steps) | 12 RA patients and 12 HS | 51.6 (18) (RA); 41.6 (9.8) (HS) | 31.1 (7.1) (RA); 23.4 (2.8) (HS) | RA group: consultant diagnosis of RA; HS group: walking freely for two minutes without pain, no known medical condition affecting their gait | Steps vs manual step count Bland–Altman width of 95% limits of agreement: HS group: Step-N-tune 22.64, A4L 44.16, IDEEA 61.52; RA group: Step-n-tune 169.74, A4L 52.90, IDEEA 225.00 |
| Verlaan (2015) | Heerlen, The Netherlands | Tri-axial  accelerometer (GCdataconcepts, US) | Lateral side of the non-affected upper leg | Steps per day; walking bouts per day; sit to stand transfers per day; minutes spent sitting/ standing/ walking | SQUASH | 30 KOA patients and 30 HS | 68.7 (6.9) (KOA); 67.3 (8.4) (HS) | 29.6 (5.7) (KOA); 24.7 (3.4) (HS) | KOA group: Kellgren-  Lawrence scale 3-4, program of total knee  Replacement; HS group: age-matched HS | SQUASH scores were moderately  correlated with both quantitative and qualitative AM parameters: bouts walking  (r=0.49; p<0.001), step counts (r=0.36; p=0.008), percentage  time sitting (r=-0.44; p=0.001), percentage time walking  (r=0.33; p=0.014), percentage time standing (r=0.42;  p=0.002), walking  bouts <1min (r=0.46; p<0.001), walking bouts 1-5min  (r=0.45; p=0.001) and amount of short sitting events (r=0.28;  p=0.039) |
| Yu (2015) | Birmingham, UK | ActiGraph GT3X accelerometer | Waist | Counts per day; minutes/day of sitting, light intensity, bouted and non bouted MVPA | IPAQ | 68 RA patients | 55 (13) | 27.8 (5.4) | Fulfilling the revised ACR classification criteria for RA | Self-reported sitting and light PA was significantly less than objectively measured sedentary and light physical time (p<0.01), self-reported MVPA was significantly lower than objectively measured MVPA (p<0.01) |
| Larkin (2016) | Limerick, Ireland | ActivPAL accelerometer | Anterior, middle right thigh | Step counts, transition counts, time spent in sedentary (sitting or lying down), standing or light activity, and walking behaviors during standardized activities and tasks related to activities of daily living | Direct observation through video recording | 20 RA patients | 55 (14) | N/A | Diagnosis of RA in accordance with the 1987 ACR criteria or the ACR/EULAR 2010 criteria; 18-80 years old; able to walk without assistive device | ActivPAL activity monitor significantly underestimated step counts [(P<.001), MD 26%, moderate inter-method reliability (ICC=.7; 95% CI= −.06, .93)] and transition counts [(P<.001), MD 36%]. No significant difference for time spent in sedentary behavior [P=.57, MD <5%, moderate/good reliability (ICC=.75; 95% CI=.46, .89)], in standing or light activity [P=.08, MD <10%, good reliability (ICC=.84; 95% CI=.64, .94)] and walking [P=.20, MD <5%, good reliability (ICC=.92; 95% CI=.82, .97)]. |
| Armbrust (2017) | Groningen, The Netherlands | Actical accelerometer | On the right anterior superior iliac spine | Counts per day; minutes/day of sitting, light intensity, bouted and non bouted MVPA. | Activity Diary | 61 JIA patients | 10.1 (1.4) | 17.3 (N/A) | JIA diagnosed according to the International League of Associations for Rheumatology criteria, disease activity lower than 2 cm on a physician’s global assessment scale (0–10). | ICC between activity diary and accelerometer for rest minutes/day and PA level was moderate (respectively 0.41 (95% CI 0.19–0.60) and 0.41 (95% CI 0.09–0.63)), low for light PA and MVPA (respectively 0.17 (95% CI -0.08-0.40) and 0.24 (95% CI 0.01–0.46)) |
| Chandrasekar (2018) | Leeds, UK | Fitbit-Zip, ActiGraph-GT3X+ accelerometers, both using LFE filter (LFE+) or without using it (LFE-) | Fitpit-Zip: one on the right hip, and one on the midline of the shirt. GT3X+ on the right hip. | Step count during 2MWT, step count during stairs test | GSSC | 27 PMR patients | 69.2 (8.8) | 28.3 (5.6) | Diagnosis  of PMR according to clinical practice guidelines use of systemic glucocorticoids for at least 1 month, and were able to walk for at least 2 minutes | Both accelerometers systematically underestimated step counts during 2MWT and stairs test. As far as the 2MWT is concerned Fitbit-Zip (waist) recorded a mean bias (95% CI) of 10 (-3, 23); Fitbit-Zip (shirt) 12 (-2, 27); GT3X+ (LFE-) 141; GT3X+ (LFE+) 20 (8, 33). As far as the stair tests is concerned Fitbit-Zip (waist) recorded a mean bias (95% CI) of 1 (-1, 3); Fitbit zip (shirt) -6 (-22, 9); GT3X+ (LFE-) 4 (2,6); GT3X+ (LFE+) 0 (-1, 1). |
| Douglas‐Withers (2018) | Otago, New Zealand | Pedometer | N/R | Mean number of steps per day, averaged on 7 days | HAQ‐DI | 71 RA patients; 68 knee or hip OA patients | 61 (12.7) (RA);  69 (8.8) (OA) | 28 (5) (RA);  31 (6) (OA) | RA diagnosed according to the ACR 1987 criteria for RA; OA defined by pain from either both knees and/or hips during the previous 3 months combined with radiological evidence of OA | Strong association (R2 = 0.562) in RA patients and weaker association (R2 = 0.156) in OA patients between activity measured by pedometer steps and HAQ‐DI score; non-linear association in the RA group and linear association (ratio 0.87 (95% CI: 0.66‐1.16)) in OA group between HAQ‐DI scores and mean steps per day |
| Munguía-Izquierdo (2019) | Andalusia provinces, Spain | ActiGraph GT3X+ accelerometer | Hip | Objective PA and sedentary behavior calculated based upon recommended vector magnitude cut point (min/week) | Subjective well-being: PANAS; SWLS | 375 women with fibromyalgia | 50.8 (7.3) | N/A | Diagnosis of fibromyalgia by a rheumatologist according to the meeting 1990 ACR fibromyalgia criteria | The amount of objective time spent in PA was associated with higher positive affect (t=3.61, p<0.001) and satisfaction with life (t=2.80, p=0.005); objectively measured sedentary behavior was negatively associated with positive affect (t = -2.28, p=0.023) |
| O’Brien (2020) | Dudley, UK | *LV*: ActiGraph GT3X+ and ActivPAL3μ™  accelerometers  *FV*: ActiGraph GT3X+ accelerometer | Right hip (GT3X+); mid-anterior position on the right thigh (ActivPAL3μ™) | *LV*: Activity counts/min (GT3X+); sedentary, standing and stepping time, and number of steps and sit-stand transitions (activPAL3μ™) during 11 6-min activities  *FV*: free-living sedentary time (min/day) during a 7-day recording period | *LV*: Indirect calorimeter Cortex Metalyzer® 3B (for GT3X+); observation of behavior recorded by a video camera (for activPAL3 μ™)  *FV*: GT3X+ and activPAL3μ  ™ | *LV*: 22 RA patients  *FV:* 100 RA patients | *LV*: 53.7 (12.5)  *FV*: 58.5 (12.1) | *LV*: 27.4 (5.7)  *FV:* 28.9 (6.1) | Adults (aged ≥ 18 years) with a clinical diagnosis of RA according to the ACR/ EULAR classification criteria; independently walking (or with an assistive device for FV) | *LV*:  - *GT3X+ and indirect calorimetry:* ‘excellent’ fit for RA-specific sedentary time (AUC = 1.00) and moderate PA (AUC = 0.94) count-based cut-points;  - *ActivPAL3μ™ and direct observation*: the activPAL3μ™ accurately classified sedentary, standing and stepping time, and step number (accuracy > 98%) and sit-stand transitions (accuracy 72%)  *FV*: For the RA-specific count-based cut-point, Bland–Altman analysis revealed a MD of 137.7 (SD = 92.0), with 95% LOA (lower to upper) = (− 42.6 to 318.0), for sedentary time (min/day), while the non-RA uniaxial count-based cut-point demonstrated a greater MD (206.2 [SD = 115.2]) and wider 95% LOA (lower to upper) = (− 19.6 to 432.0). |
| Abbreviations: SD = standard deviation; BMI = body mass index; MVPA = moderate to vigorous intensity physical activity; YPAS = Yale Physical Activity Scale; RA = rheumatoid arthritis; KOA = knee osteoarthritis; ACR = American College of Rheumatology; PA = physical activity; Y-ADSI = YPAS activity dimensions summary index; A4L = Activ4Life; IDEEA = Intelligent Device for Energy Expenditure and Activity; HS = healthy subjects; SQUASH = Short questionnaire to assess health enhancing physical activity; AM = activity monitor; IPAQ = International Physical Activity Questionnaire; EULAR = European League Against Rheumatism; MD = mean difference JIA = juvenile idiopathic arthritis; N/A = not applicable; ICC = interclass correlation coefficient; AD = activity diary; CI = confidence interval; LFE = low frequency extension; 2MWT = 2 minutes walking test; GSSC = Gold standard step-count; PMR = polymyalgia rheumatica; N/R = not reported; HAQDI = Health Assessment Questionnaire Disability Index; OA = osteoarthritis; PANAS = Positive and negative affect schedule; SWLS = Satisfaction with Life Scale; LV = laboratory validation; FV = field validation; AUC = area under the curve; LOA = limits of agreement. | | | | | | | | | | |