Rheumatic Conditions as Risk Factors for Self-Harm: A Retrospective Cohort Study

James A. Prior, Zoe Paskins, Rebecca Whittle, Alyshah Abdul-Sultan, Carolyn A. Chew-Graham, Sara Muller, Ram Bajpai, Tom A. Shepherd, Athula Sumathipala, and Christian D. Mallen

Objective. To examine the risk of self-harm in rheumatic conditions.

Methods. We conducted a retrospective cohort study using data from the Clinical Practice Research Datalink. Patients with ankylosing spondylitis, fibromyalgia, osteoarthritis, or rheumatoid arthritis were identified from 1990 to 2016 and matched to patients without these conditions. Incident self-harm was defined by medical record codes following a rheumatic diagnosis. Incidence rates (per 10,000 person-years) were reported for each condition, both overall and year-on-year (2000–2016). Cox regression analysis determined risk (hazard ratio [HR] and 95% confidence interval [95% CI]) of self-harm for each rheumatic cohort compared to the matched unexposed cohort. Initial crude analysis was subsequently adjusted and stratified by age and sex. Due to nonproportionality over time, osteoarthritis was also stratified by disease duration (<1 year, ≥1 to <5 years, ≥5 to <10 years, and ≥10 years).

Results. The incidence of self-harm was highest in patients with fibromyalgia (HR 25.12 [95% CI 22.45–28.11] per 10,000 person-years) and lowest for osteoarthritis (HR 6.48 [95% CI 6.20–6.76]). There was a crude association with each rheumatic condition and self-harm, except for ankylosing spondylitis. Although attenuated, these associations remained after adjustment for fibromyalgia (HR 2.06 [95% CI 1.60–2.65]), rheumatoid arthritis (HR 1.59 [95% CI 1.20–2.11]), and osteoarthritis (1 to <5 years HR 1.12 [95% CI 1.01–1.24]; ≥5 to <10 years HR 1.35 [95% CI 1.18–1.54]). Age and sex were weak effect modifiers for these associations.

Conclusion. Primary care patients with fibromyalgia, osteoarthritis, or rheumatoid arthritis (but not ankylosing spondylitis) are at increased risk of self-harm compared to people without these rheumatic conditions. Clinicians need to be aware of the potential for self-harm in patients with rheumatic conditions (particularly fibromyalgia), explore mood and risk with them, and offer appropriate support and management.

INTRODUCTION

Prevention of self-harm, a key risk factor for suicide, is an international public health priority (1). However, data from the UK between 2001 to 2013 showed a significant rising trend in primary care consultations for self-harm for men and women (2). A potential approach to preventing self-harm is the targeting of high-risk groups, with the World Health Organization recommending that health care professionals assess the potential for self-harm in patient groups with symptoms of chronic pain and depression (3). Although these factors can apply to patients with rheumatic conditions, whether patients...
RISK FACTORS FOR SELF-HARM IN RHEUMATOLOGY

SIGNIFICANCE & INNOVATIONS

- Patients with fibromyalgia, osteoarthritis, or rheumatoid arthritis are at increased risk of self-harm.
- Age and sex do not act as strong effect modifiers in the relationship between these rheumatic conditions and self-harm.
- In these patients, healthcare professionals need to be aware of this risk and offer appropriate management.

in these disease groups are at an increased risk of self-harm is unclear.

Our interest lies in examining and comparing the risk of self-harm in specific rheumatic conditions (ankylosing spondylitis, fibromyalgia, osteoarthritis, and rheumatoid arthritis). These are some of the most prevalent rheumatic conditions with known relationships to chronic pain and depression. Poor mental health, especially a history of a depressive disorder, is a strong risk factor for self-harm (4), and comorbid depression is frequently experienced by patients with these common rheumatic conditions to varying degrees (5–9). Although pain is on the causal pathway for depression, pain is itself an independent risk factor for self-harm (10) and is commonly experienced by those with rheumatic conditions (11).

Previous research into the role of a range of chronic health conditions on the risk of self-harm has shown conflicting findings (12–15). However, investigation into the role of rheumatic conditions as risk factors for self-harm is currently very limited, despite these conditions being among the leading causes of disability worldwide (16). Webb et al. (12) reported an initial unadjusted increased risk of self-harm in patients with osteoarthritis, but this association was not retained after adjustment. Singhal et al. (14) did find an increased relative risk of self-harm for patients with inflammatory polyarthropathies (relative risk 1.4 [95% confidence interval 95% CI] 1.3–1.4] after the first year since diagnosis, but this group contained a wide mix of rheumatic conditions (International Statistical Classification of Diseases and Related Health Problems, Tenth Revision codes M05–M09, M12–M14) limiting the clinical usefulness of such information. Our aim was to examine and compare the risk of self-harm in several rheumatic conditions from a primary care population over time and consider the role of age and sex on such risk.

PATIENTS AND METHODS

Study design. We undertook a matched retrospective cohort study using Read-coded patient consultation data (the clinical coding system used in UK primary care) from the Clinical Practice Research Datalink (CPRD), a database of anonymized primary care records covering ~7% of the UK population (17). This database provides both coded consultation and prescription data and is representative of the UK population with regards to age, sex, and ethnicity (17).

Study population. We identified patients ages ≥18 years with 1 of 4 rheumatic conditions (ankylosing spondylitis, fibromyalgia, osteoarthritis, or rheumatoid arthritis) between January 1, 1990 and December 31, 2016. Each exposed cohort was identified by specified Read codes, identified and refined from an internal code list repository and assigned an index date corresponding to the date of the patient’s diagnosis. Where a patient had consulted for >1 of the rheumatic conditions of interest, they were placed into the rheumatic cohort for which they had first consulted. A single matched unexposed cohort was constructed to be a comparison cohort for all rheumatic conditions. The unexposed cohort included individuals without a previous coded diagnosis of the rheumatic conditions of interest in their medical record, but no further exclusion was made based on the presence of other chronic disease. Cases were grouped by 10-year age range and sex, and then within these categories’ frequency matched to unexposed patients. Each control was assigned a pseudo-index date, generated at random from between their 18th birthday and the end of the study. All individuals were subsequently examined for a self-harm Read code based on the Read code list used in previous CPRD research (2) (code list available at www.keele.ac.uk/mrr, upon request). Patients with a self-harm code prior to the index date were excluded, and the incidence was based only on the first self-harm code reported post-rheumatic diagnosis.

Statistical analysis. Descriptive statistics were initially used to characterize the sample of each rheumatic condition, including age, sex, practice-level deprivation, body mass index (BMI), smoking status, alcohol consumption, and a previous diagnosis of anxiety and/or depression (the latter 4 defined by the closest value recorded before the index date). Incidence rates of self-harm per 10,000 person-years were determined for each rheumatic condition from January 1, 1990 to December 31, 2016, and year-on-year incidence trends were reported for January 1, 2000 to December 31, 2016 (a reduced time period was used due to low incidence in earlier years). Patients contributed data after the latest of 3 events: the study start date; the date they registered at a participating practice, plus 6 months; or the date on which the practice was adjudged to reach internal quality standards, known as the up-to-standard date.

Using Cox proportional hazards regression analysis over the full time period (1990–2016), crude hazard ratios (HRs) were initially reported with 95% CIs to examine the association between the presence of each of the 4 rheumatic conditions and the subsequent incidence of self-harm compared to the matched unexposed cohort. Adjusted analysis was then undertaken, accounting for age, sex, practice-level deprivation, BMI, smoking status, alcohol consumption, anxiety, and depression. Cases with missing data for smoking, BMI, and alcohol consumption were included within analysis using a missing category approach. Imputation was not considered sensible in this case because data
Table 1. Characteristics of patients with rheumatic conditions and their matched cohorts (1990–2016)*

| Factor                        | Ankylosing spondylitis | Fibromyalgia | Osteoarthritis | Rheumatoid arthritis |
|-------------------------------|------------------------|--------------|----------------|---------------------|
|                               | Exposed | Unexposed | Exposed | Unexposed | Exposed | Unexposed | Exposed | Unexposed |
| No.                           | 10,484  | 10,484    | 17,546  | 17,546     | 410,384 | 410,384   | 23,205  | 23,205    |
| Age at index date, mean ± SD  | 46.9 ± 15.6 | 46.6 ± 15.9 | 46.9 ± 12.1 | 46.6 ± 12.7 | 64.6 ± 12.7 | 64.2 ± 13.2 | 56.7 ± 15.2 | 56.4 ± 15.6 |
| Male                          | 4,376 (41.7) | 4,376 (41.7) | 2,552 (14.5) | 2,552 (14.5) | 166,241 (40.5) | 166,241 (40.5) | 7,728 (33.3) | 7,728 (33.3) |
| Follow-up, median (IQR) years| 7.4 (3.8–12.2) | 5.3 (2.7–10.6) | 5.8 (3.0–9.9) | 5.7 (2.7–11.3) | 6.8 (3.6–11.0) | 5.9 (2.9–11.0) | 6.2 (3.1–10.5) | 5.9 (2.8–11.2) |
| Deprivation status            |          |            |          |            |          |            |          |            |
| Q1 (least deprived)           | 1,986 (18.9) | 1,917 (18.3) | 3,002 (17.1) | 3,218 (18.3) | 72,018 (17.6) | 73,347 (17.9) | 3,774 (16.3) | 4,186 (18.1) |
| Q2                            | 1,806 (17.2) | 1,782 (17.0) | 2,960 (16.9) | 3,227 (18.4) | 71,941 (17.5) | 72,068 (17.5) | 4,070 (17.5) | 4,042 (17.4) |
| Q3                            | 2,109 (20.1) | 2,190 (20.9) | 3,337 (19.0) | 3,571 (20.4) | 79,179 (19.3) | 85,833 (20.8) | 4,752 (20.5) | 4,824 (20.8) |
| Q4                            | 1,925 (18.4) | 2,259 (21.5) | 3,786 (21.6) | 3,766 (21.5) | 85,826 (20.9) | 90,589 (22.1) | 4,892 (21.1) | 5,041 (21.7) |
| Q5 (most deprived)            | 2,658 (25.4) | 2,336 (22.3) | 4,461 (25.4) | 3,764 (21.4) | 104,420 (24.7) | 89,047 (21.7) | 5,717 (24.6) | 5,112 (22.0) |
| Body mass index, kg/m²         |          |            |          |            |          |            |          |            |
| Underweight (<18.5)           | 164 (1.5)  | 123 (1.2)    | 286 (1.6)  | 218 (1.2)   | 3,013 (0.7)  | 3,587 (0.9)   | 389 (1.7)   | 234 (1.0)    |
| Healthy weight (18.5–24.9)     | 3,707 (35.4) | 2,294 (21.9) | 5,602 (31.9) | 4,371 (24.9) | 99,869 (24.3) | 79,731 (19.4) | 7,491 (32.3) | 4,920 (21.2) |
| Overweight (25.0–29.9)         | 2,800 (26.7) | 1,587 (15.1) | 4,983 (28.4) | 2,638 (15.0) | 136,070 (33.2) | 72,724 (17.7) | 6,600 (28.4) | 3,960 (17.1) |
| Obese (≥30.0)                  | 1,595 (15.2) | 886 (8.4)    | 4,817 (27.5) | 1,747 (10.0) | 104,776 (25.5) | 37,063 (9.2) | 4,474 (19.3) | 2,137 (9.2) |
| Missing                       | 2,218 (21.2) | 5,594 (53.4) | 1,858 (10.6) | 8,572 (48.9) | 66,656 (16.3) | 216,739 (52.8) | 4,251 (18.3) | 11,954 (51.5) |
| Smoking                       |          |            |          |            |          |            |          |            |
| Never/ex-smoker               | 6,680 (63.7) | 4,212 (40.2) | 12,163 (69.3) | 7,696 (43.9) | 308,795 (75.2) | 170,633 (41.6) | 15,332 (66.1) | 9,660 (41.6) |
| Current smoker                | 2,540 (24.2) | 1,494 (14.2) | 4,636 (26.4) | 2,416 (13.8) | 63,869 (15.6) | 48,963 (11.9) | 5,566 (24.0) | 3,037 (13.1) |
| Missing                       | 1,264 (12.1) | 4,778 (45.6) | 747 (4.3)    | 7,434 (42.4) | 37,720 (9.2) | 190,788 (46.5) | 2,307 (9.9) | 10,508 (45.3) |
| Alcohol consumption†          |          |            |          |            |          |            |          |            |
| Never/ex-drinker              | 1,493 (14.2) | 942 (9.0)    | 4,104 (23.4) | 1,735 (9.9) | 72,098 (17.6) | 42,065 (10.2) | 4,229 (18.2) | 2,225 (9.6) |
| Current 1–9                   | 4,923 (47.0) | 3,000 (28.8) | 9,355 (53.3) | 5,824 (33.2) | 200,504 (48.9) | 116,325 (28.4) | 11,178 (48.2) | 6,891 (29.7) |
| Current ≥10                   | 16,223 (15.5) | 869 (8.5)    | 1,692 (9.6)  | 1,236 (7.0)  | 66,935 (16.3) | 32,979 (8.0) | 3,120 (13.5) | 1,891 (8.1) |
| Missing                       | 2,445 (23.3) | 5,646 (53.9) | 2,395 (13.7) | 8,571 (49.9) | 70,847 (17.2) | 219,016 (53.4) | 4,678 (20.1) | 12,198 (52.6) |
| Anxiety                       | 1,757 (16.8) | 879 (8.4)    | 5,944 (33.9) | 1,865 (10.6) | 67,894 (16.5) | 36,586 (8.9) | 3,385 (14.6) | 2,229 (9.6) |
| Depression                    | 2,356 (22.5) | 1,263 (12.1) | 8,784 (60.1) | 2,786 (15.9) | 90,354 (22.0) | 51,631 (12.6) | 5,035 (21.7) | 3,064 (13.2) |

* Values are the number (%) unless indicated otherwise. IQR = interquartile range.
† Per week.
were unlikely to be missing at random (18,19). The proportionality of hazards was examined for each model using Schoenfeld’s residuals. Where variables showed evidence of nonproportionality, they were included as time-varying covariates. Further analyses were conducted for each rheumatic cohort, stratifying by median age of the relevant exposed cohort and sex. We defined our dichotomized age subgroups as younger or older patients. This study was approved by the CPRD Independent Scientific Advisory Committee (reference number 18_018R3). Data were analyzed with Stata software, version 15.1, and a 2-sided $P$ value less than 0.05 was considered for statistical significance.

### RESULTS

#### Sample characteristics.

The number of cases identified in each rheumatic condition group was 10,484 (ankylosing spondylitis), 17,546 (fibromyalgia), 410,384 (osteoarthritis), and 23,205 (rheumatoid arthritis), with a matched unexposed cohort of the same size for each condition. Patient cohorts with fibromyalgia, osteoarthritis, or rheumatoid arthritis were predominantly female (85.5%, 59.5%, and 66.7%, respectively), and the mean age across the 4 condition cohorts (similar in their unexposed cohorts) ranged from the youngest at 47 years (fibromyalgia) to the oldest at 65 years (osteoarthritis) (Table 1).

### Table 2. Risk of self-harm associated with each rheumatic condition*

| Condition       | Exposed No. | Incidence rate (95% CI) | Unexposed No. | Incidence rate (95% CI) | Hazard ratios (95% CI) |
|-----------------|-------------|-------------------------|---------------|-------------------------|-----------------------|
|                 |             | Crude                   | Adjusted†     | Crude                   | Adjusted‡             |
| AS              | 102         | 11.37 (9.37–13.81)       | 72            | 9.57 (7.60–12.06)       | 1.21 (0.90–1.64)      |
| FM              | 303         | 25.12 (22.45–28.11)      | 108           | 8.24 (6.82–9.95)        | 3.01 (2.42–3.76)‡    |
| OA, disease duration, years | 2,060       | 6.48 (6.20–6.76)         | 1,528         | 5.02 (4.77–5.28)        | –                     |
| <1              | 277         | 6.75 (6.00–7.60)         | 260           | 6.34 (5.61–7.16)        | 1.07 (0.90–1.26)      |
| ≥1 to <5        | 844         | 6.36 (5.95–6.80)         | 664           | 5.36 (4.97–5.78)        | 1.19 (1.07–1.31)†     |
| ≥5 to ≤10       | 629         | 6.72 (6.22–7.27)         | 376           | 4.46 (4.03–7.27)        | 1.51 (1.33–1.72)‡     |
| >10             | 310         | 6.11 (5.47–6.83)         | 228           | 4.13 (3.63–4.70)        | 1.47 (1.24–1.74)‡     |
| RA              | 165         | 9.70 (8.32–11.29)        | 96            | 5.52 (4.52–6.75)        | 1.72 (1.34–2.22)‡     |

* Values for Exposed and Unexposed are the incidence rate per 10,000 person-years. 95% CI = 95% confidence interval; AS = ankylosing spondylitis; FM = fibromyalgia; OA = osteoarthritis; RA = rheumatoid arthritis.
† Adjusted for age, body mass index, smoking status, alcohol consumption, anxiety, depression, and practice-level deprivation.
‡ Statistically significant at $P \leq 0.05$.

#### Figure 1. Incidence rates of self-harm for each rheumatic condition from 2000 to 2016: A, Osteoarthritis; B, Fibromyalgia; C, Rheumatoid arthritis; and D, Ankylosing spondylitis. Solid lines show the incidence rates per 10,000 person-years; broken lines show the 95% confidence intervals.
Incidence of self-harm in rheumatic cohorts. The incidence of self-harm was highest in the fibromyalgia cohort at 25.12 (95% CI 22.45–28.11) per 10,000 person-years but lower at 11.37 (95% CI 9.37–13.81) for ankylosing spondylitis, 9.70 (95% CI 8.32–11.29) for rheumatoid arthritis, and 6.48 (95% CI 6.20–6.76) for osteoarthritis (Table 2). Over a 16-year period (2000–2016), and despite fluctuations, the year-on-year incidence rates of self-harm across each rheumatic condition changed little, with incidence rates in 2016 similar to those in 2000 (Figure 1).

Risk of self-harm in rheumatic conditions. The risk of self-harm in patients with osteoarthritis was not proportional over the study period. Therefore, risk in this group was examined over 4 separate time periods of disease duration, <1 year, ≥1 to <5 years, ≥5 to <10 years, and ≥10 years. There was a significant crude association between fibromyalgia (HR 3.01 [95% CI 2.42–3.76]), rheumatoid arthritis (HR 1.72 [95% CI 1.34–2.22]), and the majority of categories of osteoarthritis patients (excluding those with a disease duration of <1 year (HR 1.07 [95% CI 0.90–1.26]) and subsequent self-harm compared to their matched unexposed counterparts. There was no association between ankylosing spondylitis and self-harm compared to the unmatched cohort (HR 1.21 [95% CI 0.90–1.64]).

After adjustment, the association in each cohort was attenuated. Patients with fibromyalgia remained twice as likely to experience self-harm as those without a rheumatic condition, and rheumatoid arthritis patients had an increased self-harm risk of 59%. The increased risk of self-harm in osteoarthritis with a disease duration of ≥1 to <5 years and ≥5 to <10 years was 12% and 35%, respectively; however, patients with osteoarthritis for ≥10 years no longer had a significant risk of self-harm (HR 1.17 [95% CI 0.98–1.40]) (Table 2).

Age-specific risk of self-harm in rheumatic conditions. After stratifying by median age, we found a similar association between the risk of self-harm across the younger and older strata for the rheumatoid arthritis cohort. However, this association was only statistically significant for the younger cohort (younger HR 1.67 [95% CI 1.18–2.36], older HR 1.52 [95% CI 0.92–2.52]). In the fibromyalgia cohort, both age categories experienced a significant increase in risk of self-harm, with older patients experiencing a slightly greater risk (younger HR 2.28 [95% CI 1.66–3.13], older HR 2.58 [95% CI 1.67–3.99]). There was a somewhat mixed picture for osteoarthritis, with some younger patients seeing an increase in risk (≥1 to <5 years HR 1.18 [95% CI 1.03–1.34], ≥5 to <10 years HR 1.34 [95% CI 1.13–1.58]), as did older patients with osteoarthritis (HR 1.22 [95% CI 1.07–1.38] across all disease durations). There remained no increased risk of self-harm in patients with ankylosing spondylitis when stratified by age (Table 3).

Sex-specific risk of self-harm in rheumatic conditions. There were similar levels of increased risk of self-harm across the sexes in those with osteoarthritis, rheumatoid arthritis, or fibromyalgia compared to those without a rheumatic condition.

### Table 3. Age-specific risk of self-harm associated with each rheumatic condition*

| Condition and age range, years | Incidents of self-harm, no. | No. | Incidence rate (95% CI) | No. | Incidence rate (95% CI) | Crude ratios (95% CI) | Adjusted† |
|-------------------------------|-----------------------------|-----|------------------------|-----|------------------------|----------------------|-----------|
| AS <45.3                      | 131                         | 78  | 17.63 (14.12–22.01)    | 53  | 15.22 (11.62–19.92)    | 1.17 (0.98–1.40)     |           |
| ≥45.3                         | 43                          | 24  | 5.28 (3.54–7.88)       | 19  | 4.71 (3.00–7.38)       | 1.13 (0.62–2.06)     |           |
| FM <46.7                      | 282                         | 205 | 34.72 (30.27–39.81)    | 77  | 12.30 (9.83–15.37)     | 2.77 (2.13–3.61)     |           |
| ≥46.7                         | 129                         | 98  | 15.92 (13.06–19.40)    | 31  | 4.52 (3.18–6.43)       | 3.56 (2.38–5.32)     |           |
| OA, disease duration <64.6    |                             |     |                       |     |                       |                      |           |
| <1 year                       | 380                         | 192 | 9.36 (8.13–10.78)      | 188 | 8.99 (7.79–10.37)      | 1.04 (0.85–1.27)     | 1.01 (0.83–1.24) |
| ≥1 to <5 years                | 985                         | 561 | 8.25 (7.59–8.96)       | 424 | 6.53 (5.94–7.19)       | 1.26 (1.11–1.43)     | 1.18 (1.03–1.34) |
| ≥5 to <10 years               | 618                         | 393 | 7.58 (6.86–8.37)       | 225 | 4.73 (3.68–6.87)       | 1.60 (1.36–1.88)     | 1.34 (1.13–1.58) |
| ≥10 years                     | 340                         | 194 | 5.86 (5.09–6.75)       | 146 | 4.06 (3.46–4.78)       | 1.43 (1.15–1.77)     | 0.99 (0.80–1.25) |
| RA <57.0                      | 184                         | 120 | 13.20 (11.04–15.79)    | 64  | 7.15 (5.60–9.13)       | 1.83 (1.35–2.48)     | 1.67 (1.18–2.36) |
| ≥57.0                         | 77                          | 45  | 5.68 (4.24–7.60)       | 32  | 3.79 (2.68–5.37)       | 1.50 (0.95–2.37)     | 1.52 (0.92–2.52) |

* Values for Exposed and Unexposed are the incidence rate per 10,000 person-years. 95% CI = 95% confidence interval; AS = ankylosing spondylitis; FM = fibromyalgia; OA = osteoarthritis; RA = rheumatoid arthritis.
† Adjusted for sex, body mass index, smoking status, alcohol consumption, anxiety, depression, and practice-level deprivation.
‡ Statistically significant at P ≤ 0.05.
§ Data met assumptions for proportionality, and therefore stratification by time was not required (significant at P ≤ 0.05).
Men and women who had had osteoarthritis for between ≥5 to <10 years had a significantly increased risk of self-harm of 42% and 35%, respectively. However, although the risk estimates for men with rheumatoid arthritis or fibromyalgia were similar to those of women with the same condition, the increase was not statistically significant in either sex (men with fibromyalgia HR 2.16 [95% CI 1.00–4.62], women with fibromyalgia HR 2.16 [95% CI 0.91–5.31], men with rheumatoid arthritis HR 1.63 [95% CI 0.98–2.68]) (Table 4).

**DISCUSSION**

We found that primary care patients with rheumatic conditions of fibromyalgia, rheumatoid arthritis, or osteoarthritis are at an increased risk of self-harm compared to matched unexposed patients, that this risk varies across the 3 conditions, but that age and sex are weak effect modifiers. In contrast, there was no association between ankylosing spondylitis and self-harm. Finally, the year-on-year incidence of self-harm in these patient groups remained relatively consistent from 2000 to 2016.

Overall, patients with fibromyalgia had the greatest risk of self-harm, with a 2-fold increase compared to the unexposed cohort. This propensity to self-harm was greater than that seen for the rheumatoid arthritis and osteoarthritis cohorts and may relate to different effects of similar mechanisms. Patients with fibromyalgia have been shown to experience more depression (6,7,20) and poorer health outcomes, particularly bodily pain (21) and fatigue (22), than patients with osteoarthritis and rheumatoid arthritis. Furthermore, in contrast to osteoarthritis and rheumatoid arthritis, psychological factors play a major role in the origin of this disorder because both physical and childhood trauma are associated with fibromyalgia and self-harm (4,23). Although the risk of self-harm in different rheumatic conditions has not been previously described, a meta-analysis by Li et al did find the prevalence of suicidal ideation (of which self-harm is a risk factor [24]) to be greater in patients with fibromyalgia compared to the other rheumatic conditions (systemic lupus erythematosus and osteoarthritis) (25). This finding suggests that the greatest risk we observed in patients with fibromyalgia is plausible.

Our initial findings on osteoarthritis were in line with those of Webb et al (12), who examined the risk of self-harm in several physical illnesses using CPRD and found an unadjusted increase in the risk of self-harm in patients with osteoarthritis. However, in contrast, we found that after adjustment, the risk of self-harm remained for certain disease duration categories. In our study, the risk remained increased in those having had osteoarthritis for between 1 and 10 years. Our findings, which contrast with those of Webb et al, are potentially due to our increased sample size from a much longer time period of the CPRD, and thus greater statistical power. However, clearly the risk of self-harm in osteoarthritis is relatively modest, especially compared to fibromyalgia and rheumatoid arthritis. This difference may reflect a different experience in terms of pain duration, frequency, and location; osteoarthritis is typically a more localized pain condition, unlike

---

**Table 4.** Sex-specific incidents of self-harm associated with each rheumatic condition

| Condition | Exposed Incidents of self-harm, no. | Incidence rate (95% CI) | Unexposed Incidents of self-harm, no. | Incidence rate (95% CI) | Hazard ratios (95% CI) |
|-----------|-------------------------------------|-------------------------|-------------------------------------|-------------------------|----------------------|
| **AS**    |                                     |                         |                                     |                         |                     |
| Men       | 71                                  | 2.48 (2.02–3.05)        | 90                                  | 2.76 (2.40–3.19)        | 1.17 (1.01–1.38)     |
| Women     | 103                                 | 2.55 (2.12–3.08)        | 140                                 | 2.88 (2.46–3.37)        | 1.11 (1.00–1.24)     |

| **FM**    |                                     |                         |                                     |                         |                     |
| Men       | 48                                  | 2.85 (2.23–3.67)        | 36                                   | 2.75 (2.32–3.27)        | 1.30 (1.02–1.65)     |
| Women     | 363                                 | 2.75 (2.43–3.10)        | 292                                 | 2.58 (2.30–2.90)        | 1.09 (0.92–1.30)     |

| **OA**    |                                     |                         |                                     |                         |                     |
| Men       | 71                                  | 2.48 (2.02–3.05)        | 90                                  | 2.76 (2.40–3.19)        | 1.17 (1.01–1.38)     |
| Women     | 103                                 | 2.55 (2.12–3.08)        | 140                                 | 2.88 (2.46–3.37)        | 1.11 (1.00–1.24)     |

---

* Values for Exposed and Unexposed are the incidence rate per 10,000 person-years. 95% CI = 95% confidence interval; AS = ankylosing spondylitis; FM = fibromyalgia; OA = osteoarthritis; RA = rheumatoid arthritis.
† Adjusted for age, body mass index, smoking status, alcohol consumption, anxiety, depression, and practice-level deprivation.
‡ Statistically significant at P ≤ 0.05.
the generalized pain and systemic symptoms caused by fibromyalgia and rheumatoid arthritis, and therefore may have less impact on patients’ lives, leading to self-harm behavior. Furthermore, the violation of the proportional hazards assumption in our study suggests that the risk of self-harm is influenced by disease duration, which may have been masked in the study of Webb et al (12), where data were from a case-control study, and so the effect of disease duration could not be assessed. Although there is mixed evidence around the association between disease duration and progression of osteoarthritis (26), we found that those patients with newly diagnosed osteoarthritis (≤1 year) or those with long-standing disease (≥10 years) were not at significantly increased risk of self-harm. This finding could be due to patients with a recent diagnosis not yet having a prolonged negative experience of osteoarthritis, which could be a contributing factor to self-harm, or those with very long-standing osteoarthritis having developed coping mechanisms (27).

Despite crude analysis demonstrating an initial association, adjusted analysis did not show ankylosing spondylitis to be a risk factor for self-harm. These findings may be related to this cohort having the greatest proportion of men, with a reduced incidence of self-harm compared to women (2). However, our matching, adjustment, and stratification should have countered for the majority of confounding for sex. Although not examining self-harm, Wu et al (9) found no association between ankylosing spondylitis and subsequent suicide ideation or attempt. Although Wu et al used a different group of patients, their sample was from a large population-based cohort, which suggests that our findings are conceivable and not just an artifact of our ankylosing spondylitis cohort being the smallest sample.

Overall, we found age and sex to be weak effect modifiers of the relationship between all rheumatic cohorts and subsequent self-harm. For patients with fibromyalgia or rheumatoid arthritis, we found little difference in the strength of association between younger and older, or male and female, patients and the subsequent risk of self-harm. However, this finding is tempered by relatively small participant numbers, which meant that the association was not statistically significant for men with fibromyalgia or rheumatoid arthritis and older patients with rheumatoid arthritis. Therefore, further study on the role of these factors is required to clarify this association.

Our findings suggest that primary care clinicians, rheumatologists, and allied health professionals need to be especially aware of the potential for self-harm in people with fibromyalgia and rheumatoid arthritis, exploring mood and risk and offering appropriate support and management. Interventions to reduce this serious comorbidity in rheumatic patients are important because, as our incident data show, little has changed in the proportion of patients who self-harm in recent years.

With regard to the strengths and limitations of our work, this is the first study to examine several rheumatic conditions as risk factors for incident self-harm. Our use of a large UK primary care data set has allowed us to examine the incidence of self-harm over a 26-year period, examine year-on-year incidence trends over a 16-year period, and examine the role of age and sex on the risk of self-harm. Our analysis also takes account of clinically recorded depression, a key risk factor for self-harm. However, several limitations to our work need to be considered. Across these rheumatic conditions of interest, pain is likely to be an important contributory factor in the risk of self-harm (28), but pain could not be determined from consultation record data. Furthermore, to what extent the use of medications influences the risk of self-harm is unclear, although the potential causal mechanism of such medications means this influence would be difficult to disentangle. We also found large proportions of missing data for BMI, smoking, and alcohol consumption within the CPRD data set, particularly in the unexposed patients. Therefore, data were not missing at random, and we were unable to impute for these variables. However, we included missing data as a separate category in the Cox model and reported the extent of missing data in descriptive tables to ensure transparency.

There may also be some residual confounding, first for psychological comorbidities, although our adjustment for anxiety and depression will have covered the majority of these, and second, for additional rheumatic comorbidities, where patients went on to develop a further rheumatic condition of interest (most likely the common condition of osteoarthritis) after they had been grouped into a cohort based on their first rheumatic consultation. However, the small increased risk of self-harm in patients with osteoarthritis that we found would suggest that any confounding would have a minimal impact on the risk experienced by those with the other rheumatic conditions of interest. Our original intention within this analysis had also been to examine the risk of suicide, as well as self-harm, in these rheumatic conditions. However, available samples were too small to conduct such analysis. The available sample also proved problematic when stratifying by sex. Because the majority of included participants were female, stratification by sex led to small numbers of events in the male cohorts (e.g., only 35 incidents of self-harm in men with fibromyalgia). However, stratification remains justified because it highlights the role of age and sex.

In conclusion, patients with rheumatic conditions have an increased risk of self-harm compared to matched unexposed patients, but age and sex do not act as strong effect modifiers. The incidence of self-harm in these conditions has remained relatively consistent over the last decade and a half, and therefore clinicians should be vigilant, explore mood, assess risk, and offer appropriate support and management, especially to patients with fibromyalgia.

**ACKNOWLEDGMENT**

We would like to acknowledge Keele University's Prognosis and Consultation Epidemiology Research Group, who have given us permission to use the morbidity definitions (2014). For access/details relating to the morbidity definitions lists (2014), go to www.keele.ac.uk/mrr.
AUTHOR CONTRIBUTIONS

All authors were involved in drafting the article or revising it critically for important intellectual content, and all authors approved the final version to be submitted for publication. Dr. Prior had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study conception and design. Prior, Paskins, Abdul-Sultan, Chew-Graham, Shepherd, Sunnathipala, Malken.

Acquisition of data. Prior, Paskins, Whittle, Abdul-Sultan, Muller, Bajpai.

Analysis and interpretation of data. Prior, Paskins, Whittle, Abdul-Sultan, Muller, Bajpai.

REFERENCES

1. World Health Organization. World health statistics 2016: monitoring health for the SDG’s sustainable development goals. 2016. URL: https://www.who.int/gho/publications/world_health_statistics/2016/Annex_B/en/.

2. Carr MJ, Ashcroft DM, Kontopantelis E, Awenat Y, Cooper J, Chew-Graham C, et al. The epidemiology of self-harm in a UK-wide primary care patient cohort, 2001–2013. BMC Psychiatry 2016;16:53.

3. World Health Organization. Assessment for self harm/suicide in persons with priority mental, neurological and substance use disorders. URL: http://www.who.int/mental_health/mhgap/evidence/suicide/en/.

4. Fliege H, Lee J, Grimm A, Klapp BF. Risk factors and correlates of deliberate self-harm behavior: a systematic review. J Psychosom Res 2009;66:477–93.

5. Weir PT, Harlan GA, Nkoy FL, Jones SS, Hegmann KT, Gren LH, et al. The incidence of fibromyalgia and its associated comorbidities: a population-based retrospective cohort study based on International Classification of Diseases, 9th Revision Codes. J Clin Rheumatol 2006;12:124–8.

6. Matcham F, Rayner L, Steer S, Hotopf M. The prevalence of depression in rheumatoid arthritis: a systematic review and meta-analysis. Rheumatology (Oxford) 2013;52:2136–48.

7. Stubbs B, Aluko Y, Myint PK, Smith TO. Prevalence of depressive symptoms and anxiety in osteoarthritis: a systematic review and meta-analysis. Age Ageing 2016;45:228–35.

8. Drosselmeyer J, Rapp MA, Hadji P, Kostev K. Depression risk in female patients with osteoporosis in primary care practices in Germany. Osteoporos Int 2016;27:2739–44.

9. Wu JJ, Penfold RB, Primatesa P, Fox TK, Stewart C, Reddy SP, et al. The risk of depression, suicidal ideation and suicide attempt in patients with psoriasis, psoriatic arthritis or ankylosing spondylitis. J Eur Acad Dermatol Venereol 2017;31:1168–75.

10. Theodoulou M, Harris L, Hawton K, Bass C. Pain and deliberate self-harm: an important association. J Psychosom Res 2005;58:317–20.

11. Borenstein DG, Hassell AL, Pletschky D. Pain management in rheumatology research, training, and practice. Clin Exp Rheumatol 2017;35 Suppl S:25–75.

12. Webb RT, Kontopantelis E, Doran T, Qin P, Creed F, Kapur N. Risk of self-harm in physically ill patients in UK primary care. J Psychosom Res 2012;73:92–7.

13. Chen VC, Wang TN, Liao YT, Lin TC, Stewart R, Lee CT. Asthma and self-harm: a population-based cohort study in Taiwan. J Psychosom Res 2014;77:462–7.

14. Singhal A, Ross J, Seminog O, Hawton K, Goldacre MJ. Risk of self-harm and suicide in people with specific psychiatric and physical disorders: comparisons between disorders using English national record linkage. J R Soc Med 2014;107:194–204.

15. Egeberg A, Hansen PR, Gislason GH, Skov L, Mallbris L. Risk of self-harm and nonfatal suicide attempts, and completed suicide in patients with psoriasis: a population-based cohort study. Br J Dermatol 2016;175:493–500.

16. World Health Organization. The burden of musculoskeletal conditions at the start of the new millennium. Geneva: World Health Organization; 2003.

17. Herrett E, Gallagher AM, Bhaskaran K, Forbes H, Mathur R, van Staa T, et al. Data resource profile: Clinical Practice Research Datalink (CPRD). Int J Epidemiol 2015;44:827–36.

18. Bhaskaran K, Forbes HJ, Douglass I, Leon DA, Smeeht L. Representativeness and optimal use of body mass index (BMI) in the UK Clinical Practice Research Datalink (CPRD). BMJ Open 2013;3:e003389.

19. Hughes RA, Heron J, Sterne JA, Tilling K. Accounting for missing data in statistical analyses: multiple imputation is not always the answer. Int J Epidemiol 2019;48:1294–304.

20. Loje-Hagen JS, Saele A, Juul C, Bech P, Stenager E, Mellentin AL. Prevalence of depressive disorder among patients with fibromyalgia. J Affect Disord 2019;245:1098–105.

21. Hoffman DL, Dukes EM. The health status burden of people with fibromyalgia: a review of studies that assessed health status with the SF-36 or the SF-12. Int J Clin Pract 2008;62:115–26.

22. Zautra AJ, Fasman R, Parish BP, Davis MC. Daily fatigue in women with osteoarthritis, rheumatoid arthritis, and fibromyalgia. Pain 2007;128:128–35.

23. Häsiter W, Kosseva M, Ücelyer N, Klose P, Sommer C. Emotional, physical, and sexual abuse in fibromyalgia syndrome: a systematic review with meta-analysis. Arthritis Care Res (Hoboken) 2011;63:930–20.

24. Ribeiro JD, Franklin JC, Fox KR, Bentley KH, Keilman EM, Chang BP, et al. Self-injurious thoughts and behaviors as risk factors for future suicide ideation, attempts, and death: a meta-analysis of longitudinal studies. Psychol Med 2016;46:225–36.

25. Li Z, Yang Y, Dong C, Li L, Cui Y, Zhao Q, et al. The prevalence of suicidal ideation and suicide attempt in patients with rheumatic diseases: a systematic review and meta-analysis. Psychol Health Med 2018;23:1025–36.

26. Cheung PP, Gossec L, Dougados M. What are the best markers for disease progression in osteoarthritis (OA)? Best Pract Res Clin Rheumatol 2010;24:81–92.

27. Liu R, Dannman W, Kaptein AA, Rosendaal FR, Kloppenburg M. Coping styles and disability in patients with hand osteoarthritis. Rheumatology (Oxford) 2016;55:411–8.

28. Mitchell R, Draper B, Harvey L, Brodaty H, Close J. The association of physical illness and self-harm resulting in hospitalisation among older people in a population-based study. Aging Ment Health 2017;21:279–88.