

## **Life satisfaction and mental health problems (18 to 35 years)**

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### **Conflict of interest**

The Authors declare no conflict of interest.

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## **Abstract**

**Background.** Previous research has found that mental health is strongly associated with life satisfaction. In this study we examine associations between mental health problems and life satisfaction in a birth cohort studied from 18 to 35 years.

**Methods.** Data were gathered during the Christchurch Health and Development Study (CHDS) which is a longitudinal study of a birth cohort of 1265 children, born in Christchurch, New Zealand, in 1977. Assessments of mental health and life satisfaction were obtained at ages 18, 21, 25, 30 and 35 years.

**Results.** Significant associations ( $p < 0.01$ ) were found between life satisfaction and: major depression; generalised anxiety; suicidality; alcohol dependence; and substance dependence. After adjustment for non-observed sources of confounding by fixed effects and time-dynamic factors, statistically significant associations ( $p < 0.05$ ) remained between life satisfaction and major depression; generalised anxiety; suicidality; and substance dependence. Overall, those reporting three or more mental health disorders had mean life satisfaction scores that were 0.60 standard deviations lower than those who reported no mental health problems.

**Conclusions.** After adjustment for confounding, robust associations were found between mental health problems and life satisfaction.

**Key words:** Mental health; Life satisfaction; Fixed-effects regression; Longitudinal

## Introduction

In recent years, there has been growing research and interest in the area of psychological well-being and life satisfaction (Deiner *et al.*, 1999; Frey *et al.*, 2004; Ryan and Deci, 2001). This research has been broadly motivated by the emerging field of positive psychology (Deiner *et al.*, 1999; Vaillant, 2000). In general, the aims of positive psychology are to examine subjective well-being through valued experiences (e.g., satisfaction, hope or altruism) (Seligman and Csikszentmihalyi, 2000).

A growing number of studies have examined the various correlates and predictors of life satisfaction in adult populations. These predictors have spanned the areas of: socioeconomic factors (Bellis *et al.*, 2012; DeNeve and Cooper, 1998; Diener, 2000), partner relationships and social connectedness (A. and Frey, 2006; Dolan *et al.*, 2008; Gardner and Oswald, 2006; Lucas, 2005; Lucas and Clark, 2006; Lucas *et al.*, 2003; Mellor *et al.*, 2008), unemployment (Dolan *et al.*, 2008; van Praag *et al.*, 2001; Winkelmann and Winkelmann, 1998), income and finances (DeNeve and Cooper, 1998; van Praag *et al.*, 2001; Winkelmann and Winkelmann, 1998), physical health (Bellis *et al.*, 2012; Dolan *et al.*, 2008; Oswald and Powdthavee, 2006; Ryan and Deci, 2001; van Praag *et al.*, 2001), and personality traits.(DeNeve and Cooper, 1998; Ozer and Benet-Martinez, 2006; Steel *et al.*, 2008). In general, this research has found that levels of life satisfaction are higher among those who have: higher socioeconomic status; a partner relationship; social resources and support; employment; financial resources; good health, and certain personality characteristics (e.g., low neuroticism, high extroversion). However, these effects tend to explain only relatively modest amounts of variance in overall life satisfaction measures (Bartels and Boomsma, 2009; Deiner *et al.*, 1999; DeNeve and Cooper, 1998).

Mental health problems form an important class of potential predictors of life satisfaction since it may be reasoned that mental health may play an important role in shaping an individual's life satisfaction and well-being. This issue has been examined by a number of studies which have generally found the presence of mental health problems to be associated with reduced life satisfaction (Bellis *et al.*, 2012; Beutel *et al.*, 2010; Bray and Gunnell, 2006; Desousa *et al.*, 2008; Flèche and Layard, 2013; Koivumaa-Honkanen *et al.*, 2011; Layard *et al.*, 2013; Murphy *et al.*, 2005; Sun and Shek, 2012). For example, Fleche and Layard (2013) examined the association between mental health and life satisfaction in three societies (Great Britain, Germany and Australia) using fixed-effects regression methods. This analysis showed the presence of substantial associations between mental health problems and life satisfaction following control for non-observed fixed sources of confounding. In a related study, Layard et al. (2013) concluded that mental health was the single biggest predictor of life satisfaction.

While there has been growing research linking mental health to life satisfaction, research in this area is subject to a number of limitations. First, the ways in which life satisfaction has been assessed have varied between studies; with some studies using responses based on a single-item measure (Bellis *et al.*, 2012; Bray and Gunnell, 2006; Desousa *et al.*, 2008; Flèche and Layard, 2013; Layard *et al.*, 2013), whereas others have used multiple-item assessments (Beutel *et al.*, 2010; Koivumaa-Honkanen *et al.*, 2011; Murphy *et al.*, 2005; Sun and Shek, 2012). Second, consideration has not always been given to a wide range of psychiatric diagnoses spanning psychological condition, mental health problems, substance use and suicidality (Flèche and Layard, 2013; Layard *et al.*, 2013). Third, many studies have been cross-sectional and only examine the associations between mental health problems and life satisfaction at one point in time (Bellis *et al.*, 2012; Beutel *et al.*, 2010; Bray and Gunnell, 2006; Desousa *et al.*, 2008; Murphy *et al.*, 2005). Finally, studies have varied in the extent to which they control for potentially confounding factors; some studies have controlled for observed covariates (Bellis *et al.*, 2012; Beutel *et al.*, 2010; Desousa *et al.*, 2008; Layard *et al.*, 2013; Murphy *et al.*, 2005), whereas others have used fixed-effects regression methods to control for non-observed sources of confounding (Flèche and Layard, 2013).

Against this background, this paper reports on a study of the associations between mental health problems and life satisfaction in a birth cohort studied from 18 to 35 years. The aims of this research were:

1. To examine the associations between mental health problems and life satisfaction assessed using a multi-item inventory, over the developmental period from 18 to 35 years.
2. To adjust any associations between mental health problems and life satisfaction for observed and non-observed sources of confounding through the use of fixed-effects regression methods.

More generally, the aims of the study were to provide further clarification of the roles of mental health problems on life satisfaction over the life-course.

## **Method**

### ***Participants***

Participants were members of the Christchurch Health and Development Study (CHDS) birth cohort. The CHDS is a longitudinal study of 1265 children born in the Christchurch (New Zealand) urban region over a 4-month period during 1977. This cohort has been studied at regular intervals from birth until age 35 (Fergusson and Horwood, 2001, 2013). All phases of the study have been subject to ethical approval by the Canterbury

Regional Health and Disabilities Ethics Committee. All data were collected with the signed consent of the study participants.

## ***Outcome***

### *Life satisfaction*

At ages 18, 21, 25, 30 and 35 information about life satisfaction was collected as part of the follow-up interviews using a custom-written questionnaire which required participants to rate their current satisfaction with each of eleven areas of their life: work; leisure time; partner relationships; relationships with people of the same sex; relationships with people of the opposite sex; social life; money; independence; daily interactions with others; the future; and life as a whole. Participants responded on a four-point scale where '1' was very unhappy; '2' was unhappy; '3' was happy; and '4' was very happy. These items were used in a series of confirmatory factor analyses aimed at assessing the dimensionality of the life satisfaction measures. This analysis showed that when due allowance was made for correlated specificity; the test items fitted a single factor model. Details of the model fitting are provided in Data Supplement 1. To represent overall life satisfaction assessments at ages 18, 21, 25, 30 and 35, ratings from the 11 items were summed to provide life satisfaction scores. The resulting scales were of moderate to high internal consistency (Cronbach's alpha ranged from  $\alpha=0.84$  to  $\alpha=0.89$ ).

### ***Mental health problems***

At ages 18, 21, 25, 30 and 35 years, participants were questioned about their experience of the following mental health problems during the 12 months prior to each assessment.

#### *Major depression and anxiety disorder*

Cohort members were questioned about symptoms of major depression and a range of anxiety disorders (generalised anxiety disorder, panic disorder, agoraphobia, social phobia, specific phobia) in the previous 12 months. Questioning was based on the relevant components of the Composite International Diagnostic Interview (CIDI: World Health Organization, 1993) and DSM-IV criteria (American Psychiatric Association, 1994).

Using this information, dichotomous measures were constructed to reflect whether the participant met DSM-IV diagnostic criteria for a major depressive episode and any anxiety disorder in each of the intervals: 17-18, 20-21, 24-25, 29-30 and 34-35 years.

#### *Suicidal ideation/attempt*

Participants were questioned using custom-written survey items about the occurrence of suicidal thoughts (contemplating, considering or planning suicide) and/or attempts in the 12 months prior to each assessment. Using this information, participants were classified on dichotomous measures reflecting whether they met diagnostic criteria for suicidal ideation/attempt in each of the intervals: 17-18, 20-21, 24-25, 29-30 and 34-35 years.

#### *Alcohol/Illicit substance dependence*

At the 18, 21, 25, 30 and 35 year assessments, cohort members were questioned about problems associated with their use of alcohol or illicit drugs in the previous 12 months, using CIDI items to assess DSM-IV symptom criteria for dependence. Using this information, participants were classified on dichotomous measures reflecting whether they met diagnostic criteria for alcohol dependence or illicit substance dependence in each of the intervals: 17-18, 20-21, 24-25, 29-30 and 34-35 years.

#### *Any mental health problem*

To summarize the overall trends in mental health scores, a dichotomous measure of any of the above mental health problems occurring over the period from 18 to 35 years was constructed.

#### *Covariates*

To take into account potential confounding between mental health problems and life satisfaction, a number of time-dynamic factors assessed at ages 18, 21, 25, 30 and 35 were chosen from the CHDS database. These time-dynamic covariates were statistically significantly associated with life satisfaction. The covariates are described below.

#### *Cohabiting partner relationship*

Participants were asked if they were currently involved in a cohabiting partnership. Overall, 5.0% of participants had a cohabiting partner at age 18; 22.4% at age 21; 47.6% at age 25; 66.0% at age 30; and 74.7% at age 35.

#### *Interpersonal problems*

Participants were asked whether or not they had experienced any serious interpersonal problems between themselves and their partner, parents, siblings or friends in the 12 months preceding the interview. These measures were summed and dichotomized to represent those respondents who had experienced relationship problems and those who had not. Overall, 46.8% of respondents reported a relationship problem in the previous 12 months at age 18; 37.3% at age 21; 21.2% at age 25; 13.0% at age 30; and 12.5% at age 35.

#### *Financial problems*

Participants were asked if they had experienced any serious financial problems in the 12 months preceding the interview. Overall, 5.7% had experienced serious financial problems in the previous 12 months at age 18; 15.3% at age 21; 10.7% at age 25; 8.1% at age 30; and 3.4% at age 35.

#### *Weekly income (\$NZ)*

Participants were asked to report their usual weekly income from paid employment, before tax and other deductions. Income reported in currencies other than New Zealand dollars were converted into New Zealand dollars using Purchasing Power Parities (OECD, 2007), scaled to 2012 New Zealand dollars at age 35. Weekly income had a mean (standard deviation) of \$133.91 (\$170.00) at age 18; \$276.41 (\$263.89) at age 21; \$564.91 (\$416.21) at age 25; \$740.20 (\$573.21) at age 30; and \$777.10 (\$616.11) at age 35.

### ***Statistical methods***

#### *Associations between mental health disorders and life satisfaction (Table 1 and Data Supplement 2)*

The first phase of the analysis examined the associations between presence of mental health problems (major depression, generalised anxiety, suicidal ideation/attempt, alcohol dependence and illicit substance dependence) and life satisfaction at ages 18, 21, 25, 30 and 35. In each case, the analysis pooled the repeated observations at ages 18, 21, 25, 30 and 35 to obtain an estimate of the population-averaged associations between presence of mental health problems and life satisfaction. For ease of interpretation, the pooled life satisfaction data were standardized to have a mean of 100 and standard deviation of 10. Linkages between presence of mental health problems and life satisfaction were analysed using a general estimating equation (GEE) modelling approach (Zeger and Liang, 1986). These models were of the form:

$$Y_{it} = B_0 + B_1X_{it} + B_2AGE_{it} + U_{it} \quad (\text{Equation 1})$$

where  $Y_{it}$  was life satisfaction for the  $i$ th participant in time period  $t$  ( $t=18, 21, 25, 30, \text{ and } 35$ ),  $X_{it}$  was the measure of mental health for each individual  $i$  at time  $t$ ,  $AGE_{it}$  was the age of individual  $i$  at the time period  $t$ , and  $U_{it}$  was the disturbance term. In these models, the coefficient  $B_1$  provides an estimate of the change in life satisfaction with age. The models assumed an unstructured correlation matrix of life satisfaction scores for each individual over time. These models were extended to include multiplicative tests of age x mental health problems and gender x mental health problems interactions. Table 1 shows the population-averaged pooled results between each mental health problem and mean life satisfaction score. Data Supplement 2 shows the information used to compute these pooled estimates.

### *Adjustment for confounding (Table 2)*

The availability of repeated measures data makes it possible to take into account non-observed fixed factors by using repeated measures conditional fixed-effects regression models. An account of the use of fixed-effects regression methods can be found in Hamerle and Ronning (1995) and Allison (2009). The models fitted were of the form:

$$Y_{it} = B_0 + B_1X_{it} + B_2AGE_{it} + \mu_i + U_{it} \quad (\text{Equation 2})$$

where  $\mu_i$  were a set of individual specific terms that were assumed to reflect the effects of all non-observed fixed sources of variation in the outcome  $Y_i$ . The fixed-effects  $\mu_i$  are assumed to be constant over time and to be correlated with other predictors in the model.

The analyses in Table 2 were extended to include a series of observed time-dynamic covariates. These models were of the form:

$$Y_{it} = B_0 + B_1X_{it} + B_2AGE_{it} + \sum B_j Z_{ijt} + \mu_i + U_{it} \quad (\text{Equation 3})$$

where  $Z_{ijt}$  were the set of observed time-dynamic covariates. The results of these analyses are summarised in Table 3 and Data Supplement 3.

To examine the joint effects of mental health problems on life satisfaction, two further analyses were undertaken. The first analysis extended the model in Equation 3 to include all mental health problems. The analysis in Table 3 was also extended to examine the association between the number of mental health problems at any given time and mean life satisfaction, taking into account fixed-effects and time-dynamic covariates (see Data Supplement 5). This model was used to estimate the variance explained by the number of mental health problems before and after adjustment for confounding.

The population-averaged GEE regression models were conducted using SAS 9.3 for Windows and the fixed-effects regression models were conducted using Stata 12 for Windows.

### ***Sample size and sample bias***

The analyses reported in this paper were based on data from respondents studied at age 18 ( $N=1024$ ); age 21 ( $N=1011$ ); age 25 ( $N=998$ ); age 30 ( $N=986$ ) and age 35 ( $N=961$ ) who also had life satisfaction scores. These samples represented between 78.6% and 82.2% of the cohort members surviving to age 18 ( $n=1245$ ); age 21 ( $n=1240$ ); age 25 ( $n=1234$ ); age 30 ( $n=1231$ ) and age 35 ( $n=1223$ ).

The level of sample attrition raises issues of the extent to which the results may have been influenced by sample selection bias resulting from selective sample attrition. To examine this issue, all analyses were

repeated using the techniques described by Carlin et al. (Carlin *et al.*, 1999). These methods involved a two-stage process. In the first stage, a sample selection model was constructed by using data gathered at birth to predict inclusion in the analysis sample. In all cases, this analysis showed that there were statistically significant ( $p < 0.05$ ) tendencies for the analysis sample to under-represent children from more socially disadvantaged backgrounds (low parental education, single parent family, child of Māori or Pacific Island ethnicity and low socioeconomic status). On the basis of the fitted selection model, the sample was then post-stratified into a series of groups and the probability of inclusion in the analysis sample was estimated for each group. In the second stage of the analysis, the data were reanalysed with the observations for each individual weighted by the inverse of the probability of sample inclusion. In all cases, the weighted analyses produced essentially identical conclusions to the results reported here, suggesting that the effects of missing data and possible sample selection bias on the results were likely to be minimal.

## **Results**

### ***Associations between mental health disorders and life satisfaction***

Table 1 shows the population-averaged associations between measures of mental health in the past 12 months (major depression, generalised anxiety, suicidal ideation/attempt, alcohol dependence and illicit substance dependence) and life satisfaction at ages 18, 21, 25, 30 and 35. The source table on which this analysis was based is presented in Data Supplement 2. These associations were based on a statistical model that included age as a factor (see Methods); all regression models showed that life satisfaction increased statistically significantly with age ( $p < 0.001$ ). Table 1 reports the regression coefficients, standard errors and p-values relating each mental health problem to the pooled mean life satisfaction scores (scaled to a mean of 100 and a standard deviation of 10). The table shows that in all cases, the presence of mental health problems was associated with statistically significant reductions in life satisfaction ( $p < 0.01$ ). Inspection of the regression coefficients suggested that overall, those reporting mental health problems had mean life satisfaction scores which were from 0.21 to 0.45 standard deviations lower than those not reporting mental health problems. These analyses were extended to test for multiplicative age x mental health problem, and gender x mental health problem interactions. Only two statistically significant interactions were found (gender x alcohol dependence ( $p = 0.044$ ) and age x any mental health problem ( $p = 0.035$ )). However, given the number of comparisons made and the weak associations, these interactions were likely to be due to chance variation as a result of multiple statistical

significance testing. This conclusion was supported by the Bonferroni corrected p-value ( $p = 0.004$ ); using this value, neither of the interactions were statistically significant.

### **Insert Table 1**

#### ***Adjustment for confounding***

One explanation of the findings in Table 1 is that the association between mental health and life satisfaction reflects the presence of non-observed confounding factors. To address this issue, the analyses in Table 1 were extended by fitting conditional fixed-effects regression models which controlled for non-observed fixed sources of confounding (see Methods). Table 2 shows that in all cases, control for confounding reduced the regression coefficients linking mental health problems with life satisfaction. Nonetheless, after adjustment all associations between mental health problems and life satisfaction remained statistically significant ( $p < 0.05$ ), with the exception of alcohol dependence which was marginally statistically significant ( $p = 0.05$ ).

### **Insert Table 2**

The analysis in Table 2 was extended to include a series of time-varying covariates. These covariates included the respondent report (in the past 12-months prior to the assessment) of: being in a cohabiting partnership; experiencing interpersonal problems; experiencing financial problems; and weekly income from employment. Table 3 shows the fully adjusted regression model estimates which take into account both fixed-effects and time-dynamic covariates. Data Supplement 3 presents the results of the regression models shown in Table 3, including the estimates of the time-dynamic covariates. Table 3 shows that with the exception of alcohol dependence ( $p = 0.163$ ) there were statistically significant ( $p < 0.05$ ) associations between mental health problems and life satisfaction scores. The fitted models suggested that overall, the presence of mental health problems, was associated with a 0.14 to 0.31 standard deviation reduction in life satisfaction scores.

### **Insert Table 3**

The analysis in Table 3 was extended to fit a multivariate model in which all mental health problems were included as predictors of life satisfaction. This analysis showed that when the correlated effects of mental

health problems were taken into account, there were significant effects of major depression ( $B = -2.928$ ,  $SE = 0.397$ ,  $p < 0.001$ ), generalised anxiety ( $B = -1.028$ ,  $SE = 0.391$ ,  $p < 0.001$ ) and suicidal ideation/attempt ( $B = -1.366$ ,  $SE = 0.563$ ,  $p = 0.015$ ). As was the case with the analysis in Table 3, alcohol dependence was not statistically significantly related ( $B = -0.926$ ,  $SE = 0.689$ ,  $p = 0.179$ ); further, illicit substance dependence also became statistically non-significant ( $B = -0.476$ ,  $SE = 0.699$ ,  $p = 0.496$ ). Nonetheless, the model parameters for all problems were consistent with the view that the presence of mental health problems was associated with reductions in life satisfaction.

To represent the associations between life satisfaction and the accumulation of mental health problems, a further analysis was conducted on the number of mental health problems experienced (categorised as none, 1, 2, and 3+ problems). Descriptive information (mean, standard deviation (n)) for the mean life satisfaction scores at each assessment age, and pooled over all observations, by the number of mental health problems is shown in Data Supplement 4. Life satisfaction scores were predicted from the number of mental health problems at each point of observation, taking into account fixed-effects and time-dynamic covariates. The analysis showed the presence of a significant linear association ( $B = -1.675$ ,  $SE = 0.189$ ,  $p < 0.001$ ), between the number of mental health problems reported at a given time and mean life satisfaction scores. Data Supplement 4 also shows the regression coefficients for the associations between life satisfaction and the number of mental health problems (18-35 years) after adjustment for fixed-effects and time-dynamic covariates. This association is depicted in Figure 1 and shows that those reporting three or more mental health problems had mean life satisfaction scores that were approx. 0.60 standard deviations below those reporting no mental health problems. Before adjustment for fixed-effects and time-dynamic covariates, the number of mental health problems explained 7% of the variance in life satisfaction. After adjustment for fixed-effects and time-dynamic covariates, the number of mental health problems explained 4% of the variance in life satisfaction. Both estimates were consistent with the view that increasing exposure to mental health problems was associated with small to moderate reductions in life satisfaction.

### **Insert Figure 1**

### ***Supplementary Analyses***

#### *Tests of interaction (extension of Table 2)*

The fixed-effects regression models in Table 2 were extended to test for age x mental health problems and gender x mental health problem interactions. With the exception of suicidal ideation/attempt ( $p = 0.022$ ), no statistically significant ( $p < 0.05$ ) interactions were found. This analysis suggested that overall, mental health problems had similar effects on the life satisfaction scores of males and females and that these effects did not differ with age.

#### *Associations between mental health problems and life satisfaction subscales (Data Supplement 5)*

Finally, to examine the associations between mental health problems and different life satisfaction domains, the associations between the number of mental health problems and the life satisfaction subscales were considered. Subscales were developed based on a review by Cummins (1996). These subscales included satisfaction with: life as a whole; work (job, education, home); family life; finances; leisure time/hobbies; community standing; independence; and the future. The analyses fitted conditional fixed-effects regression models controlling for non-observed fixed sources of confounding, to show the associations between each life satisfaction subscale, the number of mental health problems and the time-dynamic covariates. These analyses showed that in all cases increasing mental health problems was associated with a statistically significant ( $p < .001$ ) decline in life satisfaction in each domain. These fitted models showed that those reporting three or more mental health disorders had mean life satisfaction scores that were 0.28 (satisfaction with independence) to 0.58 (satisfaction with life as a whole) standard deviations lower than those reporting no disorder. Details of the analysis are reported in Data Supplement 5.

## **Discussion**

In this paper we examined the associations between psychiatric disorder and life satisfaction using data gathered over the course of a 35 year longitudinal study. This research had a number of strengths when compared with existing research. These strengths include: a) the availability of life satisfaction measures from late adolescence to mature adulthood; b) comprehensive measurement of mental health problems using DSM diagnostic criteria; and c) statistical control for both observed and non-observed sources of confounding. A commentary on the major findings and their implications is provided below.

First, in confirmation of previous research there were consistent findings suggesting that the presence of mental health problems was associated with reductions in life satisfaction. This conclusion held for measures of major depression; generalised anxiety; suicidality; alcohol dependence; and illicit substance dependence.

Overall, the presence of mental health problems was associated with a 0.21 to 0.45 standard deviation reduction in mean life satisfaction scores.

These analyses were then extended to adjust the associations between mental health problems and life satisfaction by controlling for both non-observed fixed covariates and observed time-dynamic covariates. This analysis showed that after adjustment, significant associations ( $p < 0.05$ ) remained between life satisfaction and: major depression, generalised anxiety, suicidal ideation/attempt and illicit substance dependence. In agreement with a previous analysis (Swain *et al.*, 2012), there was no statistically significant association between alcohol dependence and life satisfaction ( $p > 0.10$ ). After statistical control, those reporting any mental health problems had mean life satisfaction scores which were 0.26 standard deviations lower than those with no disorder. This analysis was extended to examine the dose/response relationship between the number of disorders reported and mean life satisfaction (Figure 1). This analysis showed a consistent trend for mean life satisfaction to decline with increasing reports of mental health problems. Those reporting three or more disorders had mean life satisfaction scores which were nearly 0.60 standard deviations lower than those reporting no mental health problems.

These findings were generally consistent with previous research that has examined the linkages between mental health and life satisfaction (Bellis *et al.*, 2012; Beutel *et al.*, 2010; Bray and Gunnell, 2006; Desousa *et al.*, 2008; Flèche and Layard, 2013; Koivumaa-Honkanen *et al.*, 2011; Layard *et al.*, 2013; Murphy *et al.*, 2005; Sun and Shek, 2012). However, the findings also make it clear that the contribution of mental health to life satisfaction was relatively modest, accounting for about 4% of the variance in life satisfaction after adjustment for confounding. These findings were not consistent with a number of previous studies which have reported large associations between mental health and life satisfaction (Bray and Gunnell, 2006; Desousa *et al.*, 2008; Flèche and Layard, 2013; Koivumaa-Honkanen *et al.*, 2011; Layard *et al.*, 2013; Murphy *et al.*, 2005). One explanation of this difference is that previous studies have failed to take into account time-dynamic covariates. These findings support the general conclusions of Positive Psychology, which has argued that positive mental health is not simply the absence of mental health problems (Deiner *et al.*, 1999; Seligman and Csikszentmihalyi, 2000; Vaillant, 2000). The present analysis suggests that while mental health problems does contribute to life satisfaction, the associations are relatively modest, suggesting the presence of other genetic, social and life-course factors which contribute to the individual's overall life satisfaction.

One of the ongoing debates in the area of life satisfaction research has concerned the measurements used to assess life satisfaction. In this study, we used a series of custom-written items using Likert scales to

assess life satisfaction in a number of domains. These items were combined to produce a general scale of life satisfaction, with this measure having good internal consistency. For the main analyses, we used this overall measure (scaled to a mean of 100 and a standard deviation of 10) to aid model interpretation. However, we have also considered the associations between mental health and a number of subscales of the overall measure. These subscales included satisfaction with: life as a whole; work (job, education, home); family life; finances; leisure time/hobbies; community standing; independence; and the future. Findings using the subscale data were generally consistent with the results for the overall scale; and all analyses supported the conclusion that increasing mental health problems were associated with declining life satisfaction scores, irrespective of the method used to assess life satisfaction.

While this study has a number of strengths relating to the longitudinal design, it is not without limitations. In particular, the findings reported in this paper are specific to a particular cohort studied over a particular time period using a particular set of measurements. The extent to which the study findings generalize to other contexts is not known. Notwithstanding these reservations, the present study suggests the presence of robust associations between mental health problems and life satisfaction in which the presence of mental health problems is associated with consistent but small to moderate decreases in life satisfaction.

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Table 1. Mean (s.d.) life satisfaction scores by presence/absence of mental health problems (past 12 months) pooled over all observations at 18, 21, 25, 30 and 35 years.

Predictor	Life satisfaction score by presence/absence of mental health problem		B (s.e.)	P
	Problem present	Problem absent		
<u>Major depression</u>				
Pooled mean (s.d.) life satisfaction	94.8 (10.5)	100.9 (9.6)	-4.380 (0.388)	<0.001
Pooled N	750	4230		
<u>Generalised anxiety</u>				
Pooled mean (s.d.) life satisfaction	96.4 (10.4)	100.6 (9.8)	-2.767 (0.378)	<0.001
Pooled N	709	4271		
<u>Suicidal ideation/attempt</u>				
Pooled mean (s.d.) life satisfaction	93.0 (10.4)	100.5 (9.8)	-4.521 (0.587)	<0.001
Pooled N	321	4659		
<u>Alcohol dependence</u>				
Pooled mean (s.d.) life satisfaction	95.4 (9.8)	100.2 (10.0)	-2.168 (0.717)	0.003
Pooled N	177	4803		
<u>Illicit substance dependence</u>				
Pooled mean (s.d.) life satisfaction	94.9 (11.2)	100.2 (9.9)	-2.915 (0.817)	<0.001
Pooled N	200	4780		
<u>Any mental health problem</u>				
Pooled mean (s.d.) life satisfaction	96.2 (10.1)	101.5 (9.6)	-3.730 (0.293)	<0.001
Pooled N	1415	3565		

Table 2. Estimated effects (B (s.e.), *P*) of presence of mental health problems on life satisfaction scores before and after adjustment for confounding by non-observed fixed factors.

Predictor	Life satisfaction scores by presence of mental health problems			
	Unadjusted		Adjusted for confounding	
	B (s.e.)	<i>P</i>	B (s.e.)	<i>P</i>
Major depression	-4.380 (0.388)	<.001	-3.952 (0.379)	<0.001
Generalised anxiety	-2.768 (0.378)	<.001	-2.193 (0.388)	<0.001
Suicidal ideation/attempt	-4.521 (0.587)	<.001	-3.296 (0.546)	<0.001
Alcohol dependence	-2.168 (0.717)	0.003	-1.389 (0.710)	0.050
Illicit substance dependence	-2.915 (0.817)	<.001	-1.621 (0.706)	0.022
Any mental health problem	-3.730 (0.293)	<.001	-3.045 (0.313)	<0.001

Table 3. Fitted regression coefficients (B (s.e.), *P*) showing the estimated effects of presence of mental health problems on life satisfaction scores after adjustment for confounding by non-observed fixed factors and time-dynamic covariates.

Predictor	Fitted regression coefficients <sup>1</sup>	
	B (s.e.)	<i>P</i>
Major depression	-3.417 (0.378)	<0.001
Generalised anxiety	-1.791 (0.385)	<0.001
Suicidal ideation/attempt	-2.756 (0.542)	<0.001
Alcohol dependence	-0.977 (0.701)	0.163
Illicit substance dependence	-1.412 (0.693)	0.042
Any mental health problem	-2.550 (0.314)	<0.001

Note. <sup>1</sup>Time dynamic covariates included: being in a cohabiting partnership; interpersonal problems; financial problems; and weekly income from employment (\$NZ); and in the past 12-months prior to the assessment.

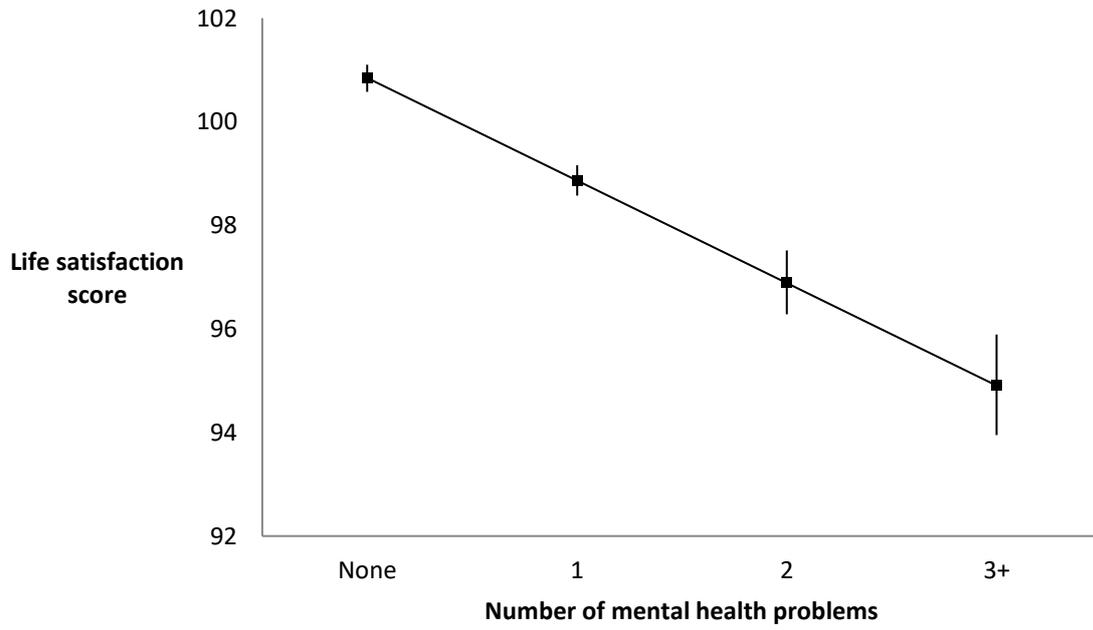


Figure. 1 Associations between the number of mental health problems and the adjusted mean life satisfaction scores after statistical control for non-observed fixed factors and time-dynamic covariates at ages 18, 21, 25, 30 and 35.