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Title: **The impact of suicidality on health-related quality of life:**

A latent growth curve analysis of community-based data

A.K. Fairweather-Schmidt[1,5], P.J. Batterham[2], P. Butterworth[3,4,5], & S. Nada-Raja[5]

[1]Flinders University, Adelaide, South Australia

[2]National Institute for Mental Health Research, Research School of Population Health, The Australian National University, Canberra, Australian Capital Territory

[3]Centre for Mental Health, Melbourne School of Population and Global Health, the University of Melbourne

[4]Melbourne Institute of Applied Economic and Social Research, the University of Melbourne, Victoria, Australia

[5]Centre for Research on Ageing, Health and Wellbeing, The Australian National University, Canberra, Australian Capital Territory

[6]Department of Preventive and Social Medicine, University of Otago, New Zealand

Running Head: Suicidality and quality of life

Address correspondence to: Dr Kate Fairweather-Schmidt, School of Psychology, Flinders University, GPO Box 2100, Adelaide, South Australia, 5001, Australia; Phone +61-8-82012318; Fax: +61-8-8201-3877; Email: Kate.Fairweather-Schmidt@flinders.edu.au

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Abstract

Objective: The subjective burden of suicidality on mental and physical health-related quality of life (HRQoL) remains to be examined. Eight-year trajectories of mental and physical components of HRQoL were compared for suicidal and non-suicidal participants at baseline. The effect of poor mental and/or physical HRQoL on subsequent suicidality was also investigated.

Method: Randomly-selected community data (W1=7,485; W2=6,715; W3=6,133) were analysed with multivariate latent growth curve (LGC) and logistic regression models.

Results: Adjusted LGC modelling identified that baseline ideation was associated with poorer mental, but better physical HRQoL at baseline (b=-3.93, 95% CI=-4.75 - -3.12; b=1.38, 95% CI=0.53-2.23, respectively). However, ideation was associated with a declining physical HRQoL trajectory over 8 subsequent years (b=-0.88, 95% CI=-1.42 - -0.35). Poorer mental HRQoL was associated with higher odds of ideation onset (OR=0.98, 95% CI=0.96-0.99).

Limitations: Frequency of data collection was four-yearly, while suicidality was reported for the previous 12-months; analyses did not control for physical health problems at baseline, baseline depression may have influenced physical QoL; suicidality was assessed with binary measures; and, prior analyses of attrition over time showed those with poorer health were less likely to continue participating in the study.

Conclusions: Suicidality has differential longitudinal effects on mental and physical HRQoL. Findings emphasise the considerable subjective HRQoL burden upon suicidal individuals. HRQoL may be useful to compare relative social and economical impacts.

Key words: suicidal ideation, suicide attempt, health-related quality of life, longitudinal, physical health, mental health.

Suicide and suicidal behaviour exacts a heavy toll, most keenly on suicidal individuals themselves, but family members, friends, local community, and employers also bear social and emotional weights. Evidence of both the loss associated with and burden of self-harm upon the community is clearly apparent. Here, we define self-harm as self-inflicted injuries regardless of intent, inclusive of suicide, suicide attempts whether or not resulting in death (Harvard Initiative for Global Health, 2009) and suicidality as the spectrum covering suicidal thoughts, suicidal behaviours and suicide death. Suicidality has the *fourth* highest position (behind ischemic heart disease, lung cancer and cerebrovascular disease; Institute for Health Metrics and Evaluation, 2015) among the top ten causes of premature mortality per 100,000 people in Australia (445.2 years of life lost [YLL], all ages) and New Zealand (512.0 YLL) and fourth highest in the US (511.7 YLL; GBD 2013 Mortality and Causes of Death Collaborators).

Over the last fifteen years, researchers and policy makers have become increasingly interested in comparing the impact of disorders and/or diseases, but the aforementioned comparison of disorders/conditions based on premature mortality (YLL) overlooks the non-fatal disease burden of morbidity. Prevailing diagnostic processes (i.e., DSM-5/ICD-10) have made it difficult to compare the experience and impairments of individual disorders or diseases. This is because the respective symptoms and effects are described in disease/disorder-centric terms (Cook and Harman, 2008). In order to address this limitation, other measures, such as Quality Adjusted Life Years (QALYs) and Disability Adjusted Life Years (DALYs) and other metrics such as those used by GBD project, have been used. Alternatively, in more recent years, research has begun to routinely consider both objective measures of impairment (i.e., impact on work, days out of role, impact on social life, visits to the doctor) and the notion of subjective wellness/quality of life, particularly health-related quality of life (HRQoL). The chief benefit of such concepts relates to the provision of a common metric which can be applied to any disease or disorder, permitting comparison of symptoms or impacts beyond the boundaries of specific health

states (Spitzer et al., 1995; Cook and Harman, 2008). One example of the application of HRQoL (operationalised as unhealthy days per month) was the comparison of perceived health and quality of life of chronic medical conditions (diabetes, back/neck problems, and hypertension) and mental health conditions (depression, anxiety, or emotional problems; Cook and Harman, 2008). Results highlighted that the level of disability and impairment associated with mental health problems (17.6 unhealthy days/month) surpassed physical medical conditions (12.2-12.3 unhealthy days/month). Subsequent multivariate regression modelling adjusting for demographic and comorbid conditions were then able to further confirm the robustness of the significant impact of mental health problems on HRQoL.

Such useful attributes of a common metric have now made the HRQoL a popular concept in healthcare settings. As Miller (1996) highlights, HRQoL is helpful in health contexts as it considers health as an intrinsically continuous process, differentiating it from categorical diagnostic criteria often ill equipped to identify interval-level change in functioning – that is, change on a continuum, which is particularly relevant to sub-clinical circumstances. Moreover, objective assessments cannot fully account for an individual's subjective experience (Engel et al., 2009). Further evidence of the utility of the HRQoL concept is provided by the significant numbers of studies now utilising the Medical Outcomes Studies (MOS) Short-Form Scales (MOS SFS; e.g., SF-12, SF-36 REF). The MOS SFS group of measures are cited as being the most universally used generic HRQoL measure (Jenkins et al., 2011), and include mental and physical HRQoL subscales. This separation of mental and physical domains allows simultaneous appraisal of change in subjective mental and physical health over time – HRQoL facets likely to possess different profiles over time. For example, Fairweather-Schmidt and colleagues (2015) investigated the longitudinal impact of disordered eating among midlife women (aging between 45-50 to 59-64 years) using the SF-36, demonstrating those with disordered eating had reduced mental rather than physical quality of life over time.

However, while studies relating to quality of life/functional impairment have rapidly increased, very few have investigated HRQoL among those experiencing suicidal thoughts and behaviours. This is surprising for at least two reasons: suicidal ideation is not uncommon, with a recent non-clinical population-based study identifying 8.2% of participants experiencing ideation in the previous 12 months (Fairweather et al., 2007); and, suicidal ideation and attempts are most common earlier in life, during the teenage years/early adulthood, conveying a lifetime diathesis for further suicidality (O'Connor et al., 2013; Suominen et al., 2004) with probable lifelong impacts on functioning. This is borne out by most suicide deaths occurring in midlife, which is a time of key economic productivity to community and crucial responsibilities to family. Each one of these reasons emphasises the importance of better understanding factors associated with and underpinning non-fatal suicidality.

One rare HRQoL study focusing on suicidality employed a disability-weighting approach to measure the impact of suicidal ideation and attempt and compare levels of impairment with 10 other health states (estimated in previous studies) with a visual analogue scale (VAS; van Spijker et al., 2011). Results indicated that the disability weights for suicidal ideation were equivalent to the disability experienced by other psychiatric disorders, including alcohol dependence and cocaine dependence (Smit et al., 2008). In relation to somatic disorders, suicidal ideation was comparable with severe asthma, and moderate heart failure (Stouthard et al., 1997), while non-fatal suicide attempts were similar to disability experienced by the early stages of Parkinson's Disease. These findings serve to highlight the significant burden of suicidality made clear by the translation into a comparative framework that is more easily understood and interpreted.

Another recent study has used data from involving a population-representative birth cohort to investigate whether suicide attempt may be used as a signal for later poor health (e.g., depression, substance dependence, metabolic syndrome) and social functioning outcomes, including unemployment and satisfaction with life (Goldman-Mellor et al., 2014). In addition to

highlighting persistently poorer mental and physical health, adjusted models indicated those who attempted suicide prior to age 24 years reported engaging in more violence, needing more welfare support, and indicated they were significantly less satisfied with their lives when assessed again at age 38 years. However, while van Spijker et al., (2011) and Goldman-Mellor et al., (2014) provide information of great value, to our knowledge no study has investigated HRQoL using self-reported data derived from a community-based sample.

Currently, surprisingly little is known of the HRQoL differences between those experiencing suicidal thoughts and/or suicide attempts and those who have not, or whether there are differences in respective longitudinal HRQoL trajectories. It also remains unclear as to whether poor HRQoL conversely is associated with increased risk of suicidality over time. MOS SFS data, including both mental and physical components of QoL, derived directly from those who have experienced suicidality would provide greater insight into the burden and personal impact of non-fatal suicidality. Thus, the purpose of the current study is to investigate three main objectives in a large community-based longitudinal cohort. First, using a population standardised (M=50) measure of mental (MCS) and physical (PCS) quality of life (i.e., SF-12), to determine whether individuals with suicide ideation or attempt have poorer HRQoL than those without ideation or attempts; second, to investigate whether those reporting suicide ideation or attempt have disparate HRQoL trajectories relative to those who report no suicidality; and third, to identify whether poorer HRQoL is associated with increased risk of subsequent onset of suicidal thoughts or attempts, that is, testing whether the association between suicidality and quality of life is potentially bidirectional.

METHOD

Participants and procedure

The PATH Through Life Project is undertaken at the Centre for Research on Ageing, Health and Wellbeing, The Australian National University (Anstey et al., 2012). The PATH Survey is a longitudinal study and the project protocol involves re-interviewing participants every four years from 1999 until 2019. The original aims of the study were to (a) describe the course of depression, anxiety, substance use and cognitive capacity as individuals; (b) to distinguish environmental and genetic risk factors impacting individual-based factors and characteristics; and (c) to investigate associations across time between the domains of depression and anxiety, substance use, and cognitive ability and dementia (Anstey et al., 2012, p. 1). Participants were initially identified via a random sample from the Australian Electoral Roll, where enrolment is compulsory. All prospective participants for the PATH survey were residents of either Canberra (Australian Capital Territory; ACT) or the neighbouring town of Queanbeyan (New South Wales; NSW). Inclusion criteria required individuals to be aged in one of three age brackets at baseline (Wave 1) 20–24, 40–44 or 60–64, and to be proficient in English to engage and respond to the interview process. Full survey methodology has been published elsewhere (Anstey et al., 2012), however, in précis, participants agreeing to take part in the project were assessed in their home or at The Australian National University. The majority of the baseline interview was self-completed on a laptop computer using computer-assisted personal interviewing software. Approval of The PATH Through Life Project protocol (No. M9807) was first granted by The Australian National University Human Research Ethics Committee on 22nd September 1998.

The present study incorporated data derived from Waves 1-3. At Wave 1 (commenced 1999, completed 2002), participation rate was 58.6% for those aged 20-24 (the 20s group; n=2,404), 64.4% for 40-44 year olds (the 40s group; n=2,530) and 58.3% for 60-64 year olds (the 60s group; n=2,551). Wave 2 (commenced 2003, completed 2006) retained 89.0% of the 20s

group (n=2,139), 93.0% of the 40s group (n=2,354), and 87.1% of the 60s group (n=2,222). At Wave 3 (commenced 2007, completed 2010), the high participation rate (88.8%-92.7%) maintained by the PATH project resulted in only a small reduction in sample sizes across the three age groups (20s group n=1,978; 40s group n=2,182; and, 60s group n=1,973).

Measures

Suicide ideation and attempt. The two outcome measures of (active) suicide ideation and suicide attempt were derived from items 3 and 5 of the Psychiatric Symptom Frequency scale (Lindelow et al., 1997). Ideation was established by asking, "In the last year have you ever thought about taking your own life?". If participants responded affirmatively to this question, they continued on to the suicide attempt item: "In the last year have you ever attempted to take your own life?". Participants responded to both items using a binary response format (yes/no). As current research suggests only a very small fraction of suicidal behavior occurs in the absence of suicide ideation (De Leo et al., 2005), it is unlikely that impulsive attempters were excluded by the 'gated' format of the PATH questionnaire.

Depression and anxiety symptoms. Symptoms of depression and anxiety were measured with the Goldberg depression and anxiety scales, where each scale consisted of nine items each establishing the presence or absence of depressive (e.g., *"have you lost interest in things?")* and anxiety symptoms over the past month (e.g., *"have you been worrying a lot?"). Respective* items were coded 0=No and 1=Yes and summed to produce a total symptom score for each disorder (Goldberg et al., 1988). Higher scores indicate greater probability of clinically important depressive and anxiety symptoms. Symptom scores from the Goldberg depression and anxiety scales have a strong association with presence of major depression and generalised anxiety disorder, with sensitivity at specified cut points of 85% and 82%, respectively, and combined specificity of 91% for absence of psychiatric disorder (Goldberg et al., 1988). Internal consistency was adequate for both the depression (Cronbach $\alpha = 0.78$) and anxiety (Cronbach $\alpha =$

0.81) scales in the present sample. Age group and gender were entered as covariates into every analyses.

Quality of life. The Mental and Physical Component Scales (MCS and PCS) of the SF-12 (Ware et al., 1996) were used as indicators of mental and physical QoL at each survey. Higher scores indicated better mental or physical QoL. Australian norms (Australian Bureau of Statistics [ABS], 1997) were used to standardise scores (mean=50, SD=10 in the Australian general population). Items assessed, for example, if participants had experienced a range of problems in relation to their work or other normal activities due to emotional problems, or pain over the previous four weeks. Reponses were binary (i.e., yes/no) or made on a Likert-type scale (*not at all*=1 to *extremely*=5). The SF-12 has been shown to accurately assess health-related quality of life in longitudinal studies relative to longer instruments (Gandek et al., 1998; Jenkinson et al., 1997).

Statistical Analyses

Latent growth curves were fit to these data, estimating the level (intercept) and slope of mental and then physical quality of life based on both suicide ideation and suicide attempt at baseline. Growth models can be undertaken using two main approaches: first, using multilevel random-effects analysis, or second, using structural equation modelling methodology to represent random effects as growth factors in a latent variable model (Muthén, 2004). The latter approach was used here, with latent growth models characterising individual level data by an initial or baseline level of performance latent factor (level/intercept) and a rate of change factor (slope), in addition to error (also referred to as residuals, assumed to be normally distributed). Benefits of growth modelling reside in accommodation of missing, unequal and/or correlated individual observations, and individual differences in rates of change (Muthén, 2004). Use of a Robust Maximum Likelihood (MLR) estimation technique enables parameters estimates to be derived from all available data, permitting inclusion of cases with missing data. Growth models

accommodate missing data by placing more weight on those observations with fewer missing data points (Curran, Obeidat and Losardo, 2010). Importantly, the ML technique assumes that data are missing at random. The robust estimator conservatively allowed for violations from normality assumptions by estimating standard errors using a sandwich estimator.

Two latent growth models were estimated to determine the role of suicidal ideation or suicide attempt at baseline on mental and then physical quality of life, using Mplus (version 6.12) that estimates models from all available data. The growth models estimated the intercept (initial level) and slope (change over time) for the quality of life measure, using random effects to account for individual difference in change (Muthén & Muthén, 1998-2010). The models simultaneously estimated the effect of baseline suicidal ideation and attempt on both intercept and slope of quality of life, to assess whether the suicide variables had a cross-sectional or longitudinal impact on quality of life. Residual variances of MCS and PCS were estimated and permitted to vary across time, and coefficients of the intercept growth factor were fixed at 1. The models were also adjusted for age group (20s vs 40s; 20s vs 60s), gender (Males = 0; Females = 1) depression symptoms and anxiety symptoms (described above). Participants who had missing baseline predictor data (specifically depression/anxiety symptoms or suicidal ideation/attempt) were excluded from analyses (n = 62), with 7,421 participants contributing to the models. Adjusted effect sizes were calculated as the difference in MCS/PCS scores (or change in MCS/PCS) between those with suicidal ideation/attempt and those without, divided by the standard deviation of baseline MCS/PCS scores.

The final analyses involved two multivariate logistic regressions using SPSS (version 20) to determine the independent contributions to either suicidal ideation or suicide attempt at Wave 2 of mental and physical quality of life at Wave 1, among participants reporting no suicidal ideation or suicide attempt at Wave 1. Both models controlled for age group, gender, and depressive and anxiety symptoms. Participants with missing baseline data (n = 62), participants reporting

suicidal ideation/attempt (n = 609 and n = 60 respectively) and/or those without Wave 2 suicide data due to attrition (n = 829) were excluded from these analyses, with sample sizes of n = 6,088 and n = 6,558 for the logistic regression models for ideation and attempts, respectively. As the longitudinal study used a narrow age-band cohort, interaction effects of age group were tested in supplementary analyses to provide further information as to whether findings were consistent across age groups. Where significant interaction effects were found, models within specific age groups were re-estimated.

RESULTS

Sample characteristics detailing age group, gender, marital status, education, mental health and mental and physical QoL for Wave 1 (baseline) are presented in **Table 1**. Trends were evident for age group: active ideation and attempts were predominantly issues for youngest cohort, attenuating with increasing age. No gender differences were observed. A greater proportion of participants experiencing ideation and attempts indicated never being married (which may have been an artifact of the age group). Both those with active ideation and attempts had significantly elevated symptoms of depression and anxiety. Notably, those reporting active ideation or suicide attempt were found to have significantly attenuated mental QoL (i.e., SF-12 mental score) compared to participants reporting no suicidality (M=39.30 and 35.59 vs. 51.34, respectively), although physical QoL was not significantly different across groups. As expected, there were significant decrements ($F_{2, 7437} = 219.2$, $p < 0.001$) in physical QoL across the lifespan: M=53.0 (SD=6.8) in the 20s, M=51.6 (SD=8.0) in the 40s and M=48.1 (SD=10.2) in the 60s. In contrast, mental QoL was significantly higher ($F_{2, 7437} = 371.0$, $p < 0.001$) later in life: M=47.1 (SD=10.5) in the 20s, M=49.4 (SD=9.8) in the 40s and M=54.2 (SD=7.9) in the 60s.

Association of baseline suicidality with mental and physical quality of life

Results for adjusted latent growth models (covarying depression and anxiety symptoms, age group and gender) are reported in **Table 2** (MCS) and **Table 3** (PCS). Both models had excellent fit based on having Root Mean Square Error Of Approximation (RMSEA) < 0.08, with RMSEA = 0.05 for both models. At baseline (i.e., intercept), participants with suicidal ideation had poorer mental QoL (Cohen's d = 0.40, p<0.001) than those without, but contrastingly had better physical QoL (Cohen's d = 0.16, p<0.001). A post hoc analysis further explored this latter finding by considering the association with depression; it indicated that depression had a key influence on PCS at baseline, demonstrated by contrasting groups with a) no ideation, low depression; b) no ideation, high depression; c) ideation, low depression; and, d) ideation, high depression (**Figure 1**, PCS W1). Highest physical QoL was reported by those reporting no ideation and low depression (i.e., a), while lowest physical QoL was among participants without ideation but reporting high depression (b). There were no significant differences, however, for mental or physical QoL at baseline between those who had attempted suicide and those who had not.

However, tests for interactions between age group and suicidality revealed a significant age group by *suicide attempt* effect for initial (i.e., intercept) PCS and MCS. Specifically, presence of a suicide attempt in the 40s age group was associated with a pronounced reduction in PCS (p < 0.001), and a notable reduction for MCS (p = 0.036), compared to the 20s age group. Contrastingly, in the 60s age group, presence of a suicide attempt was associated with less attenuation of PCS relative to the 20s age group (p = 0.012), but no significant differences for MCS (p = 0.708). The negative effect of *suicidal ideation* on initial MCS, nevertheless, remained consistently significant across all age groups (p < 0.001 for 20s; p < 0.001 for 40s, p = 0.001 for 60s), while the effect of ideation (i.e., associated with better physical QoL noted and explored

above) on initial PCS was only significant among the youngest age group (p = 0.005 for 20s; p = 0.235 for 40s; p = 0.776 for 60s).

Association of baseline suicidality with mental and physical quality of life over time

Table 2 (MCS) and **Table 3** (PCS) also provide results for modelling trajectory change over the subsequent eight years (i.e., slope). Overall there were no statistically significant changes in mental QoL trajectories over the successive waves associated with suicidal ideation or attempts (**Figure 2**, panels a and b). Importantly, while some slopes are suggestive of improvement after initial suicidal episodes at baseline, post hoc t-tests showed mental QoL was still significantly poorer among all individuals initially reporting suicide ideation or attempt, and remained so over subsequent waves ($p<0.001$ for all t-test comparisons).

Among participants reporting suicidal ideation at baseline, physical QoL was found to decline over time (**Table 3**, Cohen's d = 0.10, p=0.001; **Figure 2** panel c and d). A further post hoc test revealed that, although there was no difference in physical QoL initially, the PCS of people experiencing ideation/attempt had significantly deteriorated by Wave 2 (p = 0.001 and p = 0.014, respectively) and continued to do so (Wave 3, p = 0.001 for both ideation/attempt) relative to their non-suicidal counterparts. No significant age group by suicidality interactions were found for the slope estimates, inferring these effects were consistent across age groups.

Prediction of suicidality onset at Wave 2 from quality of life scores at baseline

Among those reporting no suicidality at baseline, logistic regression analyses identified poorer mental QoL was associated with greater likelihood of suicidal ideation onset at Wave 2 (**Table 4**). No significant interactions between age group and QoL were found, suggesting effects were consistent across age groups. No significant effects of physical or mental QoL were observed for subsequent suicide attempts (**Table 5**).

DISCUSSION

Despite that fact that suicide is a key contributor to global disease burden and years of life lost to communities and economies, to our knowledge, no study using community-based data (or otherwise) has sought to investigate the cross-sectional or longitudinal relationship between suicidality and quality of life. Thus, the first study objective was to determine whether individuals with suicide ideation or attempt at baseline had poorer HRQoL on indices of mental and physical quality of life (SF-12).

Initial descriptive statistics identified that mental HRQoL was markedly lower for those reporting ideation (M=39.30) or attempt (M=35.59) relative to those not experiencing suicidality (M=51.34). Further, based on previous data, mental HRQoL among people reporting suicidality was six to ten points lower among suicidal individuals than those suffering serious illnesses (e.g., stroke, M=45.9, cancer M=46.8, diabetes=46.7), although similar to individuals experiencing depression (M=33.9) or 'nervousness' (M=37.7; ABS, 1997). Adjusted latent growth models confirmed initial analyses, indicating that mental HRQoL was indeed poorer at baseline (i.e., intercept) among participants experiencing suicidal ideation, possessing a moderate effect size. Prior research has suggested that, although related to depression, suicidality is an independent construct (e.g., Fairweather-Schmidt et al., 2009). As our models adjusted for symptoms of depression and anxiety (which may account for a lack of gender differences for the present results), our findings further demonstrate that suicidality attenuates mental quality of life beyond the influences of depression and anxiety.

It was somewhat unexpected that our models indicated participants who reported ideation at baseline rated their physical HRQoL more highly than their non-ideating counterparts, although the effect was relatively small (interactions analyses suggested that this was

predominantly driven by 20s group). As there is building evidence that poor mental health (i.e., depression) is associated with broader physical impacts and vice versa (e.g., through inflammatory processes; Anisman, 2009), we conducted post hoc analysis contrasting high and low depression among those with and without ideation. These revealed that the adjustment for depression was linked to the reduction in physical HRQoL, that is, participants with high depression (with or without suicidal ideation) had lower physical QoL. However, our latent growth models controlled for age cohort, gender, depression, and anxiety; tests for age group by suicidality interactions found the effect of suicidal attempts on higher initial baseline PCS was significantly reduced for younger adults, relative to mid-life and late-life adults. This suggests that while there appears a link among younger adults, such an association was not observed in the 40s and 60s, which may reflect limited power (related to low frequency of attempts) to detect such effects within age groups, or a weakening of the association over the life span. Similar impacts of mental and physical health (in relation to younger versus older age) have previously been observed in depression (Aneshensel et al., 1984; Bijl and Ravelli, 2000).

The second study objective sought to investigate whether mental and physical HRQoL trajectories of those with suicide ideation or attempt were distinguishable from those without suicidality. The adjusted latent growth model estimates of slope (i.e., over a period of eight years) suggested that mental HRQoL did not significantly improve over time for suicidal participants (ideation vs. none; attempt vs. none) relative to those not suicidal, with significantly lower mental HRQoL among individuals who were initially suicidal being sustained across at all time points. By contrast, physical HRQoL deteriorated marginally (small effect) among individuals who were initially suicidal, indicating that suicidality had a detrimental effect on subsequent physical HRQoL. The divergent findings of poorer initial mental HRQoL improving over time, but physical HRQoL commensurate although deteriorating over time are novel, suggests different pathways of mental and physical health outcomes for suicidal individuals. Existing research

provides clear evidence for the relationship between physical functioning and suicidality (Fairweather et al., 2006; Fairweather et al., 2007; Goodwin et al., 2003a; Goodwin et al., 2003b; Goodwin and Marusic, 2011) but the majority of studies examines cross-sectional associations or pertains to populations with existing depression, physical illness or functional disability. Given that there is a significant literature base demonstrating the link between poor perceived health and suicidality, our results also suggest this relationship may operate bi-directionally, each increasing the risk of subsequent deterioration in perceived physical HRQoL and potentially increasing the likelihood of suicidality.

The final study objective examined whether a bidirectional association may operate between poorer mental and poorer physical HRQoL and suicidality. Multivariate logistic models revealed that among those reporting *no ideation* or *attempt* at baseline, subsequent suicide ideation four years later was significantly more likely among those with lower mental HRQoL scores. However, contrary to speculation (e.g., Goodwin and Marusic, 2011), there was no equivalent bidirectional relationship between physical HRQoL and suicidality.

This paper has a number of implications pertinent to research, clinical and public policy applications. First, mean mental and physical HRQoL scores among those who report suicidality in this study are supported by and broadly consistent with extant findings for related conditions (e.g., depression, anxiety; ABS, 1997). Second, results help quantify the extent of HRQoL impairment associated with experiencing suicidality and enable comparisons with other diseases and conditions. Third, information concerning the longitudinal impact of suicidality on HRQoL is hoped to simultaneously alert clinicians and policy makers as to the long-term impact of suicidality on life quality, and, while HRQoL effects are predominately in the mental domain, there is also a notable relationship with physical functioning. In view of these findings, both social and economic burdens need to be determined to facilitate informed policy decisions, and improved allocation of public health resources (Cook and Harman, 2008). Further, as extant

research identifies the connection of HRQoL with work productivity (e.g., Bouwman et al., 2014), these results may permit movement beyond deriving health care costs of ideation and attempts to the community, by extending the potential for more broadly modelling the economic impact of work productivity loss.

While data for this study were derived from a large, community-based cohort study, which was representative across gender and three pivotal periods during the adult lifespan, there are a number of limitations need to be considered in relation to findings of this study. First, as indicated, data were derived from an existing longitudinal project, thus variables utilised in this study were limited by those available in the project dataset. Second, suicidality (ideation and also attempts) was determined by presence or absence of suicidality in the 12 months prior to survey completion, and assessments were done every four years. Thus, it is possible that some participants were not identified as experiencing suicidality due to suicidal thoughts and behaviours occurring between data collection points but not in the 12 months immediately prior to a data collection point, thus our findings can be considered conservative. Third, suicidality was only assessed using binary measures that do not allow direct examination of severity (i.e., duration, frequency). Fourth, the study did not control for physical health problems at baseline, which may covary with mental health issues and relate to current and subsequent QoL. Fifth, it is possible that baseline depression influenced reporting of physical QoL. Sixth, prior analyses of attrition over time show that the cohort is becoming healthier at each successive wave (i.e., people who are suicidal are more prone to drop out). However, this suggests that current findings may be reporting a more conservative effect than may actually be the case. Seventh, our use of three waves of data was not sufficient to test for non-linear changes over time. Further investigation of quadratic change in datasets with additional time-points may be necessary to assess whether changes in health are more robustly modelled under quadratic assumptions. Last,

data were drawn from an Australian community sample, and with exception to other Western cultures, it is unknown whether the present findings are reliably generalisable to other populations.

This is the first study to investigate HRQoL among those reporting suiciality using a commonly utilised, reliable measure enabling comparison with other mental and physical health conditions. The disparity between mental and physical HRQoL trajectories for suicidal individuals is a novel finding that requires further exploration to identify potential mechanisms of change in HRQoL. Nevertheless, the findings emphasise the subjective burden experienced by suicidal individuals, findings that may be further translated into identifying the social and economic impact to the community. The significant impact on HRQoL by non-fatal suicidality highlighted by this study underscores the urgency to improve allocation of public health resources to suicide prevention.

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Table 1: Descriptive statistics for the sample based on presence of suicidal thoughts or behaviours at *baseline* (N=7,440)

	Suicidal thoughts or behaviours at baseline							
	None N=6831		Active ideation N=549		Suicide attempt N=60			
	Freq (%) or M (SD)		Freq (%) or M (SD)		Freq (%) or M (SD)		χ^2 or F	p
Age group							167.5	**<0.001**
20-24	2074	(30.4%)	276	(50.3%)	34	(56.7%)		
40-44	2293	(33.6%)	198	(36.1%)	24	(40.0%)		
60-64	2464	(36.1%)	75	(13.7%)	2	(3.3%)		
Gender							2.4	0.302
Male	3352	(49.1%)	277	(50.5%)	24	(40.0%)		
Female	3479	(50.9%	272	(49.5%)	36	(60.0%)		
Marital status							154.9	**<0.001**
Married	3710	(54.3%)	178	(32.4%)	19	(31.7%)		
De facto	560	(8.2%)	60	(10.9%)	7	(11.7%)		
Separated	171	(2.5%)	33	(6.0%)	2	(3.3%)		
Divorced	397	(5.8%)	31	(5.6%)	1	(1.7%)		
Widowed	192	(2.8%)	5	(0.9%)	2	(3.3%)		
Never married	1797	(26.3%)	242	(44.1%)	29	(48.3%)		
Years of education	14.14	(2.26)	14.13	(2.04)	13.74	(1.67)	1.0	0.379
Goldberg depression score	2.10	(2.11)	4.73	(2.51)	5.25	(2.84)	435.8	**<0.001**
Goldberg anxiety score	2.96	(2.57)	5.66	(2.51)	6.37	(2.62)	329.6	**<0.001**
SF-12 physical score	50.92	(8.57)	50.61	(10.16)	49.42	(9.57)	1.2	0.314
SF-12 mental score	51.34	(8.92)	39.30	(12.25)	35.59	(12.76)	506.3	**<0.001**

Note: statistics are χ^2 for categorical variables, F tests from one-way ANOVA for continuous variables; **bold** figures indicate significant differences between groups

Table 2: Multivariate latent growth model of suicidality at baseline (*intercept*) and over the subsequent 8 years (*slope*) for SF-12 **mental** quality of life (MCS) for Wave 1-3

MCS intercept	Estimate (b)	SE	p
Suicidal ideation vs none	-3.931	0.416	**<0.001**
Suicide attempt vs none	-1.406	1.193	0.238
Age group: 40s vs. 20s	1.095	0.202	**<0.001**
Age group: 60s vs. 20s	3.118	0.197	**<0.001**
Gender (Female)	-0.222	0.157	0.158
Goldberg depression	-1.545	0.058	**<0.001**
Goldberg anxiety	-1.155	0.045	**<0.001**
MCS slope	Estimate (b)	SE	p
Suicidal ideation vs none	0.535	0.338	0.114
Suicide attempt vs none	0.951	1.102	0.388
Age group: 40s vs. 20s	0.401	0.170	**0.018**
Age group: 60s vs. 20s	0.972	0.168	**<0.001**
Gender (Female)	-0.082	0.131	0.531
Goldberg depression	0.380	0.047	**<0.001**
Goldberg anxiety	0.336	0.037	**<0.001**

Table 3: Multivariate latent growth model of suicidality at baseline (*intercept*) and over the subsequent 8 years (*slope*) for SF-12 **physical** quality of life (PCS) for Wave 1-3.

PCS intercept	Estimate (b)	SE	p
Suicidal ideation vs none	1.382	0.433	**<0.001**
Suicide attempt vs none	-0.874	1.166	0.453
Age group: 40s vs. 20s	-1.740	0.206	**<0.001**
Age group: 60s vs. 20s	-6.174	0.245	**<0.001**
Gender (Female)	-0.484	0.186	**0.009**
Goldberg depression	-0.786	0.066	**<0.001**
PCS slope	Estimate (b)	SE	p
Suicidal ideation vs none	-0.883	0.273	**0.001**
Suicide attempt vs none	-1.324	1.220	0.278
Age group: 40s vs. 20s	-0.194	0.144	0.177
Age group: 60s vs. 20s	-0.022	0.171	0.895
Gender (Female)	-0.350	0.126	**0.005**
Goldberg depression	0.085	0.042	**0.042**
Goldberg anxiety	0.008	0.034	0.813

Table 4: Multivariate logistic regression of mental and physical quality of life at baseline predicting *suicidal ideation* at W2 among participants with no ideation at W1

Variables	Estimate	SE	OR	95% CI	p
SF12 Physical	-0.001	0.009	0.999	0.982, 1.017	0.920
SF12 Mental	-0.025	0.009	0.975	0.957, 0.993	**0.007**
Age group: 40s vs. 20s	-0.385	0.151	0.680	0.506, 0.914	**0.011**
Age group: 60s vs. 20s	-1.078	0.220	0.340	0.221, 0.524	**<0.001**
Gender (Female)	0.145	0.141	1.156	0.877, 1.523	0.304
Goldberg depression	0.029	0.044	1.029	0.944, 1.122	0.511
Goldberg anxiety	0.161	0.038	1.175	1.091, 1.266	**<0.001**

Table 5: Multivariate logistic regression of mental and physical quality of life at baseline predicting *suicidal attempt* at W2 among participants with no attempt at W1

Variables	Estimate	SE	OR	95% CI	p
SF12 Physical	-0.013	0.023	0.987	0.945, 1.032	0.576
SF12 Mental	-0.045	0.023	0.956	0.913, 1.001	0.055
Age group: 40s vs. 20s	-0.752	0.432	0.471	0.202, 1.099	0.082
Age group: 60s vs. 20s	-1.343	0.665	0.261	0.071, 0.962	**0.043**
Gender (Female)	0.035	0.384	1.036	0.488, 2.200	0.927
Goldberg depression	0.336	0.116	1.399	1.115, 1.756	**0.004**
Goldberg anxiety	-0.180	0.110	0.835	0.673, 1.037	0.103

Listing of titles for figures

Figure 1. Contrasts of PCS for high or low levels of depression and presence or absence of suicidal ideation.

Figure 2. Trajectories for MCS and PCS among participants with and without suicidal ideation or suicide attempt.

Figure 1.

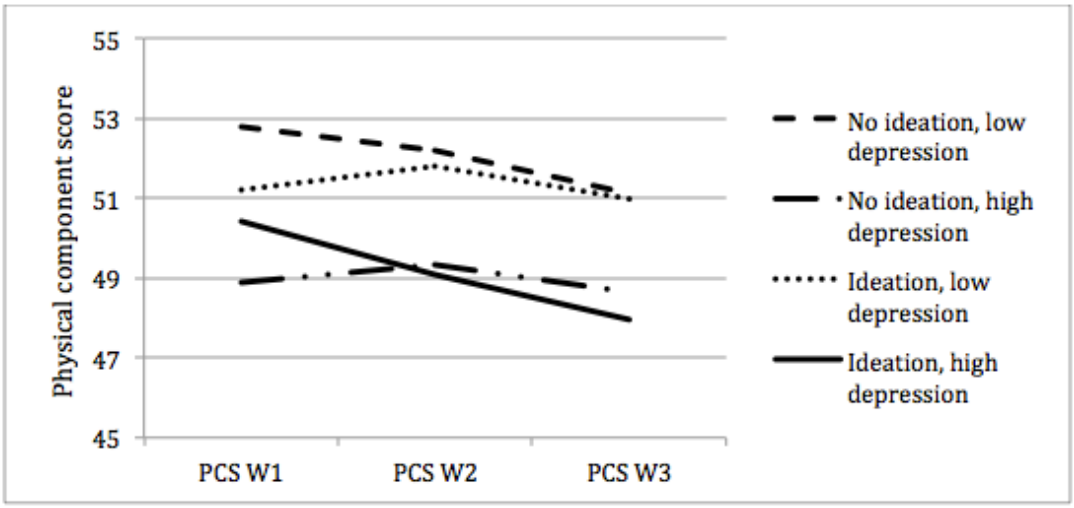
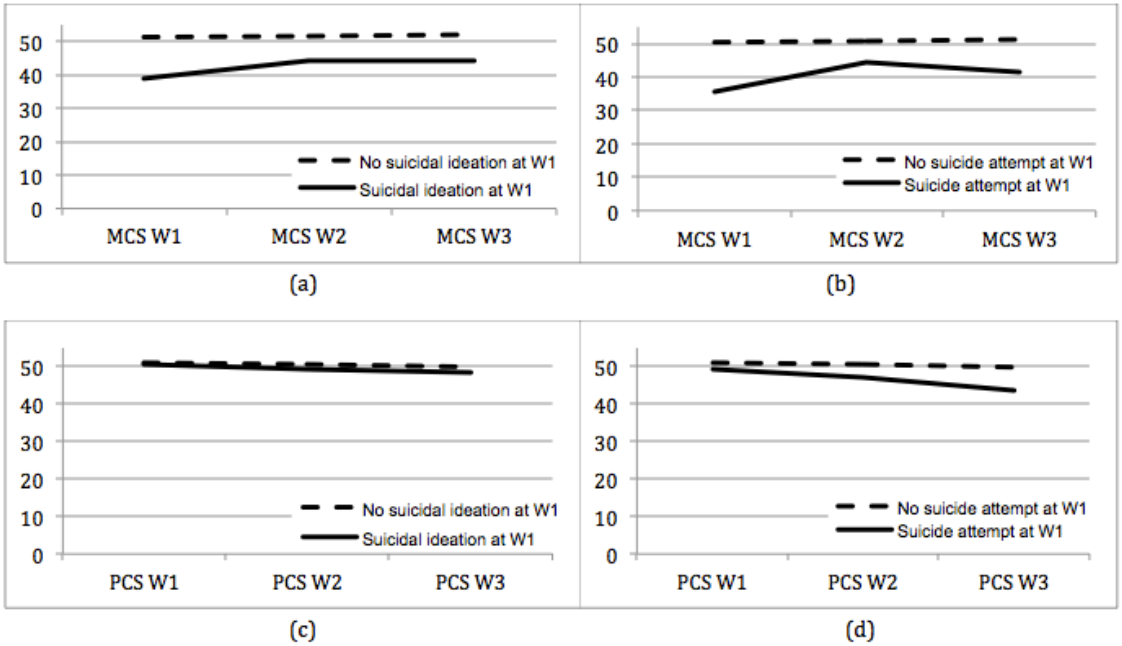

55
53
51
49
47
45
Physical component score
PCS W1
PCS W2
PCS W3
No ideation, low depression
No ideation, high depression
Ideation, low depression
Ideation, high depression

Figure 2.



Note: (a) Mental component score Wave 1-3 for participants with and without suicidal *ideation*
(b) Mental component score Wave 1-3 for participants with and without suicide attempt
(c) Physical component score Wave 1-3 for participants with and without suicidal *ideation*
(d) Physical component score Wave 1-3 for participants with and without suicide attempt