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Julia McQuillan

Jennifer A. Andersen

Terceira A. Berdahl

Jeff Willett

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Associations of Rheumatoid Arthritis and Depressive Symptoms Over Time: Are There Differences by Education, Race/Ethnicity, and Gender?

Julia McQuillan,[1] Jennifer A. Andersen,[2] Terceira A. Berdahl,[3] and Jeff Willett[4]

Objective. To examine associations between changes in rheumatoid arthritis (RA) symptoms and depressive symptoms adjusted for other time-varying characteristics, and to test if these associations differed by education, race/ethnicity, or gender.

Methods. Data from the 1988–1998 US National Rheumatoid Arthritis Study were analyzed (n = 854). Time-varying covariates included year of the study, pain, functional ability, household work disability, parental status, marital status, employment status, and social support. The time-invariant covariates included years since diagnosis, education, race/ethnicity, and gender. Multivariate multilevel-model analyses were used to estimate associations within people over time.

Results. Patients with RA experience considerable change in depressive symptoms, pain, functional disability, and household work disability over the study period. Depressive symptoms were driven more by differences between people compared to changes within people over time. Findings show that patients experienced increases in depressive symptoms over the study period. The rate of change in depressive symptoms did not differ by education, race/ethnicity, or gender. Times of worse pain, functional disability, and household disability were associated with worse depressive symptoms. The association of functional disability and depressive symptoms was stronger for men than women.

Conclusion. Increases in pain and disability were associated with worse depressive symptoms, adjusted for covariates. It is important to monitor and treat both mental and physical health symptoms. Future research efforts should focus on collecting data reflecting the educational, gender, and racial/ethnic diversity of individuals with RA.

INTRODUCTION

Rheumatoid arthritis (RA) is a chronic autoimmune disease affecting 54.4 million individuals in the US (~1% of the population) (1,2). RA is more prevalent among women than men and is a leading cause of work-related disability in the US (1). Since the late 1990s, advances in drug therapies have contributed to improved outcomes for patients with RA; however, some still have considerable physical and mental health effects from RA (3,4). Depression is more common among individuals with RA than in the general population, and although numerous studies document the physiology of RA, fewer focus on the dynamic associations of biological, psychological, and social dimensions of RA in a single study (2,4–6).

Research on RA suggests that social roles and conditions, not just biological changes in the body (7), matter for good health. In addition to higher pain, fatigue, and disability, depressive symptoms may also be higher among individuals with RA compared to those without RA (8). There is considerable variation in the extent of depressive symptoms among patients with RA (6), and increases in symptom severity (e.g., pain, disability), a greater number of difficult life experiences (e.g., job loss, relationships ending), and fewer social resources (e.g., less social support) are all associated with higher depressive symptoms (3). Belonging to a socially disadvantaged group (e.g., women, people of color, people with lower education) is also associated with higher depressive symptoms in the general population (9).

The findings and conclusions herein are those of the authors and do not necessarily represent the views of the Department of Health and Human Services or the Agency for Healthcare Research and Quality.

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[1]Julia McQuillan, PhD: University of Nebraska–Lincoln, Lincoln; [2]Jennifer A. Andersen, PhD: University of Arkansas for Medical Sciences Northwest, Fayetteville; [3]Terceira A. Berdahl, PhD: Agency for Healthcare Research and Quality, Rockville, Maryland; [4]Jeff Willett, PhD: American Heart Association, Dallas, Texas.

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Address correspondence to Julia McQuillan, PhD, University of Nebraska–Lincoln, Department of Sociology, 706 Oldfather Hall, PO Box 880324, Lincoln, NE 68508. Email: Jmcquillan2@unl.edu.

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SIGNIFICANCE & INNOVATIONS

- Changes in pain, functional disability, and household work disability were associated with changes in depressive symptoms for individuals with rheumatoid arthritis.
- Changes in marital status and employment were associated with changes in depressive symptoms over time.
- The association between pain and depressive symptoms was stronger for women compared to men; the association between functional disability and depressive symptoms was stronger for men compared to women.
- Education modifies the association of social support and depressive symptoms; the association was stronger for individuals with lower education.
- Patients varied in how much pain, functional disability, household work disability, and social circumstances mattered for depressive symptoms.

Individuals with more coping resources (e.g., higher education and/or more social support) are less vulnerable to psychological distress when they experience stressors such as pain or disability (10,11). Historic and contemporary racism also increases stressors and reduces coping resources for people of color compared to people who are White (12,13). Social expectations based on gender, for example, about employment or household duties, can shape the meaning of symptoms beyond the physical experience (14). Alternatively, physiological stress processes (e.g., HPA axis) involved with RA and depression could be direct and not modified by social determinants such as education, race/ethnicity, or gender (15,16).

Although often assumed, it is necessary to examine if the association of greater RA symptoms with higher depressive symptoms occurs within people over time, and if social statuses (e.g., gender) modify the association (17–19). The current study is guided by the social determinants of health (20), biopsychosocial model of health (21), and health disparities (14,22,23) frameworks and answers the following questions: 1) Are within-person changes in RA illness (i.e., changes in pain, functional impairment, and household work disability) associated with changes in depressive symptoms (focal associations)? 2) Do the focal associations persist after controlling for changes in demands and resources (e.g., marital status, parenthood status, employment status, and social support)? 3) Do between-person indicators of social status/social inequality (i.e., education level, race/ethnicity, or gender) modify the within-person focal associations?

PATIENTS AND METHODS

Respondents (patients). The data for this study come from the National Rheumatoid Arthritis Study (NRAS), a prospective panel, which completed its tenth and final year in 1997–98. This unique panel of 988 patients with RA were recruited from a national, random sample of board-certified rheumatologists (24). On average, respondents had depressive symptom scores (mean ± SD 11.57 ± 10.52) below the cutoff level of 16, the threshold indicating a high likelihood of meeting diagnostic criteria for depression (25–27). In addition, the study respondents were mostly middle-aged (mean ± SD 58 ± 9.7 years), married (68%), out of the labor force (65%), and women (83%), similar to the 3:1 prevalence of RA among middle-aged women compared to men and the relatively low employment rate found in similar samples of RA patients (28) (Table 1). Over the 10 years of the study, 46% of people remained in the sample for all waves of data collection. A prior analysis of the NRAS found that those in the final wave were more educated, more likely to be women, had higher levels of social support, had fewer joint groups with flares, and were more likely to be employed compared to the initial sample (24). The analytic sample includes 8 of the 10 waves (excluding the first and fourth waves because they did not include the variables of interest) and data from the 854 respondents who had at least 2 waves of complete data.

Concepts and measures. Depressive symptoms, the dependent variable, was assessed by the 20-item Center for Epidemiologic Studies Depression Scale (CES-D) depression scale in each year of the study. The CES-D contains 20 items measuring depressed mood, guilt, helplessness, slowness of psychomotor tasks, loss of appetite, and sleep disturbance (25–26,29). The CES-D scale is reliable ($\alpha = 0.85$) in population studies (28). The CES-D is also reliable in a sample of patients with RA (30), and a score of ≥16 indicates a high likelihood of meeting diagnostic criteria for depression (25,26).

Pain was assessed each year by the question, "How much arthritis pain have you felt (past week)?" Scores range from 0–100 (0 = no pain). Asking about pain in this manner is reliable, valid, and sensitive to disease symptoms in various settings (27).

Functional disability was assessed each year with the Stanford Health Assessment Questionnaire (HAQ) (31), shortened to reduce the burden of a long questionnaire and to avoid issues of correlation with other dimensions of disability (32). The shortened HAQ is not directly comparable to the original; however, it is a measure of arthritis-associated disability (33). The HAQ score is the average of answers to a standard series of questions about the ability to do specific tasks, such as open car doors, take a bath, and lift a 5-pound bag of sugar. Items were measured on a scale from 0 (with no difficulty) to 3 (unable to do). Cronbach's α across all waves of data ranged from 0.91 to 0.94 (34).

Household work disability was assessed each year by the question, "Thinking about how arthritis affects your ability to do your household responsibilities, would you say that you are doing more (=1), the same (=2), same but with difficulty (=3), or that you have cut down (=4)?" This measure is designed to capture the

Table 1. Descriptive statistics for all study variables*

	Value	Range
Within-person time-varying variables		
Outcome, mean ± SD		
Depressive symptoms (CES-D)	11.57 ± 10.52	0–57
RA symptoms, mean ± SD		
Pain (0 = no pain to 100 = extreme pain)	46.45 ± 29.66	0–100
Functional inability (HAQ) (3 = unable to do)	0.74 ± 0.56	0–3
Household work disability (4 = cut down)	2.72 ± 0.89	1–4
Demands and resources		
Parent of children age <16 years (= 1; not parent = 0)	0.22	0–1
Married (= 1; not married = 0)	0.70	0–1
Employed (= 1; not employed = 0)	0.41	0–1
Social support (4 = high support), mean ± SD	3.16 ± 0.55	1–4
Between-person variables		
Social location		
Education, years, mean ± SD	12.84 ± 2.41	3–10
Race/ethnicity (POC = 1; White = 0)	0.11	0–1
Sex (men = 1, women = 0)	0.22	0–1
Indicators of time, mean ± SD		
Length of time with RA, years	10.16 ± 8.58	0–43
Survey wave (7 = 10th survey)	4.01 ± 2.27	0–7

* Values are the proportion unless indicated otherwise. Source is the National Rheumatoid Arthritis study (person-years: n = 4,798; participants: n = 854). For variables that change wave to wave, the grand mean across all persons and all waves is provided; for variables that do not change by wave, the values come from the first wave. CES-D = Center for Epidemiologic Studies Depression Scale; HAQ = Health Assessment Questionnaire; POC = person of color; RA = rheumatoid arthritis.

unpaid work that women are more likely to be accountable for (17).

Social roles and social support were measured each year by social role indicator variables for being a parent of a child ≤16 years (=1 versus not a parent), being married (=1 versus not married = 0), or being employed (=1 versus not employed). Social support was measured each year using a subset of items from the Berkman Social Network Inventory (18). The social support scale is an average of the items assessing social support (e.g., "The important people in my life accept me as I am," "There is someone who will give me a hug when I need comforting," and "There is someone whose advice I really trust"). Cronbach's α across all waves of data for the social support scale ranged from 0.84 to 0.87.

Education, race/ethnicity, and gender were measured in the first year of the survey. Education is reported in categories (e.g., less than a high school degree, high school degree or some college, college degree or more) in the descriptive statistics and in the number of years of education completed in the multivariate analyses. Racial/ethnic status was reported by the participant. A small portion of the sample selected a category that indicated a status as a person of color (12.5%). Most were Black (6%), followed by 3% Hispanic, 2.5% Asian, and 1% "other racial/ethnic group." To indicate vulnerability to consequences from racial inequity and to accommodate the small number of people in each group, we compare people of color (=1) with people who said they were White (=0). To measure gender, we used an indicator variable for the sex category (men [=1] compared to women [=0]).

Measures of time. We also controlled for the length of time living with RA in the first year of the study (a person-level characteristic measured in years) and study year (a within-person level measure of time) that ranges from 0 (second year of data collection) to 7 (tenth and final).

Statistical approach/analysis. Repeated annual surveys created up to 8 observations for each participant for each time-varying variable (within-person). To appropriately model the observations nested within persons and to handle missing observations, we use multilevel models (MLMs) (19). MLMs estimate variance within and between persons even when there are varying amounts of missing observations (e.g., if a person skips a year). Including variables in the analyses as deviation scores (person-centered) around each person's own mean aids in meaningful interpretation (i.e., "0" represents each person's own mean) (35). The deviation scores index the year-to-year within-person change relative to each person's average level for each time-varying variable. At the between-person level, the scores are deviations from the overall sample average to indicate higher or lower scores relative to others in the sample (grand mean centered). The term "change" indicates the within-person deviation scores, and "difference" indicates the between-person level comparisons.

The descriptive statistics were estimated using SPSS, version 23, and the multivariate longitudinal regression models were estimated using HLM, version 8 (Scientific Software International). Summary statistics and ranges for the variables are in Table 1, and summary statistics are in Table 2 by education,

Table 2. Descriptive statistics for study variables (aggregated across study waves to the person level)*

	Education				Race/ethnicity			Gender		
	<HS (n = 132)	HS/some college (n = 563)	BA+ (n = 165)	*P*	White (n = 746)	POC (n = 96)	*P*	Men (n = 194)	Women (n = 666)	*P*
Depressive symptoms (CES-D), mean ± SD	16.98 ± 10.57	12.45 ± 9.06	8.73 ± 9.70	<0.001	12.19 ± 9.41	14.35 ± 10.41	0.081	10.47 ± 9.12	13.00 ± 9.59	0.001
Pain, mean ± SD	55.5 ± 24.99	48.26 ± 22.79	38.72 ± 21.98	<0.001	46.74 ± 23.39	53.88 ± 23.49	0.007	44.16 ± 24.49	48.52 ± 23.13	0.026
Functional disability, mean ± SD	0.95 ± 0.58	0.76 ± 0.51	0.58 ± 0.55	<0.001	0.74 ± 0.53	0.89 ± 0.63	0.051	0.57 ± 0.50	0.81 ± 0.54	0.000
Household work disability, mean ± SD	2.91 ± 0.57	2.79 ± 0.60	2.63 ± 0.54	<0.001	2.77 ± 0.59	2.84 ± 0.60	0.332	2.73 ± 0.65	2.79 ± 0.57	0.204
Parent of children age <16 years	0.17	0.29	0.031	0.012	0.26	0.38	0.026	0.27	0.27	0.911
Married	0.67	0.73	0.70	0.425	0.72	0.64	0.134	0.85	0.67	<0.001
Employed	0.23	0.48	0.66	0.000	0.48	0.44	0.492	0.60	0.44	<0.001
Social support, mean ± SD	3.00 ± 0.54	3.15 ± 0.49	3.14 ± .048	0.004	3.15 ± 0.49	2.98 ± 0.53	0.004	3.10 ± 0.50	3.14 ± 0.50	0.353
Education, mean ± SD years	9.14 ± 1.87	12.63 ± 0.94	16.47 ± 0.52	0	12.93 ± 2.33	12.08 ± 2.93	0.011	12.75 ± 2.68	12.86 ± 2.34	0.676
Men	0.31	0.19	0.27	0.004	0.23	0.19	0.359	–	–	–
Minority race/ethnicity (POC)	0.21	0.09	0.10	0.001	–	–	–	0.09	0.12	0.358
Length of time with RA, mean ± SD years	10.45 ± 8.59	9.96 ± 8.51	10.48 ± 8.83	0.774	10.29 ± 8.78	8.89 ± 6.67	0.040	10.15 ± 9.00	10.13 ± 8.45	0.916

* Values are the proportion unless indicated otherwise. Source is the National Rheumatoid Arthritis study (person-years: n = 4,798; participants: n = 854). Independent samples *t*-test for sex and race; analysis of variance test for education level. BA = Bachelor's degree; CES-D = Center for Epidemiologic Studies Depression Scale; HS = high school; POC = person of color; RA = rheumatoid arthritis.

Table 3. Multilevel model of changes in depressive symptoms by changes in rheumatoid arthritis symptoms, social roles, social support, and the modifying effects of social inequality indicators*

	Model 1			Model 2			Model 3		
	Coeff.	SE	*P*	Coeff.	SE	*P*	Coeff.	SE	*P*
Intercepts (mean CES-D score), π0									
Intercept for intercept, β00	10.19	0.31	<0.001	11.62	0.43	<0.001	12.25	0.48	<0.001
Years since diagnosis, β01	–0.06	0.03	0.082	–0.02	0.05	0.65	–0.02	0.05	0.789
Education, years, β02	–	–	–	–	–	–	–0.39	0.19	0.037
POC (ref. White), β03	–	–	–	–	–	–	–0.48	1.46	0.767
Men (ref. women), β04	–	–	–	–	–	–	–2.38	1.02	0.019
Pain, β05	–	–	–	–	–	–	0.04	0.01	0.001
Functional disability, β06	–	–	–	–	–	–	–0.32	0.77	0.783
Household work disability, β07	–	–	–	–	–	–	0.90	0.45	0.044
Social support, β08	–	–	–	–	–	–	–1.13	0.55	0.053
Slope for "Study year," π1									
Intercept for "Study year," β10	0.36	0.05	<0.001	0.29	0.05	<0.001	0.25	0.06	<0.001
Years since diagnosis, β11	0.00	0.01	0.908	0	0.01	0.626	0.00	0.01	0.642
Education, years, β12	–	–	–	–	–	–	0.00	0.02	0.863
POC (ref. White), β13	–	–	–	–	–	–	–0.02	0.17	0.930
Men (ref. women), β14	–	–	–	–	–	–	0.03	0.10	0.782
Slope for "Pain," π2									
Intercept for "pain," β20	0.04	0.01	<0.001	0.04	0.01	<0.001	0.04	0.01	<0.001
Years since diagnosis, β21	0.00	0.00	0.476	0.00	0	0.478	0	0	0.479
Education, years, β22	–	–	–	–	–	–	0	0	0.479
POC (ref. White), β23	–	–	–	–	–	–	–0.01	0.02	0.404
Men (ref. women), β24	–	–	–	–	–	–	–0.04	0.01	<0.001
Slope for "Functional disability," π3									
Intercept for "Functional disability," β30	6.58	0.38	<0.001	5.70	0.38	<0.001	4.45	0.52	<0.001
Years since diagnosis, β31	–0.02	0.04	0.556	–0.01	0.04	0.843	0	0.04	0.882
Education, years, β32	–	–	–	–	–	–	–0.09	0.16	0.596
POC (ref. White), β33	–	–	–	–	–	–	0.50	1.08	0.769
Men (vs. women), β34	–	–	–	–	–	–	2.68	0.86	0.001
Slope for "Household work disability," π4									
Intercept for "Household work disability," β40	0.65	0.14	<0.001	0.94	0.13	<0.001	1.03	0.16	<0.001
Years since diagnosis, β41	–0.03	0.01	0.051	–0.02	0.01	0.189	–0.02	0.01	0.166
Education, years, β42	–	–	–	–	–	–	0.03	0.06	0.630
POC (ref. White), β43	–	–	–	–	–	–	–0.87	0.45	0.070
Men (ref. women), β44	–	–	–	–	–	–	–0.21	0.30	0.393
Slope for "Parent," π5									
Intercept for "Has a child," β50	–	–	–	0.13	0.28	0.280	–0.10	0.33	0.986
Years since diagnosis, β51	–	–	–	0.01	0.03	0.032	0.01	0.03	0.799
Education, years, β52	–	–	–	–	–	–	0.07	0.13	0.590
POC (ref. White), β53	–	–	–	–	–	–	1.25	0.78	0.134
Men (ref. women), β54	–	–	–	–	–	–	0.47	0.72	0.651
Slope for "Married," π6									
Intercept for "Married," β60	–	–	–	–1.25	0.40	0.002	–1.31	0.45	0.003
Years since diagnosis, β62	–	–	–	–0.03	0.05	0.590	–0.04	0.05	0.331
Education, years, β63	–	–	–	–	–	–	–0.04	0.17	0.860
POC (ref. White), β63	–	–	–	–	–	–	–0.34	1.13	0.656
Men (ref. women), β64	–	–	–	–	–	–	1.77	0.93	0.039
Slope for "Employed," π7									
Intercept for "Employed," β70	–	–	–	–0.98	0.30	0.001	–0.48	0.37	0.249
Years since diagnosis, β71	–	–	–	–0.02	0.04	0.694	–0.02	0.04	0.529
Education, years, β72	–	–	–	–	–	–	–0.06	0.13	0.600
POC (ref. White), β73	–	–	–	–	–	–	–0.29	0.95	0.784
Men (ref. women), β74	–	–	–	–	–	–	–0.28	0.66	0.694
Slope for "Social support," π8									
Intercept for "Social support," β80	–	–	–	–4.07	0.29	<0.001	–3.61	0.43	<0.001
Years since diagnosis, β81	–	–	–	0.01	0.03	0.797	0	0.03	0.912
Education, years, β82	–	–	–	–	–	–	0.32	0.13	0.021
POC (ref. White), β83	–	–	–	–	–	–	0.12	0.91	0.861
Men (ref. women), β84	–	–	–	–	–	–	0.26	0.63	0.651

* Source is the National Rheumatoid Arthritis Study; waves 2, 3, 5–10 analyses with HLM, version 8 (Scientific Software International). Person-years: n = 4,798; participants: n = 854. Within-person continuous variables are deviations from each person's own mean (person-mean centered). Between-person continuous variables are deviations from the overall sample mean (grand mean centered). CES-D = Center for Epidemiologic Studies Depression Scale; coeff. = coefficient; POC = person of color; ref. = reference.

race/ethnicity, and gender. Tests of the significance of the differences between groups used chi-square, *t*-tests, and analyses of variance, as appropriate, based on the level of measurement. Table 3 reports the results of the multilevel models. The unstandardized maximum likelihood coefficients (β coefficients) provide the effect size estimations of magnitude and direction of changes in the dependent variable associated with the within-person changes in the independent variables. Only the slopes with significant variance components were allowed to vary randomly (unique to each person). Exploration of the normality assumption indicates scores <1 for kurtosis and skew for all variables, well within the cutoff points for problematic nonnormality allowing for the use of parametric tests (30). A baseline model (no predictors) indicated that 35% of the variance in depressive symptoms was within persons and 65% was between persons. Preliminary models with each covariate as an outcome and study year as the predictor revealed significant change over time for all variables ($P < 0.05$ for the "study year" indicator).

RESULTS

Depressive symptoms, pain, functional disability, and household work disability differed by level of education; further, pain differed by race/ethnicity, and depressive symptoms, pain, and functional disability differed by gender (Table 2). These bivariate differences indicate likely health disparities among patients with RA. Consistent with prior research, between-person comparisons indicate that depressive symptoms were highest among those with lower education and among women (Table 2). The higher depressive symptoms among people of color compared to people who were White did not reach the conventional level of statistical significance (0.081 > 0.050). Reported levels of pain, functional disability, and household work disability were higher for those with lower education, people of color, and women. People of color had higher pain than people who were White. Women had higher pain and worse functional disability than men, but, contrary to expectation, women did not have higher household work disability than men. Social support was lowest among those with lower education and was lower among people of color but did not differ by gender (Table 2).

The first multilevel model showed that each year in the study was associated with increased depressive symptoms (β = 0.36, P = <0.001) or about one-third of a symptom (0.03% of an SD [= 0.36/10.52]) (Table 3, model 1). Adjusted for the time trend, changes in pain (β = 0.04, $P < 0.001$), functional disability (β = 6.58, $P < 0.001$), and household work disability (β = 0.65, $P < 0.001$) were associated with within-person increases in depressive symptoms.

With the addition of parenthood status, marital status, employment status, and social support as controls (Table 3, model 2), the associations of pain, functional disability, and household work disability with depressive symptoms persisted. Changes in parenthood status were not associated with changes in depressive symptoms. People who were married (β = –1.25, $P = 0.002$), employed (β = –0.98, $P = 0.001$), and reported higher social support (β = –4.07, $P < 0.001$) had fewer depressive symptoms compared to those who were unmarried, unemployed, or had lower social support.

In the full model (Table 3, model 3), there was still a negative association of education with depressive symptom scores (β = –0.39, $P = 0.037$), and men (β = –2.38, $P = 0.019$) had lower depressive symptoms than women. The aggregate scores for pain (β = 0.04, $P < 0.001$) and the effect of household work disability (β = 0.90, $P < 0.001$) had negative associations with depressive symptoms.

When adjusted for education, race/ethnicity, gender, and aggregate symptom measures in Table 3 (model 3), only the change in employment status was no longer associated with depressive symptoms. Depressive symptoms increased over time (study year β = 0.25, $P < 0.001$) and with increased levels of pain (β = 0.04, $P < 0.001$), functional disability (β = 4.45, $P < 0.001$), and household work disability (β = 1.03, $P < 0.001$). If patients were married (β = –1.31, $P = 0.003$), they had lower depressive symptoms than if they were not, and, as expected, increases in social support were associated with lower depressive symptom scores (i.e., negative association) (β = –3.61, $P < 0.001$).

Gender modified the within-person associations of pain, functional disability, and marital status with depressive symptoms (Table 3, model 3). On average, results indicate that the association between pain and depressive symptoms was weaker for men than for women (the main effect for pain was β = 0.04 ($P < 0.001$), and the coefficient for men was negative (β = –0.04, $P < 0.001$). In the final model, the coefficient for marital status indicated fewer depressive symptoms if women were married compared to if they were not (β = –1.31, $P = 0.003$). The cross-level interaction of gender by marital status was positive and stronger for men (β = 1.77, $P = 0.039$), indicating that the association was weaker and positive for men. Men also had a stronger association of functional disability and depressive symptoms than women (the main effect for functional disability was β = 4.45 [$P < 0.001$], and the coefficient for men was positive and stronger [β = 2.68, $P = 0.001$]). Level of education modified the within-person association of social support and depressive symptoms. Because the main effect was negative (β = –3.61, $P < 0.001$) and the interaction coefficient was positive (β = 0.32, $P = 0.021$), the interaction indicates a weaker coefficient for social support for each additional year of education.

DISCUSSION

Consistent with prior studies focused on parts of the biopsychosocial model (8), our findings show that changes in pain, disability, social roles (marital status and employment), and social support are associated with changes in depressive symptoms. Within-person changes in pain, functional impairment, and

household work disability were associated with changes in depressive symptoms. These associations persisted after controlling for covariates, and there were substantial differences in depressive symptoms between persons. Gender modified the associations of pain, functional disability, and marital status; education modified the association of social support with depressive symptoms.

Our study also provides support for the importance of understanding the connection between pain, functional disability, and depressive symptoms for individuals with RA (36,37). For those with RA, changes in symptoms may be a reminder of the incurable nature of RA and a sign that current treatment methods are not working (36,37), potentially contributing to worsening depressive symptoms. It is possible, however, that the underlying physiology that leads to arthritic inflammation also contributes to depressive symptoms (e.g., HPA axis) (36,38,39). Prior studies show that the physiological effects of meeting clinical criteria for depression, anxiety, or both are associated with worse fatigue trajectories compared to those who did not meet criteria for depression and/or anxiety (40).

The within-person associations of pain, disability, and depressive symptoms persisted after controlling for parental status, marital status, employment status, and social support, which indicates a direct association. Women experience fewer depressive symptoms when they are married, but men do not, suggesting that marriage has different implications for RA and depressive symptoms for women and men. The association of being employed with lower depressive symptoms does not persist after controlling for education, gender, and race/ethnicity (the association exists in model 2 but not model 3 of Table 3). There are several likely ways that social status contributes to depressive symptoms, including a sense of control (41), ability to maintain the expectations of core social roles (e.g., spouse/employee) (42), and the ability to garner coping resources in the face of stressors (24). The results from this study are consistent with all of these explanations; however, further research is needed to explore the complex interactions between employment status, education, and depressive symptoms for individuals with RA (42).

Surprisingly, the multivariate models exploring race/ethnicity indicated nonsignificant coefficients for people of color. Racism and discrimination have been shown to lead to worse health outcomes for people of color (12); therefore, the expectation would be for the results to echo previous research findings among people of color with RA. The SEs for the race/ethnicity coefficients were large, suggesting that this small subgroup is heterogeneous, thus making it difficult to detect effects. Rheumatology studies struggle to include sufficient numbers of people of color in study samples. In order to make progress in understanding how historical experiences with racism and discrimination impact health outcomes, researchers need to make more concerted efforts to recruit racial and ethnic minorities into research studies (43). Ideally, future studies will include sufficient cases to analyze health disparities among people with RA from an intersectional framework (e.g., using interactions for education by race/ethnicity by gender) to provide a more comprehensive picture of health disparities in this population (13).

Our study has several important limitations. The data set used in the present study was collected during a time when accommodations for chronic illness in workplaces was less common, high rates of employment for women were new, and insurance was even more closely tied to marriage and employment (i.e., the 1990s), limiting generalizability to contemporary conditions. There are more effective treatment options for RA now than in the 1990s (44), which might suggest that fewer people are vulnerable to depressive symptoms in response to pain, functional disability, and household work disability; however, for those who still experience more severe RA symptoms, there is likely still an association with more depressive symptoms. Of course, improvements in treatment options may be concentrated among people who are White and/or have better access to medical care, an issue that also deserves more research (22). Additionally, because the current study started with patients in rheumatology practices, there could be important limits to generalizing to those who are unable to see a specialist (45,46). Some of the findings in the current study may be attenuated because those with more severe RA symptoms or more difficult social circumstances may also be those least likely to stay in the study (24). Replicating and expanding the NRAS to include those not in rheumatology practices who meet criteria for RA, more people of color, and people in different treatment modalities will be important to check the robustness of the current findings.

Even with limitations, the current study highlights the continuing relevance of social inequality for individuals living with RA and provides further evidence of the need to understand and manage differences between patients' ability to cope with the stressors associated with RA (47). When rheumatologists ask patients about mental health issues, individuals with RA are often willing to discuss them (39). Few physicians have the ability to reduce the social inequalities that lead to health disparities. Physicians can, however, recognize variations in patient coping resources and recommend accommodations for employment, social services, and counseling (39) while keeping the potential complicating impact of social determinants in mind (39,48,49).

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. McQuillan 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.

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