

# BMJ Open Is life satisfaction associated with future mental health service use? An observational population-based cohort study

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## ABSTRACT

**Objective** To investigate the prospective association between life satisfaction and future mental health service use in: (1) hospital/emergency department, and (2) outpatient settings.

**Design and setting** Population-based cohort study of adults from Ontario, Canada. Baseline data were captured through pooled cycles of the Canadian Community Health Survey (CCHS 2005–2014) and linked to health administrative data for up to 5 years of follow-up.

**Participants** 131 809 Ontarians aged 18 years and older.

**Main outcome measure** The number of mental health-related visits in (1) hospitals/emergency department and (2) outpatient settings within 5 years of follow-up.

**Results** Poisson regression models were used to estimate rate ratios in each setting, adjusting for sociodemographic measures, history of mental health-related visits, and health behaviours. In the hospital/emergency setting, compared to those most satisfied with life, those with the poorest satisfaction exhibited a rate ratio of 3.71 (95% CI 2.14 to 6.45) for future visits. In the outpatient setting, this same comparison group exhibited a rate ratio of 1.83 (95% CI 1.42 to 2.37). When the joint effects of household income were considered, compared with the highest income and most satisfied individuals, the least satisfied and lowest income individuals exhibited the highest rate ratio in the hospital/emergency setting at 11.25 (95% CI 5.32 to 23.80) whereas in the outpatient setting, the least satisfied and highest income individuals exhibited the highest rate ratio at 3.33 (95% CI 1.65 to 6.70).

**Conclusion** The findings suggest that life satisfaction is a risk factor for future mental health visits. This study contributes to an evidence base connecting positive well-being with health system outcomes.

## INTRODUCTION

Mental and substance use disorders account for approximately 7.4% of all disability-adjusted life years worldwide, and in Canada, 1 in 5 people live with a mental health problem or illness.<sup>1 2</sup> Mental illness is often accompanied by workforce participation barriers, excess comorbidity, high healthcare utilisation and shortened life expectancy.<sup>3 4</sup> In

## Strengths and limitations of this study

- This large provincially representative study links multiple cycles of the Canadian Community Health Survey with health administrative databases to evaluate the association between life satisfaction and mental health service use in two care settings.
- Insight into participants' history of mental health-related visits prior to survey interview allowed for more robust analyses that considered baseline mental health status and therefore decreased concern for reverse causation.
- Mental health-related visits with types of care providers that are not captured by the administrative databases could not be accounted for during follow-up, which could confound the reported association.
- Life satisfaction and health behaviours were only measured once at baseline, increasing the potential for misclassification bias.

Canada's most populous province of Ontario, the burden of mental illness and addictions (in terms of health-adjusted life years) is estimated to exceed 1.5 times the burden of all cancers.<sup>5</sup>

Further, the demand for mental health services is increasing. In Ontario specifically, there are common delays in wait times for counselling and therapy that are often too long for effective care and result in unmet health needs.<sup>6 7</sup> In a cross-sectional study examining self-reported mental health service use among Ontario residents, service use increased from 7.2% in 2003–2005 to 12.8% in 2011–2014.<sup>8</sup> Among the subgroup reporting a past-year major depressive episode, the proportion of individuals not using mental health services was 48.8% in 2002, which decreased to 35.6% in 2012.<sup>8</sup> This increase in demand for health services can effectively strain health system capacity, reducing the quality of services received. A study conducted in south-eastern Ontario

found that only 30% of clients seeking community-based care received an intensity of service that matched their psychosocial needs.<sup>9</sup> The majority (80%) of Canadians seek care from their primary care physician, of whom only 23% report feeling prepared to care for patients with severe mental health problems.<sup>10</sup> Evidently, there exists a comprehensive demand for accessible mental healthcare, which is deepening with time.

Epidemiological research has historically been overwhelmingly oriented towards health deficits and risk factors, but in recent years, the idea that promoting positive aspects of health can have a widespread impact on health system outcomes has gained traction. A growing body of evidence points to a variety of positive social, psychological and environmental factors that influence health and well-being outcomes to a comparable degree as what is observed in the larger risk factor-focused body of research.<sup>11</sup> With regards to mental health, a promotion and protection framework describes a dual continuum wherein mental health is conceptualised as more than just the absence of illness, extending beyond deficits, beyond neutrality, and into a positive spectrum of well-being.<sup>12</sup> The WHO adopts this framework in its description of mental health as a state of well-being in which an individual recognises their abilities and is able to work productively, cope with life stressors, and make contributions to their community.<sup>13</sup> In other words, mental illness and positive mental well-being are two distinct but related concepts: people can have a mental illness yet cope well with it and be happily satisfied with their life, while others can be free from mental illness yet exhibit high levels of mental dysfunction and dissatisfaction with their life.<sup>12 14 15</sup> Critical to this framework lies the hypothesis that gains in positive mental well-being can decrease the risk for future mental illness and health deficits.<sup>14</sup> Effectively, this premise extends understandings of health determinants and extends opportunities to integrate promotional and wellbeing-oriented supports. Expanding understandings of not only negative but also positive factors associated with healthcare utilisation encourages the development of innovative and sustainable approaches to improving health system capacity, which is especially pertinent under the context of a growing demand for mental healthcare.

Previous studies have shown associations between positive mental well-being and a variety of health outcomes.<sup>14 16–18</sup> One well-being measure in particular, life satisfaction, has been shown to be associated with multiple health outcomes, such as health behaviours, chronic disease, death, preventable hospitalisations, general healthcare use and mental health symptom development.<sup>19–23</sup> Life satisfaction is concerned with a subjective global evaluation of one's life, and previous studies support this measure as encompassing mental, physical, and social facets of well-being.<sup>22 24 25</sup> However, to the authors' knowledge, no studies have examined prospective and population-wide associations with subsequent mental health service use in Ontario. Using a large, representative population-based cohort, we aim to investigate

the prospective association between life satisfaction and future mental health service use in: (1) hospital/emergency department (ED), and (2) outpatient settings.

## METHODS

### Study population

Data from five pooled cycles of Statistics Canada's Canadian Community Health Survey (CCHS, cycles 2005, 2007/2008, 2009/2010, 2011/2012, 2013/2014) were linked with population-based health administrative databases in Ontario, Canada. Datasets were linked using unique encoded identifiers and analysed at ICES, which is an independent, non-profit research institute whose legal status under Ontario's health information privacy law allows it to collect and analyse healthcare and demographic data, without consent, for health system evaluation and improvement.

Developed and administered by Statistics Canada, the CCHS is a cross-sectional survey that uses a multistage sample allocation strategy to gather data concerning health determinants, use, and outcomes across Canada. Response rates range from 66% to 79%, and the sample is representative of 98% of the Canadian population aged 12 years or older living in private dwellings. Statistics Canada asks CCHS participants for consent to share their survey responses with provincial ministries of health and link responses to administrative databases. Detailed survey methodology is available elsewhere.<sup>26</sup>

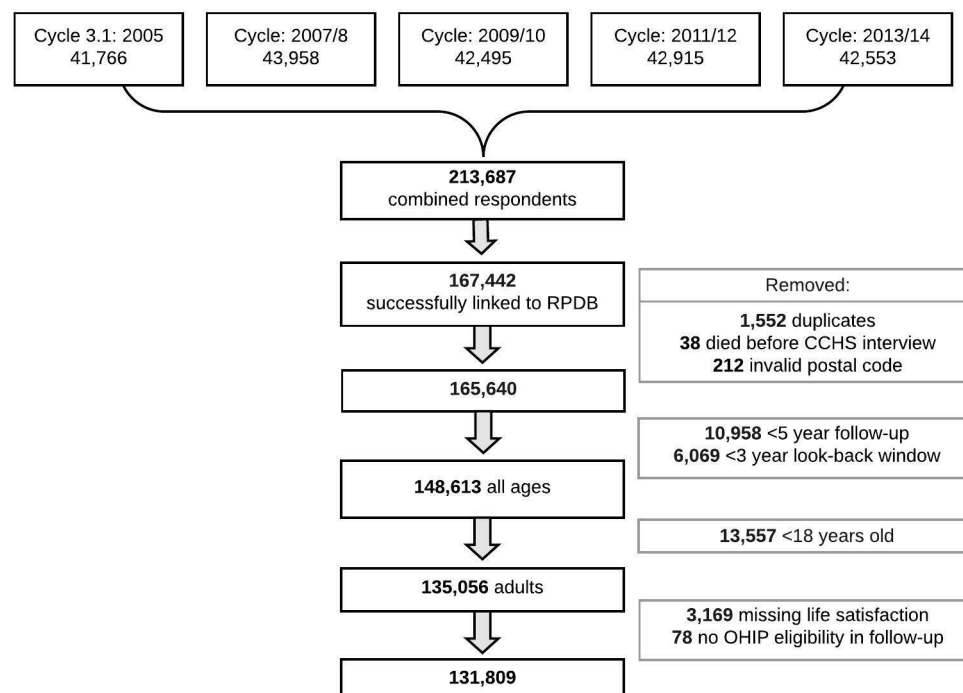
Respondents from Ontario who consented to share their survey data were linked to the Registered Persons Database (RPDB), which contains information on persons registered under the Ontario Health Insurance Plan (OHIP). Canada has a universal healthcare system controlled by each province or territory, and in Ontario all permanent residents are covered by OHIP, a single-payer insurance system where related healthcare encounters are recorded in health administrative databases. Using the CCHS interview as the index date, each participant had up to 5 years of follow-up and a 3-year lookback window in the administrative data. Mental healthcare utilisation was documented in two settings: hospital or ED visits, and outpatient visits.

Pooling the Ontario component of the five selected CCHS cycles (N=213 687), 167 442 participants were successfully linked to the RPDB. After removing duplicate records, those with invalid death dates or postal codes, those under 18 years of age, those missing life satisfaction measures, and those who were never eligible for OHIP during follow-up, 131 809 respondents were included (figure 1).

### Measures

#### Exposure

The focal exposure was a single-item measure of life satisfaction. All CCHS respondents were prompted with the question: *How satisfied are you with your life in general?* For cycles 2005 and 2007/2008, CCHS respondents were



**Figure 1** Flow chart of study population from pooled Ontario components of Statistics Canada's Canadian Community Health Surveys (CCHS, 2005–2014) linked to health administrative data through the Registered Persons Database (RPDB). OHIP, Ontario Health Insurance Plan.

directly given five response options: *very satisfied*, *satisfied*, *neither satisfied nor dissatisfied*, *dissatisfied*, or *very dissatisfied*. For cycles 2009/2010, 2011/2012, and 2013/2014, the response option was an 11-point scale (from 0 labelled *very dissatisfied* to 10 labelled *very satisfied*), which was then converted to the previous 5-point scale by Statistics Canada. For the purposes of this study, *very satisfied* and *satisfied* response levels were collapsed due to perceived similarity with respect to mental health service use outcomes. As mentioned, this measure has been shown to be reliable and valid, as well as moderately stable over time.<sup>27–29</sup> Compared with multi-item measures, this single-item measure has been shown to capture information very similarly to its multidimensional counterparts.<sup>30</sup>

## Outcome

The primary outcome was a count of the number of mental health visits in each of the two settings in the 5 years following CCHS interview date. Secondary analyses were conducted to examine binary measures of having ever had a mental health visit in the 5 years of follow-up. Hospital admissions were identified from the Canadian Institute for Health Information Discharge Abstract Database (2002–2019) and the Ontario Mental Health Reporting System (2005–2019). ED visits were obtained through the National Ambulatory Care Reporting System (2002–2019). Outpatient visits (defined as a visit to a primary care physician for any mental health condition or to a psychiatrist for any reason) were determined from the OHIP billings database between 2002 and 2019 (online supplemental table 1A).

## Covariates

Having had any prior mental health-related service use (in either of the two defined settings) was estimated from administrative data captured in the 3 years before the baseline interview for each participant. Age and sex were collected from the RPDB. Unfortunately, a measure for gender identity was not available. All other covariates were captured in the CCHS and included survey interview year, immigrant status, household income, smoking behaviour, alcohol consumption, physical activity level, and body mass index (BMI) (see online supplemental table 1B for added detail on CCHS-derived covariate categorizations). These variables were chosen as they have been shown to be important confounders in the relationship between life satisfaction and health outcomes in previous studies.<sup>19–21</sup>

## Statistical analyses

The distributions of mental healthcare service use and selected covariates were estimated according to the four defined categorizations of life satisfaction. Poisson regression models were used to estimate rate ratios of mental health visits in hospital/ED or outpatient settings with a person-days offset. In addition, we estimated risk ratios for the binary outcome of ever/never having had a subsequent visit in each setting using modified Poisson regression models. Estimates from four sequentially adjusted models were reported to transparently demonstrate the impact of the various adjustments: (1) unadjusted; (2) age-adjusted, sex-adjusted, and survey cycle-adjusted; (3) minimally adjusted; and (4) fully adjusted. Minimally



adjusted models included age, sex, survey cycle, immigrant status and household income quintile. Fully adjusted models additionally adjusted for having had any mental health visit in the 3 years prior to baseline interview, smoking behaviour, alcohol consumption, physical activity level and BMI. To examine whether the association between life satisfaction and counts of mental health visits varied by socioeconomic status, fully adjusted joint-effects models were conducted which included a 12-category joint-effects variable combining life satisfaction with a collapsed measure of household income (where *low income*=quintile 1, *mid income*=quintiles 2 and 3, and *high income*=quintiles 4 and 5).

Median values were imputed for all missing observations. Income had the highest proportion of missing observations at 6.3% and we conducted a separate sensitivity analysis coding missing observations as a separate category. To decrease concern for reverse causation and attempt to capture any baseline mental illness that may have influenced life satisfaction, we conducted two sensitivity analyses by estimating models wherein (1) participants with any documented mental health visit within their 3 year lookback window or 1 year following their interview day were excluded and (2) self-rated mental health was additionally adjusted for in the original fully adjusted models. Another sensitivity analysis excluded participants who lost OHIP eligibility for 1 consecutive year or more, and the last sensitivity analysis stratified by age group (18–59 years versus 60 years and over) to examine whether life stage substantially impacted point estimates.

Pooled survey weights were used to adjust for the complex survey design of the CCHS and provide provincially representative estimates. Bootstrap weights were applied using balanced repeated replication to estimate variance.<sup>31</sup> Statistical analyses were performed in 2020 using SAS Enterprise V.7.1 and Stata V.15.1.

## Patient and public involvement

No patients involved.

## RESULTS

Of the study cohort, 90.9% reported being very satisfied or satisfied with life, 5.8% reported being neither satisfied nor dissatisfied, 2.7% reported being dissatisfied and 0.6% reported being very dissatisfied. Compared with those most satisfied with life, those who reported being very dissatisfied with life were older (with a mean age of 51.8 years compared with 45.7), more likely to be in the lowest household income quintile (48.8% vs 15.3%), current smokers (41.7% vs 18.6%), non-drinkers (35.3% vs 19.9%), physically inactive (70.2% vs 46.8%), underweight or very obese, and have had a mental health visit in both the lookback and follow-up windows (table 1). The mean follow-up time (censored by death date) was 4.93 years.

Restricting to those that had at least one hospital/ED visit during follow-up (N=5507), the mean number of hospital/ED visits was 2.0 (95% CI 1.8 to 2.1). Stratifying this group by level of life satisfaction, the most satisfied group exhibited the lowest mean at 1.8 (95% CI 1.7 to 1.9), which increased per lower level of satisfaction to reach a mean of 3.4 (95% CI 1.9 to 4.9) hospital/ED visits among those most dissatisfied. Further restricting to those with repeat hospital/ED visits (ie, >1 visit) during follow-up (N=1757), the mean number of visits was 4.0 (95% CI 3.6 to 4.3) and estimates followed the same sequential trend when stratified by life satisfaction.

Among those that had at least one outpatient visit during follow-up (N=49 450), the mean number of outpatient visits was 7.5 (95% CI 7.2 to 7.8). The most satisfied group had the lowest mean at 6.8 (95% CI 6.5 to 7.1) and the dissatisfied group had the highest mean at 15.1 (95% CI 12.9 to 17.4) visits, followed by the very dissatisfied group at 12.8 (9.5 to 16.1) outpatient visits. Further restricting to those with repeat outpatient visits (N=31 311), the mean number of visits was 11.2 (95% CI 10.8 to 11.7). Again, the dissatisfied group had the highest mean number of visits at 19.0 (95% CI 16.1 to 21.9), following the same sequential trend when stratified by life satisfaction.

Examining the association with future mental health-related hospital/ED visits, a dose–response was observed for decreasing levels of life satisfaction. Individuals most dissatisfied with their lives exhibited the highest rate (table 2) and risk (table 3) ratios compared with those most satisfied with their lives. This dose–response was less pronounced in the outpatient setting. Regarding our fully adjusted count outcome models, compared with those most satisfied with life, those who were most dissatisfied exhibited a fully adjusted rate ratio of 3.71 (95% CI 2.14 to 6.45) for future hospital/ED visits (table 2). In the outpatient setting, the same comparison group exhibited a fully adjusted rate ratio of 1.83 (95% CI 1.42 to 2.37). Covariate adjustments attenuated the magnitude of the life satisfaction effect (ie, the unadjusted to fully adjusted rate ratios decreased from 9.48 to 3.71 in the hospital/ED setting and from 3.66 to 1.83 in the outpatient setting) (table 2).

Regarding our binary outcome models (ie, having had at least one visit during follow-up vs none), the dose–response relationship was again less pronounced in the outpatient setting (table 3). Still, those reporting the poorest level of life satisfaction exhibited the highest fully adjusted risk ratio of having at least one mental health-related visit in both the hospital/ED setting (risk ratio: 2.58, 95% CI 1.92 to 3.47), as well as the outpatient setting (risk ratio: 1.38, 95% CI 1.28 to 1.50), compared with those most satisfied with life (table 3).

Examining the joint effects of life satisfaction with household income, compared with the most satisfied, high-income group, the most dissatisfied and low-income group exhibited a fully adjusted rate ratio of 11.25 (95% CI 5.32 to 23.80) visits in the hospital/ED setting, which

**Table 1** Proportion (%) and mean\* characteristics for the study sample (N=131 809)

	Overall (N=131 809)	Life satisfaction			
		Satisfied (N=119 543)	Neither (N=7541)	Dissatisfied (N=3745)	Very dissatisfied (N=980)
Mean*					
Age	46.0	45.7	48.4	48.9	51.8
Total # hospital/ED visits	0.07	0.06	0.16	0.28	0.53
Total # outpatient visits	2.9	2.5	5.4	9.4	8.6
%*					
Sex					
Female	51.1	51.0	54.0	50.1	51.7
Male	48.9	49.0	46.0	49.3	48.3
Survey cycle					
2005/2006	16.2	16.2	16.0	17.1	13.4
2007/2009	22.3	22.1	23.8	24.1	21.0
2009/2010	23.0	23.0	23.4	22.4	20.3
2011/2012	23.3	23.5	21.3	22.9	25.1
2013/2014	15.1	15.1	15.5	13.6	20.2
Immigrant					
No	67.3	68.1	56.4	64.7	69.3
Yes	32.7	31.9	43.6	35.3	30.7
Household income					
Q1 (Lowest)	16.9	15.3	29.4	40.0	48.8
Q2	17.4	17.0	22.1	19.7	15.9
Q3	26.0	26.1	26.8	22.3	17.9
Q4	19.2	20.0	12.4	9.3	8.1
Q5 (Highest)	20.5	21.6	9.3	8.7	9.3
Smoking status					
Non-smoker	58.3	59.3	51.3	44.0	34.9
Former	21.9	22.1	19.4	20.9	21.5
Current	19.8	18.6	29.4	35.1	41.7
Alcohol consumption					
No past-year	20.6	19.9	27.0	28.1	35.3
Occasional	16.3	15.8	21.3	22.7	21.5
Regular	28.3	28.8	24.1	21.4	17.0
Regular & binge	34.8	35.5	27.6	27.8	26.2
Physical activity					
Active	26.4	27.4	17.1	15.9	15.9
Moderate	25.1	25.7	19.1	18.8	13.9
Inactive	48.5	46.8	63.8	65.3	70.2
Body mass index					
Underweight (<18.5)	2.6	2.4	3.8	3.8	6.5
Normal (18.5–24.9)	43.7	44.3	39.4	35.4	33.7
Overweight (25–29.9)	36.6	36.7	36.6	34.7	35.6
Mod obese (30–34.9)	12.1	11.9	12.9	15.3	13.0
Very obese (≥35)	5.0	4.7	7.3	10.8	11.3

Continued

**Table 1** Continued

	Overall (N=131 809)	Life satisfaction			
		Satisfied (N=119 543)	Neither (N=7541)	Dissatisfied (N=3745)	Very dissatisfied (N=980)
Hospital or emergency department visit (5-year follow-up)					
No	96.3	96.8	93.3	88.4	84.3
Yes	3.7	3.2	6.7	11.6	15.7
Outpatient visit (5-year follow-up)					
No	62.1	63.8	50.0	37.8	32.6
Yes	37.9	36.2	50.0	62.2	67.4
Any MH visit (3-year lookback)					
No	69.9	71.6	56.7	44.8	41.7
Yes	30.1	28.4	43.3	55.2	58.3

Source: pooled participants of the Canadian Community Health Survey surveyed from 2005 to 2014, linked to the Registered Persons Database, Canadian Institute for Health Information Discharge Abstract Database, the Ontario Mental Health Reporting System, the National Ambulatory Care Reporting System, and the Ontario Health Insurance Plan billings databases.

\*Survey sampling weights were used to produce population estimates.

**Table 2** Rate ratios\* and 95% CIs for counts of (1) hospitalisation or emergency department visits, or (2) outpatient visits for any mental health condition (N=131 809)

	Unadjusted	Age, sex, cycle- adjusted	Minimally adjusted†	Fully adjusted‡
<b>Hospital or emergency department visit</b>				
Very satisfied or satisfied	Ref.	Ref.	Ref.	Ref.
Neither	2.86 (1.92 to 4.27)	3.08 (2.05 to 4.62)	2.63 (1.77 to 3.90)	1.89 (1.30 to 2.73)
Dissatisfied	4.93 (3.91 to 6.21)	5.40 (4.29 to 6.80)	3.81 (2.96 to 4.91)	2.29 (1.77 to 2.96)
Very dissatisfied	9.48 (5.59 to 16.08)	10.98 (6.49 to 18.60)	7.00 (4.09 to 11.99)	3.71 (2.14 to 6.45)
<b>Outpatient visit</b>				
Very satisfied or satisfied	Ref.	Ref.	Ref.	Ref.
Neither	2.24 (1.97 to 2.56)	2.27 (1.99 to 2.59)	2.24 (1.96 to 2.56)	1.62 (1.42 to 1.84)
Dissatisfied	3.92 (3.33 to 4.62)	4.03 (3.42 to 4.75)	3.67 (3.11 to 4.33)	2.20 (1.88 to 2.58)
Very dissatisfied	3.66 (2.85 to 4.71)	3.84 (2.97 to 4.95)	3.31 (2.56 to 4.29)	1.83 (1.42 to 2.37)

Source: pooled participants of the Canadian Community Health Survey surveyed from 2005 to 2014, linked to the Registered Persons Database, Canadian Institute for Health Information Discharge Abstract Database, the Ontario Mental Health Reporting System, the National Ambulatory Care Reporting System, and the Ontario Health Insurance Plan billings databases.

\*Multivariable adjusted rate ratios from Poisson regressions (with balanced repeated replication to produce 95% CIs) for a count of the number of (1) hospitalisation or emergency department visits, or (2) outpatient visits for any mental health condition, per person-days of follow-up for up to 5 years following interview.

†Minimally adjusted model includes age, sex, survey cycle, immigrant status and household income.

‡Fully adjusted model includes age, sex, survey cycle, immigrant status, household income, having had any mental health visit in the 3 years prior to survey interview, smoking status, alcohol consumption, physical activity level and body mass index.

**Table 3** Risk ratios\* and 95% CIs for risks of (1) hospitalisation or emergency department visit, or (2) outpatient visit for any mental health condition (N=131 809)

	Unadjusted	Age, sex, cycle adjusted	Minimally adjusted†	Fully adjusted‡
<b>Hospital or emergency department visit</b>				
Very satisfied or satisfied	Ref.	Ref.	Ref.	Ref.
Neither	2.12 (1.78 to 2.53)	2.23 (1.87 to 2.65)	2.02 (1.71 to 2.40)	1.58 (1.33 to 1.87)
Dissatisfied	3.73 (3.18 to 4.38)	3.99 (3.40 to 4.68)	3.16 (2.69 to 3.71)	2.15 (1.84 to 2.52)
Very dissatisfied	5.12 (3.84 to 6.83)	5.77 (4.31 to 7.72)	4.22 (3.14 to 5.67)	2.58 (1.92 to 3.47)
<b>Outpatient visit</b>				
Very satisfied or satisfied	Ref.	Ref.	Ref.	Ref.
Neither	1.40 (1.34 to 1.46)	1.38 (1.33 to 1.44)	1.37 (1.32 to 1.43)	1.18 (1.13 to 1.23)
Dissatisfied	1.76 (1.68 to 1.84)	1.76 (1.68 to 1.84)	1.70 (1.62 to 1.78)	1.33 (1.27 to 1.38)
Very dissatisfied	1.93 (1.80 to 2.07)	1.93 (1.79 to 2.08)	1.84 (1.70 to 1.98)	1.38 (1.28 to 1.50)

Source: pooled participants of the Canadian Community Health Survey surveyed from 2005 to 2014, linked to the Registered Persons Database, Canadian Institute for Health Information Discharge Abstract Database, the Ontario Mental Health Reporting System, the National Ambulatory Care Reporting System, and the Ontario Health Insurance Plan billings databases.

\*Multivariable adjusted risk ratios from modified Poisson regressions (with balanced repeated replication to produce 95% CIs) comparing those who had at least one (1) hospitalisation or emergency department visit, or (2) outpatient visit for any mental health condition, per person-days of follow-up for up to 5 years following interview.

†Minimally adjusted model includes age, sex, survey cycle, immigrant status and household income.

‡Fully adjusted model includes age, sex, survey cycle, immigrant status, household income, having had any mental health visit in the 3 years prior to survey interview, smoking status, alcohol consumption, physical activity level and body mass index.

differed substantially from the fully adjusted model that did not take the joint effects of income into account. In the outpatient setting however, the most dissatisfied and high-income group exhibited the highest rate ratio of 3.33 (95% CI 1.65 to 6.70), exceeding that of the most dissatisfied and low-income group (rate ratios: 1.84, 95% CI 1.29 to 2.63) (table 4).

### Sensitivity analyses

In our count models that excluded participants with a history of a mental health visits or in the first year following their CCHS interview, the overall magnitude and direction of all rate ratios remained consistent. However, rate ratios for those reporting being neither satisfied nor dissatisfied became statistically insignificant in both settings, and due to small cell counts, there was considerable uncertainty around the estimate for those reporting being very dissatisfied in the hospital/ED setting (online supplemental table 2A). Next, taking the original fully adjusted models and additionally adjusting for self-rated mental health, the direction of point estimates remained consistent but were attenuated. Specifically, the rate ratios for those reporting being very dissatisfied became statistically insignificant in the outpatient setting (online supplemental table 2B). The rate ratios for those reporting being neither satisfied nor dissatisfied became statistically insignificant in the hospital/ED setting. In the sensitivity analysis excluding participants who lost OHIP eligibility for one consecutive year or more, the general magnitude and direction of all point estimates remained consistent (online supplemental table 3). Categorising missing income observations as a separate response

category resulted in no meaningful differences (online supplemental table 4). Lastly, the two age strata (18–59 years vs 60 years and over) exhibited similar point estimates and overlapping CIs (online supplemental table 5).

### DISCUSSION

The current study investigated the prospective association between life satisfaction and mental health-related visits in a provincially representative sample of Ontarian adults. We found that poorer life satisfaction is associated with increased mental health service use in both hospital/ED and outpatient settings. Following adjustment for sociodemographic measures, mental health-related visit history, and health behaviours, point estimates were attenuated but continued to indicate higher rate and risk ratios for lower levels of life satisfaction. The findings of our joint-effects models showed that among those most dissatisfied with life, low household income substantially increased the magnitude of the rate ratio for hospital/ED visits, which was not the case in the outpatient setting.

Multiple mechanisms could explain the association between life satisfaction and mental health-related service use seeing as a variety of broader life contexts and resources that influence health trajectories have been shown to be associated with life satisfaction. For instance, adults with higher life satisfaction are more likely to report positive psychological, behavioural, and social resources including higher optimism, social integration and wealth.<sup>22 23</sup> Regarding psychological resources for instance, Kim *et al* (2014) proposed that higher health service utilisation by those with lower life satisfaction may



**Table 4** Joint effects of life satisfaction and income\*† on counts of (1) hospitalisation or emergency department visits, or (2) outpatient visits for any mental health condition (N=131 809)

Hospital or emergency department visit	
Satisfied and high income	Ref.
Satisfied and mid income	1.37 (1.08 to 1.73)
Satisfied and low income	2.93 (2.23 to 3.84)
Neither and high income	0.96 (0.67 to 1.39)
Neither and mid income	2.73 (1.71 to 4.35)
Neither and low income	6.10 (3.20 to 11.61)
Dissatisfied and high income	2.74 (1.54 to 4.86)
Dissatisfied and mid income	4.39 (2.57 to 7.50)
Dissatisfied and low income	5.33 (3.81 to 7.45)
Very dissatisfied and high income	6.20 (3.62 to 10.64)
Very dissatisfied and mid income	3.04 (1.70 to 5.43)
Very dissatisfied and low income	11.25 (5.32 to 23.80)
Outpatient visit	
Satisfied and high income	Ref.
Satisfied and mid income	0.89 (0.79 to 1.00)
Satisfied and low income	1.13 (1.00 to 1.28)
Neither and high income	1.73 (1.31 to 2.27)
Neither and mid income	1.50 (1.23 to 1.83)
Neither and low income	1.64 (1.32 to 2.04)
Dissatisfied and high income	2.09 (1.55 to 2.82)
Dissatisfied and mid income	1.94 (1.45 to 2.60)
Dissatisfied and low income	2.51 (1.98 to 3.18)
Very dissatisfied and high income	3.33 (1.65 to 6.70)
Very dissatisfied and mid income	1.37 (1.03 to 1.83)
Very dissatisfied and low income	1.84 (1.29 to 2.63)

Source: pooled participants of the Canadian Community Health Survey surveyed from 2005 to 2014, linked to the Registered Persons Database, Canadian Institute for Health Information Discharge Abstract Database, the Ontario Mental Health Reporting System, the National Ambulatory Care Reporting System, and the Ontario Health Insurance Plan billings databases.

\*Fully adjusted rate ratios from Poisson regressions (with balanced repeated replication to produce 95% CIs) for a count of the number of (1) hospitalisation or emergency department visits, or (2) outpatient visits for any mental health condition, per person-days of follow-up for up to 5 years following interview.

†Fully adjusted model includes age, sex, survey cycle, immigrant status, household income, having had any mental health visit in the 3 years prior to survey interview, smoking status, alcohol consumption, physical activity level and body mass index.

be additionally explained not only by objectively poorer health, but also by excessive worrying about health status, resulting in overtreatment.<sup>23</sup> In this study, more satisfied individuals indeed reported higher household income levels and exhibited higher instances of health promoting behaviours.

Our findings also showed that low household income exacerbates the observed association between life satisfaction and mental health-related service use in the hospital/ED setting. The most dissatisfied low-income group exhibited a substantially higher rate ratio of hospital/ED visits compared with their higher income counterparts. Yet in the outpatient setting, compared with their most dissatisfied counterparts, the low-income group exhibited a lower rate ratio of mental health-related visits. Given that emergency healthcare settings are less porous to affordability-related barriers, this finding points to socioeconomic-related barriers to accessing long-term mental healthcare. Indeed, studies have shown that affordability issues (as well as medication, stigma, and trust-related barriers) are associated with a higher likelihood of experiencing unmet health needs and a lower likelihood of seeking help.<sup>32 33</sup> In this way, our joint-effects models demonstrated that improving access to long-term mental health-related care is particularly pertinent for the most dissatisfied and lowest-income individuals.

As established, however, an overburdened health system is not a well-equipped support to sufficiently meet population mental health needs in a timely manner. Identifying modifiable positive subjective well-being factors associated with improved mental health (and reduced service use) lays precedence for the development of sustainable approaches to promoting mental well-being. Positive psychology interventions (which encapsulate intentional activities aimed at fostering positive emotions, cognitions and behaviours) provide one potential approach to modifying life satisfaction and generally maintaining or improving psychological well-being. Two meta-analyses explored the effectiveness of positive psychology interventions and found that they can increase levels of subjective well-being in both younger and older adult populations.<sup>34–36</sup> However, the applicability of larger scale positive psychology interventions does require further study.

### Limitations

Our study has a number of limitations that should be considered when interpreting the findings. It is possible that the associations observed reflect the negative influence of baseline poor mental health on life satisfaction. In fact, other studies have found that mental illness and negative affect are key determinants of individual perceptions of life satisfaction.<sup>22 37</sup> However, the cohort study design (which is a key advantage over previous studies) and the results of our sensitivity analyses (which considered previous mental health-related visits with a 1-year wash-out period, and considered an adjustment for self-rated mental health) showed that prospective associations remained. Still, we could not entirely account for negative affect uncaptured by the mental health service system or self-rated mental health, which could confound reported life satisfaction and subsequent service use. Another limitation to consider is that life satisfaction was only measured once at baseline, meaning



any changes that could have influenced the outcome were not captured. Similarly, health behaviours such as smoking and drinking could have changed over the follow-up period, and this potential misclassification could affect the confounding control of our model's health behaviours, which we note were important. We were also unable to distinguish between different types of mental health visits, given that billing codes for conditions are not validated for any mental health conditions other than schizophrenia.<sup>38 39</sup> The outcomes examined represent health service use for mental health-related issues and should not be interpreted as a diagnosis for a particular mental health condition. Lastly, our findings are not directly applicable to sub-populations excluded from the CCHS sampling frame. Unrepresented populations include Indigenous populations living on reserve, individuals in the military, and those living in institutions.

## Conclusion

Conceptualising positive mental well-being and health deficits on a dual continuum, our study contributes to a growing body of evidence that connects positive well-being with meaningful health system outcomes. The findings of this study emphasise the value in identifying positive well-being factors associated with subsequent mental health-related service use, strengthening an evidence base that supports the development of innovative and sustainable mental health interventions.

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plan and underlying analytic code are available from the authors upon request, understanding that the computer programs may rely upon coding templates or macros that are unique to ICES and are therefore either inaccessible or may require modification.

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**Supplementary Table 1A:** Source databases and corresponding ICD-9 or -10 codes defining mental health visits in each respective study setting.

<b>Hospitalization/emergency department visit for any mental health condition</b>	
ICD-9 codes (OMHRS - DSM IV)	Any OMHRS (including missing, excluding 290.x, 294.x in primary diagnosis) Exclude if Dxcode missing and provisional=2
ICD-10 codes (NACRS/DAD)	DX10CODE1= F09-F99 DX10CODE2-25 = X60-X84, Y10-Y19, Y28 when DX10CODE1 ne F06-F99
<b>Outpatient (primary care/psychiatrist/pediatrician) visit for any mental health condition</b>	
ICD-9 codes (OHIP)	291-293, 295-319  Psychiatrist [SPEC=19] and outpatient (LOCATION: O, L, H) and non-lab service [substr(FEECODE,1,1) ne 'G'], <i>OR</i>  FP/GP [SPEC=00] and MHA diagnosis code [DXCODE] and outpatient (LOCATION: O, L, H) and non-lab service [substr(FEECODE,1,1) ne 'G'], <i>OR</i>  Paediatrician [SPEC=26] and undefined location (LOCATION =U) and MHA diagnosis code [DXCODE] and fee code (FEECODE=K122 or K123 or K704). Paediatrician fee code description: K122 Developmental and/or behavioural care - individual developmental and/or behavioural care K123 Developmental and/or behavioural care - family developmental and/or behavioural care K704 Paediatric out-patient case conference

Abbreviations: ICD International Classification of Disease; DSM Diagnostic and Statistical Manual of Mental Disorders; OMHRS Ontario Mental Health Reporting System; NACRS National Ambulatory Care Reporting System; DAD Distract Abstract Database; OHIP Ontario Health Insurance Plan; FP Family physician; GP General practitioner; Dxcode Diagnosis code

**Supplementary Table 1B:** Detailed breakdown of CCHS-derived covariate categorizations used in regression models.

Focal Exposure	Source and classification details
Life satisfaction	<b>Source:</b> CCHS <b>Question:</b> Using a scale of 0 to 10, where 0 means "Very dissatisfied" and 10 means "Very satisfied", how do you feel about your life as a whole right now? (Response options: 0-10) <b>Analytic classification:</b> (1) <i>Very satisfied/satisfied</i> (6,7,8/9,10) (2) <i>Neither</i> (5) (3) <i>Dissatisfied</i> (2,3,4) (4) <i>Very dissatisfied</i> (0,1)
<b>Covariates</b>	
Age	<b>Source:</b> Registered Persons Database (contains information on persons registered under the Ontario Health Insurance Plan (OHIP)) <b>Analytic classification:</b> <i>continuous, 18 and over</i>
Sex	<b>Source:</b> Registered Persons Database <b>Analytic classification:</b> (1) <i>Male</i> (2) <i>Female</i>
Immigrant status	<b>Source:</b> CCHS <b>Question:</b> Were you born a Canadian citizen? (Response options: Yes/No) <b>Analytic classification:</b> (1) <i>Immigrant</i> (No) (2) <i>Canadian-born</i> (Yes)
Household income	<b>Source:</b> CCHS <b>Question:</b> Thinking about the total income for all household members, from which of the following sources did your household receive any income in the past 12 months? <b>Analytic classification:</b> Income deciles are determined by Statistics Canada, which are grouped by the distribution of an adjusted ratio of their total reported household income to the low income cut-off corresponding to their household and community size. It provides, for each respondent, a relative measure of their household income to the household incomes of all other respondent. We collapsed 10 categories into 5. (1) <i>Lowest income quintile</i> (quintile 1, 2) (2) <i>Quintile 3, 4</i> (3) <i>Quintile 5, 6</i> (4) <i>Quintile 7, 8</i> (5) <i>Highest income quintile</i> (quintile 9, 10).
Smoking status	<b>Source:</b> CCHS <b>Question:</b> Several variables examining the number of cigarettes smoked per day currently and formerly, a binary measure of having ever smoked 100 or more cigarettes <b>Analytic classification:</b> (1) <i>Current smoker:</i> smokes daily (smoked at least 100 lifetime cigarettes) (2) <i>Former smoker:</i> smoked regularly or occasionally in the past and no longer does (including smoked at least 100 lifetime cigarettes) (3) <i>Never smoker:</i> has indicated no current or former smoking habits, or has smoked less than 100 lifetime cigarettes



Alcohol consumption	<p><b>Source:</b> CCHS</p> <p><b>Question:</b> Several variables examining frequency and amount of alcohol consumption</p> <p><b>Analytic classification:</b></p> <ul style="list-style-type: none"> <li>(1) <i>Regular and binge drinker</i>: has consumed alcohol in the past year with a frequency ranging from once a month to daily, and has engaged in binge drinking (defined as 4 drinks for females and 5 drinks for males in one sitting) at any frequency</li> <li>(2) <i>Regular drinker</i>: has consumed alcohol in the past year with a frequency ranging from once a month to daily, and has never engaged in binge drinking</li> <li>(3) <i>Occasional</i>: has consumed alcohol in the past year with a frequency of less than once per month</li> <li>(4) <i>Non-drinker</i>: no alcohol consumption in the past year</li> </ul>
Physical activity level	<p><b>Source:</b> CCHS</p> <p><b>Question:</b> This variable is based on the participants' leisure time total daily Energy Expenditure values (kcal/kg/day). <i>Energy Expenditure for each activity</i> = <math>(N \times D \times \text{METvalue}) / 365</math>  N=number of times a respondent engaged in an activity over a 12 month period  D= average duration in hours of the activity  MET value=the energy cost of the activity expressed as kilocalories expended per kilogram of body weight per hour of activity (kcal/kg per hour)/365 (to convert yearly data into daily data); the low-intensity MET value was used for calculations.</p> <p><b>Analytic classification:</b></p> <ul style="list-style-type: none"> <li>(1) <i>Active</i> (<math>EE \geq 3</math>)</li> <li>(2) <i>Moderately active</i> (<math>1.5 \leq EE &lt; 3</math>)</li> <li>(3) <i>Inactive</i> (<math>0 \leq EE &lt; 1.5</math>)</li> </ul>
Body mass index (BMI)	<p><b>Source:</b> CCHS</p> <p><b>Question:</b> Self-reported height and weight</p> <p><b>Analytic classification:</b> International standard of BMI classification (kg/m<sup>2</sup>) for adults aged 18 and over</p> <ul style="list-style-type: none"> <li>(1) <i>Underweight</i> (&lt;18.5)</li> <li>(2) <i>Normal</i> (18.5-24.9)</li> <li>(3) <i>Overweight</i> (25-29.9)</li> <li>(4) <i>Moderately obese</i> (30-34.9)</li> <li>(5) <i>Very obese</i> (<math>\geq 35</math>)</li> </ul>

**Supplementary Table 2A:** Fully adjusted rate ratios<sup>a,b</sup> and 95% confidence intervals for counts of (i) hospitalization or emergency department visits, or (ii) outpatient visits for any mental health condition, excluding participants had any mental health visit three years prior to or 1 year following interview (N=84,528)

<b>Hospital or emergency department visit</b>	
<i>Very satisfied or satisfied</i>	Ref.
<i>Neither</i>	1.51 (0.74, 3.08)
<i>Dissatisfied</i>	2.23 (1.27, 3.89)
<i>Very dissatisfied</i>	3.97 (0.40, 40.54)
<b>Outpatient visit</b>	
<i>Very satisfied or satisfied</i>	Ref.
<i>Neither</i>	1.19 (0.97, 1.46)
<i>Dissatisfied</i>	1.72 (1.06, 2.79)
<i>Very dissatisfied</i>	2.15 (1.21, 3.83)

**Supplementary Table 2B:** Fully adjusted rate ratios<sup>a,b</sup> and 95% confidence intervals for counts of (i) hospitalization or emergency department visits, or (ii) outpatient visits for any mental health condition, additionally adjusting for self-rated mental health (N=131,809)

<b>Hospital or emergency department visit</b>	
<i>Very satisfied or satisfied</i>	Ref.
<i>Neither</i>	1.45 (0.93, 2.24)
<i>Dissatisfied</i>	1.46 (1.10, 1.95)
<i>Very dissatisfied</i>	2.23 (1.28, 3.86)
<b>Outpatient visit</b>	
<i>Very satisfied or satisfied</i>	Ref.
<i>Neither</i>	1.16 (1.02, 1.32)
<i>Dissatisfied</i>	1.31 (1.11, 1.55)
<i>Very dissatisfied</i>	1.04 (0.80, 1.34)

Source: pooled participants of the Canadian Community Health Survey surveyed from 2005 to 2014, linked to the Registered Persons Database, Canadian Institute for Health Information Discharge Abstract Database, the Ontario Mental Health Reporting System, the National Ambulatory Care Reporting System, and the Ontario Health Insurance Plan billings databases.

<sup>a</sup> Multivariable adjusted rate ratios from Poisson regressions (with balanced repeated replication to produce 95% confidence intervals) for a count of the number of (i) hospitalization or emergency department visits, or (ii) outpatient visits for any mental health condition, per person-days of follow-up, within 5 years following Canadian Community Health Survey interview.

<sup>b</sup> Fully adjusted model includes self-rated mental health, age, sex, survey cycle, immigrant status, household income, having had any mental health visit in the three years prior to survey interview, smoking status, alcohol consumption, physical activity level, and body mass index with an additional adjustment for self-rated mental health.

**Supplementary Table 3:** Fully adjusted rate ratios<sup>a,b</sup> and 95% confidence intervals for counts of (i) hospitalization or emergency department visits, or (ii) outpatient visits for any mental health condition, excluding participants who lost OHIP eligibility for more than 1 consecutive year (N=125,304).

<b>Hospital or emergency department visit</b>	
<i>Very satisfied or satisfied</i>	Ref.
<i>Neither</i>	1.90 (1.30, 2.78)
<i>Dissatisfied</i>	2.23 (1.70, 2.92)
<i>Very dissatisfied</i>	3.82 (2.16, 6.73)
<b>Outpatient visit</b>	
<i>Very satisfied or satisfied</i>	Ref.
<i>Neither</i>	1.64 (1.44, 1.86)
<i>Dissatisfied</i>	2.22 (1.89, 2.61)
<i>Very dissatisfied</i>	1.85 (1.42, 2.41)

Source: pooled participants of the Canadian Community Health Survey surveyed from 2005 to 2014, linked to the Registered Persons Database, Canadian Institute for Health Information Discharge Abstract Database, the Ontario Mental Health Reporting System, the National Ambulatory Care Reporting System, and the Ontario Health Insurance Plan billings databases.

<sup>a</sup> Multivariable adjusted rate ratios from Poisson regressions (with balanced repeated replication to produce 95% confidence intervals) for a count of the number of (i) hospitalization or emergency department visits, or (ii) outpatient visits for any mental health condition, per person-days of follow-up, within 5 years following Canadian Community Health Survey interview.

<sup>b</sup> Fully adjusted model includes age, sex, survey cycle, immigrant status, household income, having had any mental health visit In the three years prior to survey interview, smoking status, alcohol consumption, physical activity level, and body mass index.

**Supplementary Table 4:** Fully adjusted rate ratios<sup>a,b</sup> and 95% confidence intervals for counts of (i) hospitalization or emergency department visits, or (ii) outpatient visits for any mental health condition, with missing income observations categorized as a separate category (N=131,809).

<b>Hospital or emergency department visit</b>	
<i>Very satisfied or satisfied</i>	Ref.
<i>Neither</i>	1.87 (1.29, 2.72)
<i>Dissatisfied</i>	2.28 (1.77, 2.94)
<i>Very dissatisfied</i>	3.67 (2.12, 6.38)
<b>Outpatient visit</b>	
<i>Very satisfied or satisfied</i>	Ref.
<i>Neither</i>	1.61 (1.42, 1.83)
<i>Dissatisfied</i>	2.19 (1.87, 2.56)
<i>Very dissatisfied</i>	1.82 (1.41, 2.35)

Source: pooled participants of the Canadian Community Health Survey surveyed from 2005 to 2014, linked to the Registered Persons Database, Canadian Institute for Health Information Discharge Abstract Database, the Ontario Mental Health Reporting System, the National Ambulatory Care Reporting System, and the Ontario Health Insurance Plan billings databases.

<sup>a</sup> Multivariable adjusted rate ratios from Poisson regressions (with balanced repeated replication to produce 95% confidence intervals) for a count of the number of (i) hospitalization or emergency department visits, or (ii) outpatient visits for any mental health condition, per person-days of follow-up, within 5 years following Canadian Community Health Survey interview.

<sup>b</sup> Fully adjusted model includes age, sex, survey cycle, immigrant status, household income, having had any mental health visit In the three years prior to survey interview, smoking status, alcohol consumption, physical activity level, and body mass index.



**Supplementary Table 5:** Fully adjusted rate ratios<sup>a,b</sup> and 95% confidence intervals for counts of (i) hospitalization or emergency department visits, or (ii) outpatient visits for any mental health condition, stratified by age group (18-59 years/60 years and over; N=131,809).

<b>Hospital or emergency department visit</b>	<b>18-59 years (N=83,851)</b>	<b>60 years and over (N=47,958)</b>
<i>Very satisfied or satisfied</i>	Ref.	Ref.
<i>Neither</i>	1.96 (1.33, 2.94)	1.31 (0.95, 1.80)
<i>Dissatisfied</i>	2.29 (1.72, 3.04)	2.53 (1.72, 3.72)
<i>Very dissatisfied</i>	3.69 (1.98, 6.89)	3.81 (1.86, 7.83)
<b>Outpatient visit</b>		
<i>Very satisfied or satisfied</i>	Ref.	Ref.
<i>Neither</i>	1.68 (1.45, 1.96)	1.33 (1.08, 1.65)
<i>Dissatisfied</i>	2.26 (1.91, 2.69)	1.44 (1.17, 1.77)
<i>Very dissatisfied</i>	1.77 (1.30, 2.41)	1.65 (1.25, 2.19)

Source: pooled participants of the Canadian Community Health Survey surveyed from 2005 to 2014, linked to the Registered Persons Database, Canadian Institute for Health Information Discharge Abstract Database, the Ontario Mental Health Reporting System, the National Ambulatory Care Reporting System, and the Ontario Health Insurance Plan billings databases.

<sup>a</sup> Multivariable adjusted rate ratios from Poisson regressions (with balanced repeated replication to produce 95% confidence intervals) for a count of the number of (i) hospitalization or emergency department visits, or (ii) outpatient visits for any mental health condition, per person-days of follow-up, within 5 years following Canadian Community Health Survey interview.

<sup>b</sup> Fully adjusted model includes age, sex, survey cycle, immigrant status, household income, having had any mental health visit in the three years prior to survey interview, smoking status, alcohol consumption, physical activity level, and body mass index.