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DISCUSSION PAPER SERIES

IZA DP No. 11431

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ABSTRACT

The Transmission of Mental Health within Households: Does One Partner's Mental Health Influence the Other Partner's Life Satisfaction?

This paper investigates the relationship between partner's mental health and individual life satisfaction, using a sample of married and cohabitating couples from the Household, Income and Labour Dynamics of Australia Survey (HILDA). We use panel data models with fixed effects to estimate the life satisfaction impact of several different measures of partner's mental health and to calculate the Compensating Income Variation (CIV) of them. To the best of our knowledge, this is the first paper to study the effect of partner's mental health on individual's wellbeing and to measure the impact of reduced life satisfaction in monetary terms. We also provide some new insights into adaptation and coping mechanisms. Accounting for measurement error and endogeneity of income, partners' mental health has a significant and sizeable association with individual well-being. The additional income needed to compensate someone living with a partner with a long term mental condition is substantial (over USD 60,000). Further, individuals do not show significant adaptation to partners' poor mental health conditions, and coping mechanisms show little influence on life satisfaction. The results have implications for policy-makers wishing to value the wider effects of policies that aim to impact on mental health and overall levels of well-being.

JEL Classification: I10, I12

Keywords: partner's health, compensating income variation, fixed effects

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1. Introduction

Valuations of health conditions serve an important role of informing decision-makers of the relative value for money of interventions and policies designed to improve health and well-being. However, some health conditions have substantial spillover effects on the family of the individual who directly experiences the conditions, and these effects should be taken into account when evaluating the impact of such conditions. A challenge however is to identify a suitable valuation method with which to incorporate these spillover effects.

One of the most common health conditions that occur in populations worldwide is poor mental health (Vigo et al 2016). There are various mechanisms through which mental health is likely to have an impact on partners' well-being (Doran & Kinchin 2017). First of all, individuals derive utility from the health of their partners. See for example Jacobson (2000), who provides an interesting generalization of the Grossman model, in which family, rather than an individual, is the producer of health, and individual members of the family receive investment and consumption benefits from investing in other family members' health. Second, individuals with poor mental health are more likely to drop out of the labour market and this may impose additional financial stress on the family (Schofield et al 2011). Third, individuals with poor mental health may need care and supervision, and this may lead to greater risk of depression amongst carers (Joling et al., 2010; Ask et al 2014). Further, caregiving responsibilities can impact negatively on life satisfaction (see for example Mentzakis et al., 2010). Last, mental ill-health such as depression can cause additional problems within the family, such as increased family conflicts (Burke 2003).

This study investigates the impact of partner's mental health on individual life satisfaction, using a large dataset of Australian couples, and calculates the compensation needed for individuals living with a partner in poor mental health. Understanding the impact of mental health on family members is important, as they are likely to be the primary source of care for individuals affected, and can be responsible for choosing among different treatment options. The existing economics literature has neglected the analysis of important spillover effects from individual mental health to the well-being of their partners, and therefore this study aims to fill this important gap.

To the best of our knowledge, this is the first paper to estimate the impact of one person's mental health on their spouses or partners in monetary terms using the compensation

income variation method (CIV). This method calculates the amount of additional income that would be just sufficient for an individual living with a health condition or experiencing a negative event such that their life satisfaction would then be equivalent to a similar individual living in similar circumstances who did not have that condition or experience the relevant event (for a recent health example, see Howley 2017).

Our results show that individuals living with a partner in poor mental health experience a substantial drop in life satisfaction, and results are stable in all of the different specifications of the model, controlling for partners' and family's characteristics, life events, long term health conditions. . The impact of partners' mental health is larger than the impact of individual's unemployment status, and negative life events (including being victim of violence, property crime, or experiencing death or illness of a relative). The implied compensating needed is substantial, and ranges from around AUD 50,000 (USD 40,000) to around AUD 83,000 (USD 65,000), depending on how poor mental health is defined and on the severity of the condition. Further, the negative effect of partners' mental illness does not fade away with time and we find no evidence of adaptation to this condition.

These estimates have important policy implications, and contribute to a fuller understanding of the costs associated with poor mental health.

The rest of this paper is organized as follows. Section 2 describes the existing literature on the cost of mental health. Section 3 presents the data and the mental health and well-being indicators. Section 4 discusses the estimation methods and Section 5 presents the main results. Section 6 concludes.

2. Literature review

The effects of poor mental health on individuals' lives and economic outcomes have been widely documented and analysed in economics literature. Poor mental health is a significant predictor of negative economic outcomes, such as reduced education and labour market success (see for example Chatterji et al., 2011; Fletcher, 2010; Smith and Smith, 2010; Johnston et al., 2014, among many others). Individuals who are in poor mental health may experience reduced productivity (Bubonya et al., 2017) and increased probability of being out of the education system or the labour market at a young age (Cornaglia et al., 2015).

Poor mental health imposes a substantial cost on society and on health care systems around the world. Mental, neurological and substance use disorders account for over 10%

of the global burden of disease, measured in years lost, and account for over 25% of years lived with a disability (World Health Organisation, 2013). Recently, the cumulative global impact of mental disorders in terms of lost economic output has been estimated around US$ 16 trillion over the next 20 years, or more than 1% of global GDP over this period (Bloom et al., 2011).

In Australia, mental illness is the third leading cause of disability, accounting for approximately 27% of years lost due to disability. In a recent survey conducted by the Australian Bureau of Statistics, almost one in five Australians had experienced symptoms of a mental disorder in a 12 months period, with a higher incidence of anxiety and depression disorders, followed by affective and substance use disorders (ABS, 2007).

Mental health conditions impose substantial costs to the individuals experiencing them, including costs for treatment, loss in productivity in the labour market and difficulty in family relationships. Calculating the monetary costs associated with these conditions is a particularly complex task, and recent developments in valuation methodology have shown that measures of subjective well-being, such as life satisfaction, can be particularly useful in this context, as they can capture the relative effects of mental health conditions more accurately, taking into account all different domains of individual lives that are affected by the condition (Fujiwara and Dolan, 2014).

However, the impact of mental health of family members on individual well-being has been largely unexplored, and, in general, there is limited evidence of the connections between partners' health and individual happiness and well-being in the economic literature.

Existing studies analyse the correlation between partners' health behaviours and characteristics, such as smoking and obesity, and show that individuals tend to sort themselves in the marriage market and choose partners with similar health behaviours and lifestyles (see for example Clark and Etile', 2006 and 2011; Brown et al., 2014, among others). Similarly, Powdthavee (2009) analyses the correlation in partners' life satisfaction and shows that there are positive and significant spillover effects between partners' life satisfaction, due to assortative mating and shared home environment.

A separate strand of literature investigates the impact of mental health within the family, and in particular the relationship between parental mental health and children outcomes, showing that poor maternal mental health is a significant predictor of a wide range of negative outcomes, including lower education and earnings, higher incidence of emotional problems, and higher likelihood of crime (Schepman et al., 2011; Johnston et

al., 2014). Dahal and Fertig (2013) analyse the impact of mental health on household spending behaviour and show that mental illness generally has a negative effect on spending, and in particular decreases educational spending.

This study makes three new contributions to the prior economics literature on family health and spillover effects. First, we investigate the impact of partners' mental health and well-being on individuals' life satisfaction, and therefore shed some light on the broad consequences of mental illness on other family members, rather than on the individual directly affected. To the best of our knowledge, this is the first study in the economics literature to adopt this broad approach and to investigate the effects of poor mental health on the well-being of partners.

Second, we calculate the compensating income variation for an individual living with a partner experiencing a long term mental condition, using recent methodology that takes into account the potential measurement error and endogeneity of income.

Last, we explore the richness of our dataset and investigate the potential protective effects of coping mechanisms for individuals living with partners in poor mental health, and in particular we analyse the effect of social and family networks.

3. Data

This study uses data from fifteen waves of the HILDA Survey, which is a household representative longitudinal study of the Australian population that started in 2001, including 13,969 individuals in 7,682 households in wave 1 (Wooden and Watson, 2002).

At each wave, all respondents in HILDA answer the following question about their life satisfaction: All things considered, how satisfied are you with your life? Answers vary on a scale from 0 to 10, where 0 means "totally dissatisfied" and 10 means "totally satisfied".

Life satisfaction is a measure of subjective well-being that has been extensively used in the economic literature to evaluate the impact of health conditions and, more broadly, life events on individuals (see for example Johnston et al., 2017; Howley, 2017; Frijters et al., 2011; Powdthavee and van den Berg, 2011; among many others).

Table 1 summarises the distribution of life satisfaction in the estimation sample. In general, the majority of respondents report a moderately high level of life satisfaction. The mean and median of the life satisfaction variable are around 8. The proportion of

individuals reporting low satisfaction (0-4 on a 0-10 scale) is less than 2%, but increases when we analyse the distribution of life satisfaction among individuals whose partners experience some mental health conditions.

Table 1 here

Individuals can be linked to their married or cohabiting partners in HILDA using partners' identifiers. We use the information provided by each individual when answering the HILDA survey and then link partners by using the partners' identifiers. In this way, we are able to collect information about partners' mental health by using answers reported by each individual (instead of relying on possibly misreported partners' information).

We adopt two broad approaches to measurement of partners' mental health in our analysis. First, we begin by using the information available in the Short Form (36) Health Survey, which is included in the HILDA Self- Completion module.

The Short Form (36) Health Survey (SF-36) is a health status measure originally designed in the Medical Outcome Study, undertaken by RAND Corporation (Ware and Sherbourne, 1992), to be used in clinical practice and research, as well as in general population surveys. SF-36 includes scores in eight domains of patients' lives: physical functioning, bodily pain, role limitations due to physical health problems, role limitations due to personal or emotional problems, mental health (psychological distress and psychological well-being, social functioning, vitality (energy/fatigue), and general health perceptions. Each score is constructed using the specific questions in the relevant section and transforming the answers to a 0-100 scale, where 0 corresponds to maximum disability and 100 indicates high functioning or no disability.

We used the information from the SF-36 in three different ways. First, we evaluate the effect of partners' broad mental health and analyse the impact of changes in partners' SF-36 scores in the following domains:

- Mental health
- Vitality
- Role limitations due to emotional problems
- Social functioning

Second, we focus on the specific components of the mental health and vitality scores and analyse the separate impact of each of them (see Table 4 for details). The mental health SF-36 score is based on five items, covering feelings of nervousness, depression,

calm and happiness. Similarly, the vitality score is composed by four items, asking the individual whether she/he feels tired and worn out all the time, or full of energy in daily activities.

Finally, we examine the influence of more severe mental health, by examining the effects for those with a mental health score in the bottom quartile of the SF-36 distribution.

The second broad approach uses different information from self-report relating to treatment, more specifically, we analyse the life satisfaction effect of having a partner who experiences any mental health or emotional long term condition which requires treatment, help and supervision.

Table 2 and 3 report the distribution of the SF-36 scores for individuals and partners, and the occurrence of mental and emotional long term condition in the estimation sample.

Table 2 and 3 here

Our main model (Specification 1) includes an extensive set of independent variables, to consider other factors that may influence life satisfaction, such as individual's and partner's self-assessed health, education, gender, employment and marital status, number and age of children, geographic remoteness, time binary variables[1], and life events that took place in the last 12 months (personal injury or illness, serious illness of a family member, victim of physical violence, death of a close relative or family member, victim of a property crime). We also estimate two additional specifications (Specifications 2 and 3) of each model, including other variables, such as partners' long term conditions, and possible strategies to help the individual to deal with partners' mental health, such as presence of social networks, and engagement in social activities. The complete list of variables included in the model is reported in Table 4.

The estimation sample includes around 109,000 observations of over 17,000 individuals who live with a partner and have non-missing information on partner's health and other essential individual and family characteristics (see Table 4 for descriptive statistics). We then limit the analysis to the sample of individuals who do not experience poor mental health (or a long term mental health condition) themselves in the current wave, in order to avoid the risk of life satisfaction being affected by both individual and partner's mental health conditions. Therefore, the estimation sample is reduced and includes around 76,000 observations from over 14,000 individuals. We have tested the

[1] We follow Frijiters et al., 2004 and do not control simultaneously for age, time and fixed-effects. We therefore do not include age as a covariate and note that the time dummies will include age effects.

stability of our main results by including individual mental health and the pattern of findings is unchanged. However, we have decided not to include individual mental health, as it is potentially endogenous with respect to partner's conditions and to individual life satisfaction (Howley 2017).

Table 4 and 5 here

4. Estimation

In this study, we estimate life satisfaction (measured on a 0-10 scale) as a function of individual and partner's self-assessed health (H and PH), partner's mental health (PMH), individual and household characteristics X, and income windfall Y.

Therefore, we model an underlying indirect life satisfaction function (LS) as follows:

$$LS = F(H, PH, PMH, X, Y) \quad (1)$$

We follow the methodology in Johnston et al. (2017) and evaluate the life satisfaction effect of a positive income shock. This is an alternative approach to the inclusion of annual income as a separate variable in the life satisfaction equation (Groot and Maassen van den Brink, 2004 and 2006; Carroll et al. 2009; McNamee and Mendolia, 2014; Powdthavee and van den Berg, 2011). A positive income shock is measured with a binary variable equal to 1 if the individual experienced a "major improvement in finances". Frijters et al. (2011) show that this approach overcomes the challenges in correctly estimating the relationship between income and life satisfaction. More specifically, it addresses potential measurement error in income, which, if uncorrected, can lead to underestimates of the effect of income on life satisfaction, and, as a consequence, overestimation of the CIV (see Clark et al, 2008 for a thoughtful discussion of the methodological difficulties of analysing the relationship between income and life satisfaction).

The use of unexpected financial improvements or "positive income shock" in effect treats income as exogenously determined, and avoids the need to assume that variations in income are completely independent of changes in partner's health status. This is important as many observed changes in income are possibly related to changes in health or to changes in other life circumstances (i.e. changes in employment situation, marital separation, etc.), which may also have a relationship with partner's mental health status.

Results from an OLS model may be biased because of individuals' unobserved characteristics that may affect both life satisfaction and partner's health (such as personality traits, risk attitudes, time preferences, etc.). Further, people may answer life satisfaction questions in a different way, depending on their own interpretation of the meaning of the scores. Therefore, life satisfaction is estimated in a model with individual fixed effects, in order to take into account individual unobserved characteristics that might have an effect on life satisfaction and do not vary over time, such as personality traits, cultural background, risk aversion, ability, etc:

$$LS_{it} = \alpha + \beta_1 H + \beta_2 PH + \beta_3 PMH + \beta_4 Y_{it} + \beta_5 X_{it} + c_i + \varepsilon_{it} \quad (2)$$

where life satisfaction depends on individual and partner self-assessed health, partner's mental health, individual characteristics X, and income shock Y. The parameter c_i is an individual fixed effect that takes into account time-invariant unobserved heterogeneity.

Unfortunately, the data does not include any quasi-experimental variation across the sample that can be exploited to address potential selection on unobservables and it is challenging to identify an instrumental variable that is correlated with partner's mental health and well-being but uncorrelated with the error terms in the life satisfaction equation. Interpretation of results from this model therefore relies on the assumption that the time-dependent error term in the life satisfaction equation is independent of changes in partners' mental health, conditional on the regressors included in the model and on the individual fixed effect. This assumption will not hold if there are unobserved random shocks that affect partners' mental health and individual life satisfaction at the same time. For this reason, we control for a wide set of individual characteristics, as well as for negative life events (such as being the victim of violence, property crime, death or serious illness of a family member, etc.).

We use the parameter estimates from (2) to calculate the CIV of partner's mental health, following the approach presented in Frijters et al. (2011) and Johnston et al. (2017). We calculate the magnitude of "financial improvements" that would be needed to compensate an individual for a specific mental health condition experienced by her/his partner.

Therefore, we calculate the following ratio:

$$CIV = \frac{\beta_3}{\beta_4} \quad (3)$$

Further, we convert the CIV ratio into a monetary value by multiplying it by the estimated mean change in income associated after a "major improvement in finances" in our sample. Following Au and Johnston (2015) and Johnston et al. (2017), we calculate the estimated mean change in household disposable income from a major improvement in finance (defined as reporting a "major improvement in finance"[2] ***and*** an increase in the household gross income). In the estimation sample, this figure is approximately 75,000 $.

A similar methodology has been used in previous studies to calculate the monetary compensation needed after life events such as marriage breakup, major illness, death of a relative or friend (Frijters et al, 2011) or to estimate the compensation for crime victims (Johnston et al., 2017). In this context, Au and Johnston (2015) have shown that the financial improvement variable is not statistically associated with receipt of accident or illness insurance, workers compensation, life insurance, or redundancy payments, suggesting therefore that this variable does not appear to be influenced by time-varying characteristics that might also affect health status. Further, Johnston et al (2017) use HILDA data and verified that income shocks are not correlated with individual socio-economic characteristics, after controlling for individual-area fixed effects.

As a further check on the data used in this paper[3], we verified that receiving a positive income shock in the next 12 months was not determined by household income and socio-economic status, or by any major illness or long term health condition in the previous period, and any other life event (apart from death of a relative, consistent with the idea of financial improvements being partly related to inheritances), once we control for fixed effects (see Appendix Table A2).

We run three different specifications of the model, including the basic set of covariates in Specification 1, adding other partners' long term conditions in Specification 2, and individual's coping strategies in Specification 3.

We have also run a sensitivity analysis and calculated CIV using the traditional methodology, where we include logarithm of income in the life satisfaction equation, as undertaken in previous studies (see for example Groot and Maassen van den Brink, 2004

[2] The exact question is: "We now would like you to think about major events that have happened in your life over the past 12 months. For each statement cross YES or NO to indicate whether each event happened in the last 12 months" – "Major improvement in financial situation (e.g. won lottery, received an inheritance)"

[3] Our analysis is focused on the impact of partners' (and not individuals) mental health on individual life satisfaction, and it seems unlikely that positive income shocks are correlated with partners' mental health conditions. We have run an additional sensitivity test, controlling for the receipt of disability benefits for individuals or partners, and main results are unchanged.

and 2006; among many others). However, as already discussed, this methodology does not correct for the potential measurement error in income. We find that the household income coefficient becomes insignificantly different from zero (possibly because of the use of the fixed effect methodology and the inclusion of several important life events, which substantially affect life satisfaction), leading to unrealistically high estimates of CIV. Results are not reported here but are available from the authors.

To examine adaptation, we follow Oswald and Powdthavee (2008), and Mendolia and McNamee (2014), and analyse the effect of partner's poor mental health in current and prior waves, in order to understand whether life satisfaction levels adapt. To do this, we create a variable "Past condition from t-3 to t-1", PMH_{t-3}, which takes values in the interval between zero and one. This variable will take the following values:

- 1/3 for an individual whose partner had poor mental health in one year within the previous three years;
- 2/3 for an individual whose partner had poor mental health in two years within the previous three years;
- 1 for an individual whose partner had poor mental health each year in the previous three years.

This variable is introduced into the model separately and interacted with current partner's poor mental health:

$$LS_{it} = \alpha + \beta_1 H + \beta_2 PH + \beta_3 PMH + \beta_5 PMH_{t-3} + \beta_6 (PMH * PMH_{t-3}) + \beta_7 Y_{it} + \beta_8 X_{it} + \varepsilon_{it} + c_i \quad (4)$$

The estimation of the model from Equation (4) allows us to test whether individuals' life satisfaction adapt to prolonged periods of partner's poor mental health.

5. Results

The main results from the estimation are presented in Tables 7-11.

We present results from three different specifications of the fixed effects model, where different independent variables are included, in order to show the stability of our results.

Partners' mental health has a large and significant association with the life satisfaction of individuals in the estimation sample. As expected, the size of the association slightly decreases when we include additional independent variables, and in particular when we include individual coping strategies and social networks

(Specification 3). However, the coefficients of partners' mental well-being remain significantly different from zero in all cases.

In Table 7, we begin with the analysis of the impact of the partner's standardised SF-36 mental health score (0-100, where higher values represent higher level of well-being). Increasing this score by one standard deviation increases individual's life satisfaction by 0.07 points (on a 1-10 scale), which is equivalent to 5% of a standard deviation in life satisfaction. To put this in context, this is similar to the (reversed) effect of becoming unemployed or being victim of a property crime (see Table 10).

Improvements in partner's SF-36 vitality score have a similar effect, while changes in the social functioning and role limitation because of emotional problem scores have smaller (but significant) effects.

In the second section of Table 7, we focus on the components of the mental health and vitality scores and estimate two separate models including all mental health (and vitality) components. As expected, having partners who often experience feeling of depression is associated with a substantial drop on individuals' life satisfaction (-0.07 points), while positive feelings of calmness, energy and vitality increase the level of individual life satisfaction by a significant amount (positive effects ranging from +0.03 to +0.07).

Table 7 here

In Table 8, we analyse the impact of partner's poor mental health, defined in three different ways. Focusing here only on the results from models where mental health is defined in terms of long term mental health conditions, such as a long term mental illness requiring help or supervision, or a nervous condition requiring treatment, we find a significant negative association between having a partner in poor mental health and own life satisfaction. The effects range from -0.074 points for nervous or emotional condition (5% of a standard deviation of life satisfaction) to -0.12 points for a long term mental illness which requires help or supervision (around 9% of a standard deviation). This effect is larger than the negative impact of individual's unemployment status, and negative life events (including being victim of violence, property crime, or experiencing death or illness of a relative) (see Appendix Table 1). Partners' other long term health conditions have a very limited impact on individual life satisfaction (see Appendix Table 1) and the inclusion of these variables slightly decreases the association with mental health.

In Specification 3, we investigate the role of possible coping strategies, which could support the individual living with a partner who suffers from poor mental health, such as

being member of a sport or community club, or having a network of friends or relatives. Caution should be used when looking at the impact of these variables, as they are potentially endogenous with respect to life satisfaction. However, we present results from this specification in order to test whether the impact of partner's mental health is sensitive to the inclusion of these variables. Interestingly, as showed in Table A1, all these variables have a significant association with individual life satisfaction, but the size of the coefficient of partner's poor mental health is only slightly reduced when these controls are included. Therefore, even if the individuals can potentially benefit from the various coping mechanisms, the association between partner's poor mental health on own life satisfaction remains strong and significant.

Table 8 here

The independent variables included in the model follow the literature in the field (see for example Blanchflower and Oswald, 2008; Green, 2011, among others) and the main findings on the covariates included in the model (see Table A1) are generally consistent with previous studies investigating the determinants of life satisfaction (see for example Winkelmann and Winkelmann 1998, Clark et al. 2001; Frey and Stutzer 2000; Frijters et al. 2004; Mendolia and McNamee, 2014). Individual and partner's self-assessed health play a substantial role in explaining the variation in life satisfaction, and the life satisfaction score decreases by almost 1 point (almost 70% of a standard deviation) for individuals in poor health (with respect to individuals who report excellent self-assessed health) .

Education does not play a very important role in explaining the variation in life satisfaction, while labour force participation is definitively associated with increased life satisfaction, with respect to unemployment. As expected, negative life events, such as personal injury, illness or death of a family member and being a victim of crime, are significantly associated with decreased individual life satisfaction (-0.03 to -0.07 points in life satisfaction).

The compensating income variations associated with partner's poor mental health are presented in Table 9. The third column shows the CIV ratios, calculated according to (3). For example, a CIV ratio of 1.11 indicates that the negative life satisfaction effect of this measure of partner's poor mental health is equivalent to 1.11 times the positive effect of a major improvement in finances. The fourth column shows the one-off income windfall that is equivalent to each condition (for example, almost A$77,000 for a partner suffering from long term mental illness that requires help or supervision) and is calculated by

multiplying the CIV ratio by the average value of financial improvement in the estimation sample ($74,745). These values suggest, for example, that individuals living with a partner who has a long term mental illness that requires help and supervision, would need an extra A$77,000 (or almost USD 60,000) income to return to the same level of life satisfaction they would have if their partner did not suffer from that condition.

The CIVs of partners' poor mental health range between almost AUD 50,000 (USD 40,000) for individuals living with a partner with a long term nervous or emotional condition which requires treatment, to almost AUD 83,000 (USD 65,000) for individuals whose partner mental health score form SF-36 is in the bottom quartile of the index distribution.

Table 9 here

Lastly, we estimate Equation (4) in order to analyse whether people adapt to partners' poor mental health conditions. As earlier, we highlight long term mental illness or emotional conditions, as these variables are better suited to capture the effect of serious and non-transitory conditions. Results from these estimations are presented in Table 10 and 11.

The long run effect of partners' mental illness is -0.338 (equal to the sum of -0.120 and -0.218). The second column of Table 10 presents results from a model where we include past partner's mental illness, as well as the interaction between past and current mental illness. The inclusion of these variables allows us to estimate the extent of adaptation. For example, a person whose partner had mental illness for every year in the last three years has a ratio of time in mental illness from t-3 to t-1 equal to 1. Hence, other factors held constant, the effect on life satisfaction is -0.229. In addition, if this individual also reports her/his partner have mental illness at time t, there is an offsetting effect, captured by the interaction term, and the overall effect is equal to -0.125-0.229+0.029 =-0.325. This coefficient is bigger than -0.125 (the effect of contemporaneous mental illness) and does not show any partial adaptation, although we notice that the coefficient is slightly lower than the contemporaneous effect multiplied by 3, and therefore signals that the negative impact increases with a decreasing rate.

A person whose partner had mental illness for one additional year in the past has a combined penalty of -0.125-0.229/3+0.029/3=-0.19. A person whose partner had mental illness for two additional years in the last three would have a life satisfaction penalty of -0.125-0.229*2/3+0.029*2/3=-0.258. These data show that the negative effect of partner's

mental illness on life satisfaction keeps increasing (at a decreasing rate) when people live with a partner who experiences the condition for a more prolonged period of time.

Similarly, individuals show very limited adaptation to a partner's long term nervous or emotional condition that requires supervision. The long term life satisfaction effect of such conditions is -0.17 and the impact of having a partner with this kind of conditions for 1, 2 or 3 years in the past is -0.108, -0.104 and -0.100, compared to the effect of current conditions, which is equal to -0.112.

6. Discussion

This paper analyses the relationship between partner's mental health and individual life satisfaction, using the Household, Income and Labour Dynamics Survey of Australia, estimating a fixed effects model in order to control for characteristics of individuals that do not vary over time. To the best of our knowledge, this is the first study to analyse the important spillover effects of mental health on partners' well-being and to estimate the Compensating Income Variation of partner's mental health. We find that living with a partner with a long term mental illness has a negative association with life satisfaction and that the implied monetary valuations of losses are also substantial. Further, we show that individuals do not adapt to living with a partner in poor mental health and the cumulative effect of mental illness increases with time.

The negative association between partner's mental health conditions and life satisfaction is not unexpected if one considers the various transmission channels through which the health status of a family member can affect individual well-being. First of all, individuals may derive utility from their partner's well-being, and are expected to suffer a substantial decrease in life satisfaction if their partner is unwell. In addition, mental health deterioration is associated with increased chances of leaving the labour market and this may imply a drop in household income, as well as a negative effect on the partner's perceived role in society. Further, the negative effect of mental illness may be mediated through a variety of other factors, such as increase in family conflicts, lack of personal contacts for the individual and the family, and increased need for care and supervision. These spillover effects may drive further reductions in partners' life satisfaction and well-being.

The present study adds to the existing literature which calculates CIV of health conditions in several ways (see for example Groot and Maassen van den Brink, 2004 and 2006). First, we focus the attention on partner's (rather than individual's) conditions and explicitly

acknowledge the important effects of mental health on the family. Second, we use a very large sample (over 75,000 observations from over 14,000 individuals) and are able to control for a very extensive set of partners' and family's characteristics. Last, we directly address the issue of measurement error in income and therefore are able to generate potentially more reliable estimates of CIVs.

Our estimates are consistent with those calculated in studies that address potential measurement error in income. For example, Frijters et al. (2011) calculate a CIV for "serious illness" of around A$105,000, using data from six waves of HILDA. Further, Fujiwara and Dolan (2014) estimate an annual compensation of GBP£44,237 to compensate individuals affected by depression and anxiety. However, all these studies are focused on individual conditions and none of them considers the negative effect of partners' illness.

A potential limitation of our analysis is that the fixed effects estimates only control for time-invariant effects, and it is possible that other time-varying shocks affect both partners' mental health and individual life satisfaction. However, it is difficult to adopt analytical solutions to these problems as there is no quasi-experimental variation that could be used to deal with these issues. Furthermore, there is a lack of suitable instrumental variables with the power to predict changes in partners' mental health without having an effect on individuals' life satisfaction. For these reasons, we have controlled for a wide set of independent variables, including individual and family characteristics, and important life events which can affect life satisfaction and mental health, and we have primarily focused on the impact of long term mental conditions.

Our estimates suggest that mental illness imposes a substantial burden on well-being of the partner of the individual experiencing the condition. The strength of the association between partner mental health and partner well-being provides further evidence of the importance of spillover effects and, together with the lack of adaption, suggests that the impact of mental health problems is felt by individuals as well as partners for considerable periods of time. Research on longer–term effects on other family members, e.g. the magnitude of impacts on children as they grow older, would further add to our knowledge on the extent of even longer lasting impacts.

Knowledge of the magnitude of spillover effects is important from a policy-maker's perspective, as the benefits of effective mental health interventions will be larger with the inclusion of such effects. Further, their inclusion can also inform the development of

interventions and policies for mental health. With policy-makers and funders within the mental health field increasingly interested in identifying cost-effective interventions that can be delivered at scale, policies such as improvements to urban environments and greater provision of greenspace are attracting more attention (Bakolis et al 2018; White et al 2013). The evaluation of such policies requires a method by which to identify and value wider effects on health and well-being. The method of compensating income variation is one possible approach, and further work on establishing whether the technique is able to identify such effects from policies that impact on mental health would be a useful future contribution.

Tables

Table 1 – Distribution of life satisfaction

Variables/categories	***Frequency***	***Percent***
Life satisfaction		
Least satisfied (0-4)	1,736	1.59
5	3,249	2.98
Satisfied (6-10)	104,096	95.43

All sample	**Mean (SD)**	**Median**
Life Satisfaction	8.06 (1.33)	8

	Life satisfaction (%)		
Partner's mental health	**Least Satisfied (0-4)**	**5**	**Satisfied (6-10)**
Partner has a nervous or emotional condition which requires treatment	4.09	5.98	89.93
Partner has any mental illness which requires help or supervision	3.58	6.30	90.12
Partner has mental health in the bottom quartile of SF-36 score	3.06	5.10	91.84

Table 2 –Distribution of SF-36 scores for individuals and partners

SF-36 Components	Individuals Mean (SD)	Partners Mean (SD)
Mental health	75.66 (16.20)	75.64 (16.22)
Role limitations due to personal or emotional problems	85.75 (30.60)	85.70 (30.66)
Vitality	60.57 (19.34)	60.55 (19.36)
Social functioning	84.37 (22.31)	84.33 (22.34)

Table 3 – Mental health conditions - % in the estimation sample

	Individuals	Partners
Any mental illness which requires help or supervision	1,030 (0.94%)	1,032 (0.95%)
A nervous or emotional condition which requires treatment	2,701 (2.48%)	2,710 (2.48%)

Table 4 – SF-36 – Mental health and vitality components

	Individual	Partners
Mental health		
Being a nervous person	8%	8%
Felt so down that nothing could cheer you up	4.7%	4.8%
Felt calm and peaceful	67.2%	67.2%
Felt down	7.8%	7.7%
Been a happy person	81.1%	81.4%
Vitality		
Have a lot of energy	61.6%	61.6%
Felt worn out	20.4%	20.4%
Felt full of life	69.3%	69.5%
Felt tired	28.7%	28.7%

Possible answers are: 1=all the time; 2=most of the time; 3= a good bit of the time; 4=some of the time; 5=a little of the time; 6 = none of the time. Binary variables = 1 if answers are = 1, 2, or 3.

Table 5- Independent variables

Characteristics	***Variable***
Major improvement in finances*	=1 if individual reports a major improvement in finances in the past year and a positive windfall income
Self-assessed and partner health*	5 groups (for individual and partner): excellent (omitted), very good, good, fair, poor
Education*	3 groups: University (or post-graduate) qualification (omitted) ; Certificate or Diploma; High School or lower qualification
Children in the household*	3 binary variables: age 0-4; 5-9; 10-14.
Employment status*	3 groups: employed (omitted), unemployed, out of the labour force
Remoteness*	3 groups: Major city (omitted); Inner Regional Areas; Outer Regional Areas (including remote and very remote Australia)
Life events*	Personal injury or illness
	Victim of physical violence
	Victim of property crime
	Serious illness of a family member
	Death of a close relative or family member
Partner's Long term health conditions**	Binary variables for the following conditions: Sight problems; hearing problems; speech problems; condition affecting arms; condition affecting legs; difficulty gripping things; blackouts of loss of consciousness; slow at understanding; any condition that restricts physical activity; any disfigurement or deformity; chronic or recurring pain; shortness of breath or difficulty breathing; long term effect resulting from a head injury; any other long term condition
Individual's coping strategies***	Binary variables for: involved in physical activity at least once a week; gets together with friends and/or relatives socially at least once a month; is member of a sport/hobby/community club; agrees (strongly or moderately) with the statement "I have many friends"; agrees (strongly or moderately) with the statement "When I need someone to help me out, I can usually find someone"; disagrees with the statement "I have no one to lean on in times of trouble".

*Covariates included in Specification 1; **Covariates included in Specification 2; ***Covariates included in Specification 3 (see section 4 for a discussion of the three specifications).

Table 6- Descriptive statistics of independent variables

Variable	Estimation sample
Fiunancial improvements (%)	3
Self-assessed health (individual)	
Excellent	10
Very Good	37
Good	37
Fair	13
Poor	3
Self-assessed health (partner)	
Excellent	10
Very Good	37
Good	37
Fair	13
Poor	3
Employment Status (%)	
Employed	68
Unemployed	2
Out of the L force	30
Educational Qualification (%)	
University (or post grad.) qualification	26
Certificate or Diploma	33
High School or Lower Education	41
Remoteness (%)	
City	61
Inner regional area	26
Outer regional area	13
Male (%)	47
Children 0-4 (%)	27
Children 5-9 (%)	23
Children 10-14 (%)	23
Life events (%)	
Personal illness or injury	8
Victim of violence	1
Victim of property crime	4
Death of a relative	11
Illness of a family member	15

Table 7- Results – The impact of partner's mental health on individual's life satisfaction

Partners' mental well-being (each model includes a different dependent variable)	**Specification 1**	**Specification 2**	**Specification 3**
Partner's SF-36 mental health score (standardised)	0.071 (0.005)***	0.070 (0.005)***	0.066 (0.005)***
N+	76,113	66,358	74,259
Partner's SF-36 vitality score (standardised)	0.068 (0.005)***	0.062 (0.006)***	0.067 (0.005)***
N+	75,062	65,141	72,973
Partner's role limitation due to emotional problems score (standardised)	0.032 (0.004)***	0.030 (0.004)***	0.031 (0.004)***
N+	86,046	75,114	83,791
Partner's social functioning score (standardised)	0.033 (0.005)***	0.030 (0.005)***	0.032 (0.005)***
N+	73,302	63,796	71,474
+ All samples exclude individuals in the bottom quartile of SF-36 respective scores			
Partner SF-36 scores components^			
Mental health (all components in one model)			
Been a nervous person	0.013 (0.016)	0.009 (0.017)	0.011 (0.016)
Felt so down in the dumps that nothing could cheer up	-0.070 (0.022)**	-0.059 (0.023)**	-0.061 (0.022)**
Felt calm and peaceful	0.047 (0.009)***	0.043 (0.009)***	0.046 (0.009)***
Felt down	0.010 (0.017)	0.004 (0.018)	0.013 (0.017)
Been a happy person	0.058 (0.012)***	0.063 (0.012)***	0.058 (0.012)***
N (excl. indiv. in in bottom quartile of SF-36 mh score)	75,247	65,644	73,436
Vitality (all components in one model)			
Have a lot of energy	0.025 (0.009)***	0.018 (0.010)*	0.025 (0.010)**
Felt worn out	-0.019 (0.011)	-0.005 (0.012)	-0.014 (0.012)
Felt full of life	0.068 (0.010)***	0.067 (0.011)***	0.066 (0.011)***
Felt tired	-0.018 (0.011)*	-0.023 (0.011)**	-0.021 (0.011)*
N (excl. indiv. in bottom quartile of SF-36 vitality score)	74,359	64,561	72,308

Notes: Independent variables by specifications are reported in Table 5. (see section 4 for a discussion of the three specifications).
^ Possible answers are: 1=all the time; 2=most of the time; 3= a good bit of the time; 4=some of the time; 5=a little of the time; 6 = none of the time. Binary variables = 1 if answers are = 1, 2, or 3.
Standard errors are in brackets * indicates that the underlying coefficient is significant at 10% level, ** at 5% and ***at 1%.

Table 8 – Results – Impact of partner's poor mental health on individual's life satisfaction

Partner poor mental health	**Specification 1**	**Specification 2**	**Specification 3**
Partner has low mental health	-0.092	-0.088	-0.085
(bottom quartile of SF-36 score)	(0.009)***	(0.009)***	(0.009)***
Financial improvements	0.085	0.080	0.085
	(0.018)***	(0.018)***	(0.018)***
N (excl. indiv. in bottom quartile of SF-36 mh score)	76,113	66,358	74,259
Partner has a long-term mental illness which requires help or supervision	-0.114	-0.106	-0.110
	(0.039)***	(0.039)***	(0.039)***
Financial improvements	0.113	0.113	0.110
	(0.018)***	(0.018)***	(0.018)***
N (excl. indiv. with lt ment. illness)	93,981	93,981	91,295
Partner has a long-term nervous or emotional condition which requires treatment	-0.070	-0.061	-0.069
	(0.025)***	(0.025)**	(0.025)***
Financial improvements	0.110	0.110	0.107
	(0.018)***	(0.018)***	(0.018)***
N (excl. indiv. with long term emotional cond.)	92,307	92,307	89,692

Notes: Independent variables are reported in Table 5. Standard errors are in brackets * indicates that the underlying coefficient is significant at 10% level, ** at 5% and ***at 1%

Table 9 - Results – CIV of Partner's poor mental health

Partner mental health measure	*Coeff. Poor mental health*	*Coeff. Financial improvement*	*CIV Ratio*	*CIV Value (A$)*
Poor mental health	-0.092	0.085	1.08	80,724
LT mental illness	-0.114	0.113	1.00	74,745
LT nervous or emotional condition	-0.070	0.110	0.64	47,837

Table 10– Adaptation and partner mental illness (estimation with Specification 1)

Partner has a long-term mental illness which requires help or supervision at time t	-0.120 (0.038)***	-0.125 (0.046)***
Past condition (from t-1 to t-3)	-0.218 (0.073)***	-0.229 (0.089)***
Mental illness t*Past Condition (from t-1 to t-3)		0.029 (0.129)
Financial improvements	0.113 (0.018)***	0.113 (0.018)***

Note: Standard errors are in brackets + indicates that the underlying coefficient is significant at 10% level, * at 5% and **at 1%. Other independent variables are listed in Table 5.

Table 11– Adaptation and partner mental emotional condition (estimation with Specification 1)

Partner has a long-term nervous or emotional condition which requires treatment at time t	-0.071 (0.024)***	-0.112 (0.030)***
Past condition (from t-1 to t-3)	-0.098 (0.043)***	-0.177(0.055)**
Emotional condition t*Past condition (from t-1 to t-3)		0.189 (0.078)**
Financial improvements	0.110 (0.018)***	0.109 (0.018)***

Note: Standard errors are in brackets + indicates that the underlying coefficient is significant at 10% level, * at 5% and **at 1%. Other independent variables are listed in Table 5.

Appendix

Table A1 – Results – The impact of other independent variables on life satisfaction (Estimation of the impact of partner's low mental health-bottom SF-36 mh score- see Table 8)

	Specification 1		**Specification 2**		**Specification 3**	
Financial improvement	0.081***	(0.018)	0.081***	(0.019)	0.081***	(0.018)
Individual health:						
Very good	-0.168***	(0.012)	-0.159***	(0.013)	-0.163***	(0.012)
Good	-0.334***	(0.014)	-0.318***	(0.015)	-0.323***	(0.014)
Fair	-0.537***	(0.020)	-0.500***	(0.021)	-0.522***	(0.020)
Poor	-0.912***	(0.044)	-0.901***	(0.046)	-0.917***	(0.044)
Partner health:						
Very good	-0.022*	(0.013)	-0.022	(0.014)	-0.024*	(0.013)
Good	-0.064***	(0.015)	-0.052***	(0.016)	-0.066***	(0.015)
Fair	-0.145***	(0.019)	-0.127***	(0.020)	-0.149***	(0.019)
Poor	-0.263***	(0.032)	-0.250***	(0.035)	-0.273***	(0.033)
Unemployed	-0.062**	(0.027)	-0.073**	(0.029)	-0.074***	(0.028)
Out of the labour force	0.113***	(0.012)	0.107***	(0.013)	0.111***	(0.012)
Inner regional areas	0.018	(0.021)	-0.011	(0.023)	0.018	(0.021)
Outer regional areas	-0.016	(0.029)	-0.030	(0.032)	-0.005	(0.030)
Certificate or Diploma	-0.079*	(0.047)	-0.119**	(0.050)	-0.083*	(0.047)
High school or lower qualification	0.040	(0.047)	-0.023	(0.051)	0.045	(0.047)
N. children 0-4	-0.014*	(0.007)	-0.027***	(0.008)	-0.009	(0.008)
N. children 5-9	-0.035***	(0.007)	-0.036***	(0.008)	-0.035***	(0.007)
N. children 10-14	-0.024***	(0.007)	-0.031***	(0.008)	-0.023***	(0.007)
Victim of violence	-0.069	(0.049)	-0.076	(0.050)	-0.087*	(0.049)
Victim of property crime	-0.067***	(0.018)	-0.068***	(0.018)	-0.070***	(0.018)
Death of a relative	-0.027***	(0.010)	-0.017*	(0.010)	-0.031***	(0.010)
Personal illness	-0.042***	(0.014)	-0.035**	(0.014)	-0.041***	(0.014)
Illness in the family	-0.015	(0.009)	-0.005	(0.009)	-0.018*	(0.009)
Partner LT conditions:	n.a.				n.a.	
Sight	n.a.		-0.015	(0.028)	n.a.	
Hearing	n.a.		0.028	(0.022)	n.a.	
Speech	n.a.		-0.037	(0.077)	n.a.	
Blackouts	n.a.		-0.001	(0.062)	n.a.	
Understanding	n.a.		-0.085	(0.052)	n.a.	
Condition affecting arms	n.a.		-0.019	(0.028)	n.a.	
Difficulty gripping things	n.a.		0.018	(0.029)	n.a.	
Condition affecting legs	n.a.		0.016	(0.022)	n.a.	
Physical restriction	n.a.		-0.005	(0.016)	n.a.	
Disfigurement	n.a.		-0.187***	(0.065)	n.a.	

Shortness of breath	n.a.	-0.044	(0.027)	n.a.	
Chronic pain	n.a.	-0.022	(0.018)	n.a.	
Restrictive condition	n.a.	-0.009	(0.008)	n.a.	
Head injury	n.a.	0.004	(0.052)	n.a.	
Other condition	n.a.	0.025	(0.017)	n.a.	
Coping strategies for the individual:	n.a.	n.a.			
Member of sport/hobby/community club	n.a.	n.a.		0.019**	(0.009)
Physical activity at least once a week	n.a.	n.a.		0.043***	(0.009)
Gets together socially at least once a month	n.a.	n.a.		0.048***	(0.013)
Many friends	n.a.	n.a.		0.060***	(0.008)
I can find someone to help me	n.a.	n.a.		0.089***	(0.011)
I have someone to lean on in times of troubles	n.a.	n.a.		0.048***	(0.011)
N	76,113	66,358		74,259	

Note: Standard errors are in brackets * indicates that the underlying coefficient is significant at 10% level, ** at 5% and ***at 1%.

Table A2– Determinants of financial improvements

Total household Income	-0.000 (0.000)*
Personal illness	0.001 (0.002)
Long term conditions	0.000 (0.001)
Education – Certificate or Diploma	0.002 (0.004)
Education – High school or lower qualification	-0.004 (0.004)
Victim of violence	0.006 (0.005)
Victim of property crime	0.000 (0.002)
Death of a relative	0.032 (0.002)**
Unemployed	0.004 (0.003)+
Out of the labour force	0.001 (0.002)
Has children between 0 and 4	-0.000 (0.001)
Has children between 5 and 9	0.001 (0.001)
Has children between 10 and 14	-0.002 (0.001)
Inner regional area	-0.006 (0.003)*
Outer regional area (incl. remote)	-0.011 (0.004)**

*Note: Standard errors are in brackets * indicates that the underlying coefficient is significant at 10% level, ** at 5% and ***at 1%.*

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