



# BMJ Open Well-being and flourishing mental health in adults with inflammatory bowel disease, multiple sclerosis and rheumatoid arthritis in Manitoba, Canada: a cross-sectional study

Shaza Almweisheer,<sup>1</sup> Charles N Bernstein,<sup>2</sup> Lesley A Graff,<sup>3</sup> Scott B Patten,<sup>4</sup> James Bolton,<sup>5</sup> John D Fisk,<sup>6,7</sup> Carol A Hitchon ,<sup>8</sup> James J Marriott,<sup>8</sup> Ruth Ann Marrie ,<sup>8</sup> for the CIHR Team in Defining the Burden and Managing the Effects of Immune-mediated Inflammatory Disease

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For numbered affiliations see end of article.

## Correspondence to

Dr Ruth Ann Marrie;  
[rmarrie@hsc.mb.ca](mailto:rmarrie@hsc.mb.ca)

## ABSTRACT

**Objectives** Among people with immune-mediated inflammatory disease (IMID), including multiple sclerosis (MS), inflammatory bowel disease (IBD) and rheumatoid arthritis (RA) most research has focused on mental illness rather than on mental health. We assessed dimensions of mental health among persons with IMID and compared them across IMID. We also evaluated demographic and clinical characteristics associated with flourishing mental health.

**Design** Participants: Adults with an IMID (MS, 239; IBD, 225; RA 134; total 598) who were participating in a cohort study.

**Setting** Tertiary care centre in Manitoba, Canada.

**Primary outcome measure** Participants completed the Mental Health Continuum Short-Form (MHC-SF), which measures emotional, psychological and social well-being, and identifies flourishing mental health. This outcome was added midway through the study on the advice of the patient advisory group. Depression, anxiety, pain, fatigue and physical function were also assessed.

**Results** Total MHC-SF and subscale scores were similar across IMID groups. Nearly 60% of participants were considered to have flourishing mental health, with similar proportions across disease types (MS 56.5%; IBD 58.7%; RA 59%,  $p=0.95$ ). Older age was associated with a 2% increased odds of flourishing mental health per year of age (OR 1.02; 95% CI: 1.01 to 1.04). Clinically meaningful elevations in anxiety (OR 0.25; 95% CI: 0.12 to 0.51) and depressive symptoms (OR 0.074; 95% CI: 0.009 to 0.61) were associated with lower odds. Higher levels of pain, anxiety and depressive symptoms were associated with lower total Mental Health Continuum scores at the 50th quantile.

**Conclusions** Over half of people with MS, IBD and RA reported flourishing mental health, with levels similar across the disease groups. Interventions targeting symptoms of depression and anxiety, and upper limb impairments, as well as resilience training may help a higher proportion of the IMID population achieve flourishing mental health.

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This study compared a large sample of participants with three different immune-mediated inflammatory diseases.
- ⇒ A validated measure of mental well-being was used.
- ⇒ The cross-sectional design does not allow causal inference.
- ⇒ The study sample was not fully representative of people with the studied immune-mediated inflammatory diseases, as women and individuals who self-identified as white were over-represented.
- ⇒ Some factors relevant to well-being such as resilience were not assessed.

## INTRODUCTION

Immune-mediated inflammatory diseases (IMID), including multiple sclerosis (MS), rheumatoid arthritis (RA) and inflammatory bowel disease (IBD), are chronic diseases with a high prevalence of mental illness, including depression and anxiety disorders.<sup>1–3</sup> Persons with IMID often experience symptoms such as chronic pain or physical impairment, which may adversely affect mental health. These IMID also share several other features including their relapsing remitting nature, inflammatory processes, use of immune therapies for management and the high associated social, emotional and economic burdens.<sup>4–6</sup> While much attention has focused on mental illness in IMID, less has focused on mental health in the context of these diseases.<sup>7–9</sup> Studies which have purported to evaluate well-being in persons with IMID have often used measures of mental illness and equated low scores indicating the absence of mental illness with mental well-being.<sup>10–12</sup> Other

recent studies have focused on well-being solely in the context of the COVID-19 pandemic.<sup>13</sup>

Mental health is not simply the absence of mental illness.<sup>14</sup> Rather, it has been conceptualised as a positive phenomenon; a state of well-being and positive psychological functioning, that is, related to, but distinct from mental illness.<sup>14–16</sup> Keyes' model of mental health includes dimensions of emotional, psychological and social well-being that are represented in the Mental Health Continuum (MHC) scale.<sup>17</sup> Using this framework, persons with mental illness, such as depression, can still have what has been termed 'flourishing' mental health, that is, positive emotions (well-being), positive psychosocial and positive social functioning.<sup>14</sup> Similarly, persons free of mental illness may nonetheless have 'languishing' mental health (absence of well-being), which can be a risk factor for depression, and can be associated with comparable psychosocial impairment.<sup>14–16</sup>

In the general population and for persons with mental illness, socio-demographic factors associated with better mental health include older age and a higher level of education,<sup>18–21</sup> although these associations can vary with the dimension of well-being studied.<sup>14</sup> The association between gender and mental health also differs across mental health dimensions.<sup>22–23</sup> For example, women have been found to have higher personal growth levels and positive relations, while men demonstrate higher autonomy and self-acceptance levels. Physical symptoms can have a detrimental impact on mental health. In the Canadian Community Health Survey, persons with chronic pain were less likely to report flourishing mental health than persons without chronic pain and physical disability was associated with lower levels of emotional well-being.<sup>24</sup>

Mental health is a crucial aspect of overall health and an improved understanding of factors associated with flourishing mental health can help guide interventions to promote well-being. We aimed to assess and compare levels of well-being across IMID given the differences in the organ systems involved and clinical manifestations of these diseases; and assess demographic and clinical characteristics associated with flourishing mental health and the three dimensions of well-being. We reasoned that if findings were similar across these three IMID, then this would support their generalisability to other IMID. Further, we have extensively explored mental illness in these three chronic diseases, hence an exploration of mental health in these three diseases provides a balanced assessment of the psychological status of persons with these chronic diseases. We hypothesised that lower symptoms of depression, anxiety, pain and less severe physical impairments would be associated with higher mental health across all domains of well-being.

## METHODS

### Design and study population

This cross-sectional study was embedded within a prospective longitudinal study examining the effects of psychiatric comorbidity in persons with IMID (the 'IMID'

study).<sup>25</sup> Participants included individuals aged ≥18 years or older with IBD (Crohn's disease or ulcerative colitis, physician diagnosed<sup>26–27</sup>), MS (definite diagnosis based on Poser *et al* or revised McDonald *et al* criteria<sup>28–31</sup>) or RA (definite diagnosis based on the 2010 American College of Rheumatology/European League Against Rheumatism<sup>32</sup>), who were recruited from community and tertiary care settings as previously described.<sup>25</sup> Participants in the longitudinal study completed four annual study visits. The current study included participants who completed the Mental Health Continuum Short-Form (MHC-SF) at the third visit, when the MHC-SF was added to the data collection. All participants provided written consent and had adequate English knowledge to complete questionnaires. There were no exclusion criteria applied, to support participation of individuals regardless of disease severity.

### Patient and public involvement

Following receipt of funding, the IMID study was informed by three advisory groups comprised of: (1) primary care providers; (2) people living with MS, IBD or RA; and (3) representatives from consumer advisory groups. These groups met with the study's investigators several times a year throughout the project, providing input regarding questions, outcome measures and interpretation of findings. They provided input regarding the information of interest to the patient community. The MHC-SF was added partway through the study, at the third visit, to focus more on positive aspects of mental health, on the recommendation of the patient advisory group.

## Measures

### Socio-demographic characteristics

Participants used questionnaires to report their age, gender, marital status, race and ethnicity and highest level of education completed.<sup>25</sup> We categorised marital status as single (single/never married/divorced/separated/widowed) versus partnered (married/common law). We categorised race and ethnicity as white versus other given the small number of participants identifying as other. We categorised education as high school or less versus post-secondary.

### Mental health

The MHC-SF is a 14-item measure derived from the MHC with strong psychometric properties.<sup>17</sup> It is comprised of three subscales: emotional well-being (EWB), which has a single item for each of positive affect, interest in life and satisfaction with life; psychological well-being (PWB) which has a single item for each of self-acceptance, environmental mastery, positive relations with others, personal growth, autonomy and purpose in life; and social well-being (SWB), which includes a single item for each of social contribution, social integration, social actualisation, social acceptance and social coherence. Response options range from never (0) to every day (5), thus total scores range from 0 to 70, with higher

scores indicating better overall well-being. Based on the MHC-SF scale, individuals can be categorised as having flourishing, moderate or languishing mental health. Flourishing mental health is defined as scores of 4 or 5 for  $\geq 1$  of the 3 EWB items, and  $\geq 6$  of the 11 PWB and SWB items combined. That is, individuals must demonstrate well-being across all subscales. Languishing mental health is defined by scores of 0 or 1 for  $\geq 1$  of the 3 EWB items, and  $\geq 6$  of the 11 PWB and SWB items combined. All other response combinations are classified as representing moderate mental health.

### Mental illness

The Hospital Anxiety and Depression Scale (HADS) is a well-validated measure commonly used in medical populations to assess symptoms of anxiety (HADS-A) and depression (HADS-D).<sup>33</sup> Each subscale has seven items, with response options from 0 to 3, and total scores ranging from 0 to 21; higher scores indicate worse symptoms. We used cut-off scores of  $\geq 11$  for the HADS-A and HADS-D to indicate clinically meaningful symptoms of anxiety and depression, respectively, as this threshold has high specificity ( $>85\%$ ) in the IMID populations of interest.<sup>34–36</sup>

### Pain

The Modified Pain Effects Scale is comprised of six items derived from the Pain Effects Scale developed for the Medical Outcomes Study which assess the effect of pain on mood, mobility, sleep, normal work, recreational activities and enjoyment of life.<sup>37 38</sup> Total scores range from 6 to 30, with higher scores indicating greater detrimental impact of pain.

### Physical function

Upper limb function was assessed using the 9-hole peg test (9-HPT), and lower limb function was assessed using the timed 25-foot walk test (T25-FW).<sup>39–41</sup> The 9-HPT is a quantitative tool to assess manual dexterity validated for use in MS and RA.<sup>39–42</sup> The T25-FW is a simple, reliable and objective assessment of lower limb function.<sup>43</sup> We used the scores of the entire MS cohort to estimate the mean and SD values to calculate z-scores for each test.<sup>40</sup>

### Fatigue

The Daily Fatigue Impact Scale (DFIS) is an 8-item scale, derived from the Fatigue Impact Scale, that measures subjective impact of fatigue on daily lives for people with medical conditions with fatigue as a common symptom. DFIS assesses three domains of fatigue including physical, cognitive and social. Response options are 0 (no problem) to 4 (extreme problem), with the total scores ranging from 0 to 32.<sup>44</sup> The DFIS has high internal consistency and good discriminative validity and stability, particularly for persons with MS.<sup>45</sup>

### Statistical analysis

Participant characteristics were summarised for each cohort (MS, IBD and RA) using medians (IQR) for continuous variables, and frequencies (per cent) for

categorical variables; missing data were not imputed. Bivariate analyses were conducted using analysis of variance, Kruskal-Wallis tests with pairwise comparisons and Spearman correlations.

Using multivariable logistic regression, we assessed the association between cohort (MS (reference group), IBD and RA) and flourishing mental health; the dependent variable was flourishing versus either moderate or languishing (reference), consistent with other studies examining factors associated with flourishing where the proportion of participants with languishing mental health was low.<sup>46</sup> Covariates included gender (men as reference), race (other as reference), education ( $\leq$ high school as reference), marital status (single as reference), age (continuous), pain impact (continuous), upper limb impairment (continuous) and lower limb impairment (continuous) and fatigue impact (continuous). Clinically significant symptoms of depression and anxiety were included as categorical variables (presence vs absence (reference)). A sensitivity analysis repeated the model including symptoms of depression and anxiety as continuous variables. We report ORs and 95% CIs, model c-statistics and the Hosmer-Lemeshow goodness of fit test.

Because categories of mental health (eg, flourishing) combine information from multiple well-being subscales, we also conducted analyses exploring the association between cohort (MS, IBD and RA) and MHC-SF total and subscale scores in continuous form using separate quantile regression models. Quantile regression does not require distributional assumptions such as normality and allows evaluation of the relationship of the variable of interest across the full range of the continuous dependent variable.<sup>47</sup> The primary approach for each model was the 50th percentile. Sensitivity analyses examined the 20th and 80th percentiles. These models included the same covariates as the logistic models.

As described elsewhere, the IMID study sample size of a minimum of 150 participants per group was based on the principal aim of testing the association between psychiatric comorbidity and health-related quality of life or work disability.<sup>25</sup> A formal sample size calculation was not conducted for the present analysis as cohort size was fixed; post hoc power analysis is flawed.<sup>48</sup> Since we were testing novel hypotheses, we sought to avoid type II error by excessive adjustment for multiple comparisons.<sup>49</sup> Therefore, we did not adjust for multiple comparisons in this analysis.

Data were analysed using SPSS Statistics for Mac, V.28 (IBM, Armonk, New York, USA).

## RESULTS

### Participants

Of the 656 participants with an IMID enrolled in the longitudinal study, 599 completed the third study visit of whom 598 completed the MHC-SF. Three-quarters of participants were women, and most self-identified as white (table 1). Two-thirds of participants had some

**Table 1** Participant characteristics stratified by disease group

Characteristic	Total	MS	IBD	RA	P value
Participants, n	598	239	225	134	
Age (years), mean (SD)	53.7 (14.2)	53.0 (12.9)	49.7 (15.0)	61.7 (11.6)	<b>&lt;0.0001</b>
Gender, n (%)					<b>&lt;0.001</b>
Men	148 (24.7)	43 (18.0)	87 (38.7)	18 (13.4)	
Women	450 (75.3)	196 (82.0)	138 (61.3)	116 (86.6)	
Race,* n (%)					<b>0.029</b>
White	502 (83.9)	205 (85.8)	194 (86.2)	103 (76.9)	
Other	94 (15.7)	33 (13.8)	30 (13.3)	31 (23.1)	
Education,† n (%)					0.79
≤High school	185 (30.9)	78 (32.6)	69 (30.6)	38 (28.3)	
Post-secondary	406 (67.8)	160 (66.9)	155 (68.9)	91 (67.9)	
Marital status, n (%)					0.70
Single	205 (34.3)	80 (33.5)	75 (33.3)	50 (37.3)	
Partnered	393 (65.7)	159 (66.5)	150 (66.7)	84 (62.7)	
HADS-A, mean (SD)	6.16 (4.4)	5.84 (4.4)	6.59 (4.5)	5.99 (4.0)	0.15
HADS-A ≥11, n (%)	101 (16.9)	36 (15.1)	44 (19.6)	21 (15.7)	0.40
HADS-D, mean (SD)	4.57 (4.0)	4.96 (4.3)	3.93 (3.6)	4.95 (4.1)	<b>0.010</b>
HADS-D ≥11, n (%)	51 (8.5)	25 (10.5)	11 (4.9)	15 (11.2)	<b>0.045</b>
MPES,‡ median (Q25, Q75)	12 (8, 17)	13 (8, 17)	11 (7, 15)	15 (10, 19)	<b>&lt;0.001</b>
DFIS,§ median (Q25, Q75)	8 (3, 14)	8 (3, 17)	6 (2, 12)	8 (3, 16)	<b>0.009</b>
9-HPT z-score,¶ mean (SD)	−0.03 (1.07)	−0.40 (1.2)	0.48 (0.79)	−0.22 (0.92)	<b>&lt;0.001</b>
T25-FW z-score,** mean (SD)	−0.53 (2.81)	−1.52 (4.2)	0.25 (0.18)	−0.02 (0.49)	<b>&lt;0.001</b>

Missing data (n).

Bold identifies the statistically significant p-value.

\*Race: 1 MS, 1 IBD.

†Education: 1 MS, 1 IBD, 5 RA.

‡Pain 1 RA.

§The Daily Fatigue Impact Scale: 1 MS.

¶9-HPT z-score: 8 MS, 14 IBD, 2 RA.

\*\*T25-FW z-score: 7 MS, 17 IBD, 2 RA.

DFIS, Daily Fatigue Impact Scale; HADS-A, HADS-Anxiety; HADS-D, Hospital Anxiety and Depression Scale-Depression; 9-HPT, 9-hole peg test; IBD, inflammatory bowel disease; MPES, Modified Pain Effects Scale; MS, multiple sclerosis; RA, rheumatoid arthritis; T25-FW, timed 25-foot walk.

post-secondary education, and were partnered. The RA cohort was the smallest, comprising 22.4% of the participants and had the highest median age. Participants with RA reported highest median pain effects scores, which were significantly higher compared with IBD participants. Participants with IBD were least likely to have clinically meaningful elevations of depressive symptoms. Lower limb function assessed using the T25-FW was worse in participants with MS than participants in the other two groups.

### Well-being and flourishing mental health

In unadjusted analyses, total MHC-SF and subscale scores did not differ by IMID cohort, gender or race (table 2). A higher level of education was associated with higher total MHC-SF and subscale scores. Being partnered was associated with higher total scores and EWB scores. Lower symptoms of depression and anxiety, pain impact, fatigue

and less physical impairment were associated with higher well-being for the total MHC-SF and subscale scores (online supplemental table e1 and figure e1). When we categorised participants according to whether they had flourishing, moderate or languishing mental health, over half of participants had flourishing mental health (n=339, 56.7%), and this did not differ between IMID cohorts (figure 1, p=0.35). One-third (n=217) had moderate mental health, while 7.0% (n=42) had languishing mental health.

### Factors associated with flourishing mental health

On multivariable logistic regression analysis, older age was associated with increased odds of flourishing mental health (OR 1.03; 95% CI: 1.01 to 1.04) (table 3). In contrast, clinically meaningful elevations of symptoms of anxiety and depression, as well as pain and fatigue were associated with lower odds of flourishing mental health

**Table 2** Mental Health Continuum Short-Form scores according to participant characteristics (N=598)

Characteristic	EWB score median (Q25–Q75)	P value	SWB score median (Q25–Q75)	P value	PWB score median (Q25–Q75)	P value	Total score median (Q25–Q75)	P value
Participants								
MS	12 (9–14)	0.44	17 (8–21)	0.42	23 (16–27)	0.52	51 (34–61)	0.43
IBD	12 (9–14)		17 (11–21)		24 (18–27)		52 (39–61)	
RA	12 (9–13)		16 (9–20)		24 (17–27)		51 (36–58)	
Gender								
Men	12 (9–13)	0.32	15 (9–20)	0.17	23 (17–27)	0.28	50 (38–58)	0.18
Women	12 (9–14)		17 (10–21)		24 (17–28)		52 (37–61)	
Race								
White	12 (9–14)	0.48	17 (10–21)	0.10	24 (17–27)	0.96	52 (37–61)	0.44
Other	12 (9–14)		15 (8–20)		24 (16–28)		49 (36–59)	
Education								
≤High school	12 (8–13)	0.004	14 (8–20)	<0.001	21 (15–26)	<0.001	47 (32–57)	<0.001
Post-secondary	12 (9–14)		17 (11–21)		24 (18–27)		53 (39–61)	
Marital status								
Single	12 (8–13)	0.002	16 (9–20)	0.073	22 (16–27)	0.062	48 (34–59)	0.026
Partnered	12 (10–14)		17 (10–21)		24 (18–27)		53 (38–61)	

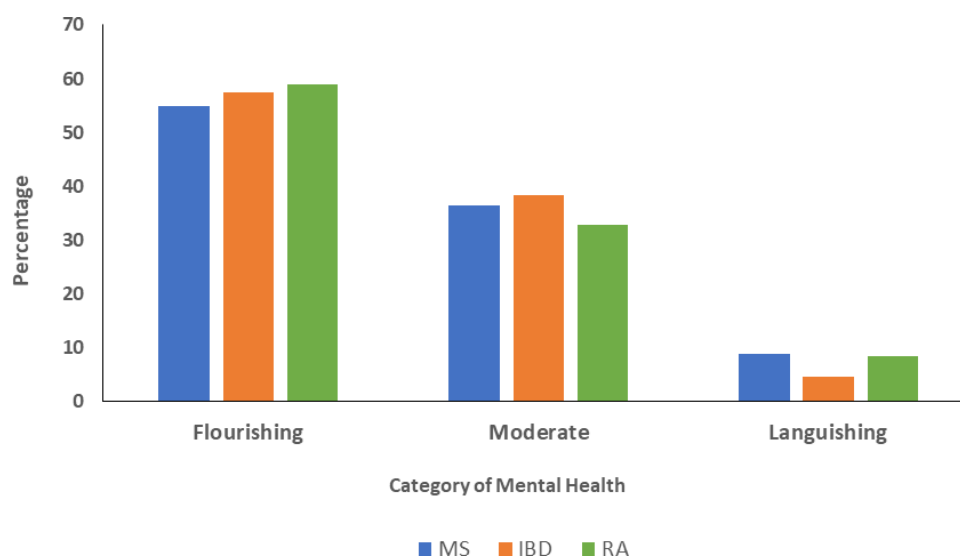
EWB, emotional well-being; IBD, inflammatory bowel disease; MS, multiple sclerosis; PWB, psychological well-being; RA, rheumatoid arthritis; SWB, social well-being.

(table 3, Model 1). None of the other factors assessed were associated with flourishing mental health, including type of IMID. The direction of the association was similar when symptoms of anxiety and depression were included as continuous variables (table 3, Model 2).

### Factors associated with well-being

Multivariable quantile regression models at the 50th percentile of the MHC total scores showed that lower symptoms of depression, anxiety (as continuous variables) and pain impact were associated with higher total MHC-SF scores (table 4). Women had significantly higher

total MHC-SF scores than men. There was no observed interaction between the IMID cohort and symptoms of depression, anxiety or pain impact. Similarly, higher symptoms of depression and anxiety were associated with lower SWB, PWB and EWB scores. Greater pain impact was associated with lower PWB scores, but not with EWB or SWB scores. Being a woman was solely associated with higher PWB scores. Age, race, education, fatigue impact and upper and lower limb function were not associated with MHC-SF total or subscale scores.



**Figure 1** Categorisation of mental health according to immune-mediated inflammatory disease. IBD, inflammatory bowel disease; MS, multiple sclerosis; RA, rheumatoid arthritis.

**Table 3** Factors associated with flourishing versus moderate or languishing mental health on multivariable logistic regression

Variable	OR (95% CI)	
	Model 1†	Model 2
IBD†	0.75 (0.45 to 1.28)	0.65 (0.36 to 1.19)
RA†	1.03 (0.56 to 1.86)	0.99 (0.51 to 1.92)
Age	1.02 (1.01 to 1.04)**	1.03 (1.01 to 1.05)**
Gender (reference: men)	1.59 (0.96 to 2.62)	1.45 (0.82 to 2.56)
Race (reference: other)	1.14 (0.64 to 2.02)	1.25 (0.66 to 2.36)
Education (reference: ≤high school)	1.26 (0.81 to 1.97)	1.02 (0.62 to 1.67)
Partner status (reference: single)	1.18 (0.76 to 1.83)	0.95 (0.57 to 1.57)
HADS-A§	0.25 (0.12 to 0.51)***	0.65 (0.59 to 0.73)*
HADS-D§	0.078 (0.009 to 0.65)***	0.91 (0.84 to 0.98)***
MPES	0.90 (0.86 to 0.95)***	0.94 (0.89 to 0.99)*
DFIS	0.94 (0.91 to 0.97)***	0.99 (0.96 to 1.04)
T25-FW z-score	1.03 (0.94 to 1.14)	1.02 (0.92 to 1.13)
9-HPT z-score	1.22 (0.93 to 1.59)	1.24 (0.91 to 1.67)

Dependent variable: Categorical diagnoses (flourishing vs moderate or languishing mental health).

\*P value<0.05, \*\*p value<0.01, \*\*\*p value<0.001.

†MS is the reference category.

‡HADS-D and HADS-A dichotomised at ≥11. C-statistic=0.83. Hosmer-Lemeshow goodness of fit= $\chi^2=4.60$ , p=0.80.

§HADS-D and HADS-A continuous. C-statistic=0.89. Hosmer-Lemeshow goodness of fit= $\chi^2=8.18$ , p=0.42.

DFIS, Daily Fatigue Impact Scale; HADS-A, HADS-Anxiety; HADS-D, Hospital Anxiety and Depression Scale-Depression; 9-HPT, 9-hole peg test; IBD, inflammatory bowel disease; MPES, Modified Pain Effects Scale; MS, multiple sclerosis; RA, rheumatoid arthritis; T25-FW, timed 25-foot walk.

When we examined the 80th quantile, findings were similar to those at the 50th percentile with respect to symptoms of depression, and anxiety (online supplemental table e2). Pain impact was associated with lower EWB scores but was not with PWB scores. In contrast to prior findings, female gender was associated with higher EWB but not PWB scores. When we examined the 20th quantile, the findings remained similar to those at the 50th percentile (online supplemental table e3) although better upper limb function was associated with higher SWB scores, and older age was associated with higher EWB scores.

## DISCUSSION

This cross-sectional study compared mental health with respect to three dimensions of well-being across three IMID, and specifically examined factors associated with

flourishing mental health. Overall, close to 6 in 10 participants had flourishing mental health, whereas less than 1 in 10 had languishing mental health, suggesting that positive mental health can be achieved despite the presence of these chronic diseases. The frequency of flourishing mental health did not differ across IMID, consistent with prior findings regarding mental illness. Factors associated with a greater likelihood of flourishing mental health included older age, whereas symptoms of anxiety and depression were associated with reduced odds. Consistent with our hypothesis, greater depression and anxiety symptoms were consistently associated with lower total MHC-SF scores, as well as with lower scores for EWB, PWB and SWB. Pain effects were associated with lower PWB and EWB scores. Findings regarding gender and upper limb function were not consistent across dimensions of mental health.

In the 2012 Canadian Community Health Survey (CCHS) 76.9% of Canadians over age 15 years reported flourishing mental health based on the MHC-SF,<sup>50</sup> which is considerably higher than for the disease groups in our IMID cohort. General population studies in other countries have reported variable flourishing mental health prevalence, ranging from 20% (South Africa) to 64.5% (Denmark) in adults and adolescents.<sup>51 52</sup> In two samples with chronic pain, the prevalence of flourishing ranged from 23% to 34%.<sup>53</sup> Our findings with respect to age and flourishing mental health are consistent with prior observations in the general population,<sup>18</sup> persons with mental illness,<sup>20</sup> and among persons with various connective tissue diseases.<sup>54</sup>

We found that the lower depressive and anxiety symptoms were associated with flourishing mental health. Our findings with respect to symptoms of depression and anxiety are also consistent with observations in other populations. In the 2012 CCHS survey, only 4.5% of respondents with a psychiatric disorder, including depression, bipolar disorder, generalised anxiety disorder and alcohol or drug dependence had flourishing mental health.<sup>50</sup> In a multi-ethnic Asian general population cohort with 404 participants, persons with depression or anxiety had lower levels of positive mental health compared with persons without these conditions.<sup>23</sup> In a longitudinal study of participants with IBD, fewer depressive symptoms were associated with 'thriving'.<sup>55</sup> Similarly, elevated symptoms of depression and anxiety on the HADS were associated with lower mental well-being among 174 Irish persons with cystic fibrosis.<sup>56</sup>

While older age was associated with flourishing mental health, when we examined individual domains of well-being, we found that age and gender were only associated with EWB at specific quantiles and gender was not specifically associated with PWB. A study that included 1340 participants in the Netherlands aged 18–78 years also demonstrated that older age was associated with better EWB, except for the oldest-old participants. The Dutch study showed that women had higher PWB. The reasons for the association of older age with greater well-being

**Table 4** Quantile regression at the 50th percentile for the factors associated with positive mental health

Variable	SWB	PWB	EWB	Total
IBD (ref: MS)	−0.30 (−2.17, 1.57)	0.71 (−0.51, 1.93)	−0.35 (−0.91, 0.20)	0.33 (−2.93, 3.59)
RA (ref: MS)	−0.85 (−2.55, 0.84)	0.081 (−1.33, 1.50)	−0.46 (−1.11, 0.18)	−0.44 (−3.45, 2.57)
Age	0.044 (−0.0063, 0.095)	0.020 (−0.018, 0.060)	0.0046 (−0.014, 0.023)	0.043 (−0.051, 0.14)
Gender (ref: men)	1.08 (−0.65, 2.81)	1.53 (0.28, 2.78)*	0.46 (−0.075, 0.99)	3.61 (0.66, 6.66)*
Race (ref: other)	1.16 (−0.51, 2.84)	−0.12 (−1.56, 1.33)	0.028 (−0.52, 0.57)	1.13 (−1.91, 4.18)
Education (ref: ≤high school)	0.19 (−1.09, 1.47)	0.88 (−0.21, 1.97)	−0.24 (−0.74, 0.27)	1.42 (−1.96, 2.18)
Partner (ref: single)	−0.26 (−1.44, 0.92)	0.078 (−0.90, 1.06)	0.30 (−0.17, 0.77)*	0.11 (−1.96, 2.18)
HADS-A	−0.25 (−0.50, −0.0088)*	−0.22 (−0.39, −0.051)*	−0.11 (−0.18, −0.036)*	−0.66 (−1.06, −0.26)***
HADS-D	−0.88 (−1.10, −0.67)***	−1.00 (−1.23, −0.78)***	−0.57 (−0.69, −0.45)***	−2.48 (−2.91, −2.04)***
MPES	−0.12 (−0.26, 0.014)	−0.15 (−0.28, −0.025)*	−0.049 (−0.12, 0.025)	−0.37 (−0.64, −0.11)**
DFIS	0.007 (−0.12, 0.14)	−0.007 (−0.11, 0.093)	−0.0050 (−0.052, 0.042)	0.093 (−0.11, 0.29)
T25-FW z-score	−0.042 (−0.41, 0.33)	0.096 (−0.16, 0.35)	0.0084 (−0.12, 0.14)	0.13 (−0.49, 0.75)
9-HPT z-score	0.85 (−0.11, 1.81)	−0.012 (−0.65, 0.62)	−0.068 (−0.42, 0.28)	0.43 (−1.30, 2.16)
Pseudo-R <sup>2</sup>	0.30	0.35	0.38	0.40

\*P value<0.05, \*\*p value<0.01, \*\*\* p value<0.001.

DFIS, Daily Fatigue Impact Scale; HADS-A, HADS-Anxiety; HADS-D, Hospital Anxiety and Depression Scale-Depression; 9-HPT, 9-hole peg test; IBD, inflammatory bowel disease; MPES, Modified Pain Effects Scale; MS, multiple sclerosis; RA, rheumatoid arthritis; T25-FW, timed 25-foot walk.

in our sample are unknown. Some studies in the general population have suggested that emotional regulation improves with age, but others these findings have not been consistent.<sup>57</sup> A systematic review of 13 articles suggested that social support, and emotional intelligence as well as emotional regulation contribute to well-being at older ages.<sup>58</sup>

While lower limb function was not associated with any dimensions of well-being in our study, better upper limb function was positively related to SWB but not with EWB or PWB. This may reflect the particular importance of upper limb function for enabling independence and participation in society. For example, a study of people with MS that found that participants with impaired upper limb dexterity reported restrictions in participation including in home, social and work or school settings; restrictions for social participation were most prominent.<sup>59</sup> This also suggests a potential mechanism by which more severe disease might result in lower well-being, but requires further investigation using a longitudinal design.

More severe pain and fatigue effects were associated with lower EWB and PWB, again highlighting the potential effects of disease severity on well-being. These findings are consistent with prior studies in the general population, older people, persons with RA and other connective tissue diseases and in MS.<sup>9 24 54 60</sup> One of these studies used the MHC-SF to assess overall mental well-being, while the others used different measures focusing primarily on EWB. Interestingly, a 10-year cohort study of older women found that changes in pain severity over time were not associated with changes in the level of PWB.<sup>61</sup> The authors speculated that this was due to resilience, that is, the phenomenon of maintenance, recovery

or improvement in health following a specific challenge, such as pain.

In the context of chronic disease, resilience can be viewed as a dynamic, adaptive response to adversity or the ability to maintain mental health (well-being) when facing social, physical or other stressors.<sup>62 63</sup> For example, among 104 people with Crohn's disease, greater resilience as measured the Resilience Pillars Scale was associated with greater PWB.<sup>8</sup> Resilience is influenced by the balance between vulnerabilities, such as poor health, and resources such as coping strategies, psychological factors including self-efficacy, and social support,<sup>64</sup> including from peers affected by the same condition.<sup>65</sup> Resilience is of particular importance for persons with chronic illness because it is modifiable.<sup>66</sup> One meta-analysis of 11 randomised controlled trials found that cognitive behavioural therapy-based, mindfulness and mixed interventions were beneficial for improving psychological resilience.<sup>67</sup> These trials included a range of populations including people with breast cancer, US veterans, workers with chronic illness, physicians and students among others. Small pilot studies have shown that resilience training programmes are associated with improvements in resilience, and quality of life among people with MS.<sup>68</sup> Further study of targeted resilience training programmes and other strategies to improve mental health may be useful for IMID populations who do not have flourishing mental health.

The strengths of the study included the large sample, the comparison of physician-diagnosed IMID disease types, validated measures of well-being and other factors. Moreover, the focus of this study on well-being was directed by persons with lived experience involved in the research

programme. However, some limitations are notable. The cross-sectional design does not allow causal inference. The study sample was not fully representative of the IMID disease types, as most participants were women, and more than three-quarters of the participants self-identified as white, limiting the generalisability of results to men and other racial groups. Although the MHC-SF is recognised as a valid and reliable measure, its performance characteristics have not been specifically assessed in people with IMID. We did not assess all factors that were potentially relevant to well-being including health behaviours such as exercise, social support networks, self-efficacy and successful management of chronic disease. Moreover, although we assessed pain, fatigue, depression, anxiety and physical function, we did not examine disease-specific clinical manifestations that might influence well-being due to the comparative study design. These should be evaluated in future studies.

In summary, over half of people with IBD, MS and RA had flourishing mental health and less than 1 in 5 experienced languishing mental health. Symptoms of depression, anxiety and pain were associated with lower mental well-being in multiple dimensions. Upper limb function affected SWB. Interventions targeting symptoms of depression and anxiety, and upper limb impairments, as well as resilience training may help a higher proportion of the IMID population achieve flourishing mental health.

#### Author affiliations

<sup>1</sup>Internal Medicine, University of Manitoba, Winnipeg, Manitoba, Canada

<sup>2</sup>Department of Gastroenterology, University of Manitoba, Winnipeg, Manitoba, Canada

<sup>3</sup>Clinical Health Psychology, University of Manitoba, Winnipeg, Manitoba, Canada

<sup>4</sup>Community Health Sciences & Psychiatry, University of Calgary Cumming School of Medicine, Calgary, Alberta, Canada

<sup>5</sup>Department of Psychiatry, University of Manitoba, Winnipeg, Manitoba, Canada

<sup>6</sup>Nova Scotia Health Authority, Halifax, Nova Scotia, Canada

<sup>7</sup>Departments of Psychiatry, Psychology & Neuroscience, and Medicine, Dalhousie University, Halifax, Nova Scotia, Canada

<sup>8</sup>Internal Medicine, University of Manitoba College of Medicine, Winnipeg, Manitoba, Canada

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#### ORCID iDs

Carol A Hitchon <http://orcid.org/0000-0001-5547-3268>

Ruth Ann Marrie <http://orcid.org/0000-0002-1855-5595>

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