



Research paper

A longitudinal test of the predictions of the interpersonal-psychological theory of suicidal behaviour for passive and active suicidal ideation in a large community-based cohort



Philip J. Batterham^{a,*}, Jennie Walker^a, Liana S. Leach^b, Jennifer Ma^a, Alison L. Caley^a, Helen Christensen^c

^a Centre for Mental Health Research, Research School of Population Health, The Australian National University, Canberra, Australia

^b National Centre for Epidemiology and Population Health, Research School of Population Health, The Australian National University, Canberra, Australia

^c Black Dog Institute, University of New South Wales, Sydney, Australia

ARTICLE INFO

Keywords:

Suicidal ideation
Suicidal behaviour
Interpersonal-psychological theory
Thwarted belongingness
Perceived burdensomeness

ABSTRACT

Background: The Interpersonal-Psychological Theory of Suicide (IPTS) aims to elucidate the key antecedents of suicide deaths. Limited research has tested the IPTS in a community setting, and very little longitudinal research has been conducted. The current study longitudinally tested the predictions of the IPTS for suicidal ideation in a large population-based sample.

Methods: The PATH through Life study assesses three age cohorts (20's, 40's, 60's) every four years. Two interpersonal factors were estimated at the third wave of assessment: thwarted belongingness (TB) and perceived burdensomeness (PB). The roles of these factors in suicide ideation (active and passive) four years later were estimated using logistic regression models ($n = 4545$).

Results: A one SD increase in TB was associated with increased odds of 37% for passive ideation and 24% for active ideation. For PB, odds were increased 2.5-fold for passive ideation and 2.4-fold for active ideation. A significant negative $PB \times TB$ interaction was found for passive but not active ideation. Effects were not consistent by age group or gender.

Limitations: Proxy measures were used to assess the constructs. The extended timeframe and low prevalence of suicidal ideation limited power to find effects within subgroups.

Conclusions: Although TB and PB were individually associated with suicidal thoughts, little evidence was found for the key predictions of the IPTS longitudinally. Further investigation of the dynamic interplay between interpersonal factors over time is needed.

Over the past ten years the suicide rate has increased in many Western countries including Australia (Australian Bureau of Statistics, 2015) and the United States (Curtin et al., 2016), with an overall increase observed worldwide (World Health Organization, 2014). Despite ongoing efforts to identify risk factors for suicide, the prediction of suicide continues to be a challenge. A recent meta-analysis noted that over the past 50 years, suicide prevention research has identified few novel risk factors for suicide with an ongoing focus on a few risk factor categories such as mental illness, previous suicidality and demographic factors (Franklin et al., 2017). Indeed, rather than increasing identification, recent risk factor research has typically explained a lower proportion of variance in suicidal ideation (thoughts about suicide) and suicidal behaviours (self-harm with intent to die) compared to research conducted 30 years ago (Franklin et al., 2017).

Grounding research in theory may better generate explanations for the development of suicidal thoughts and behaviours by providing a framework through which the key putative antecedents of suicidal thoughts and behaviours can be hypothesised and tested (Rogers, 2001). The Interpersonal-Psychological Theory of Suicide (IPTS; Joiner, 2005) aims to elucidate the contexts which increase the risk of suicide by highlighting the role interpersonal factors and cognitive interpretations of interpersonal relationships play in the development of suicidal behaviour (Van Orden et al., 2010). Specifically, Joiner (2005) hypothesised that for an individual to desire suicide, they must feel a disrupted sense of belonging to the community (thwarted belongingness, TB) and perceive themselves as a burden to others (perceived burdensomeness, PB). Individually each factor is predicted to lead to passive suicide ideation (i.e., a desire to die), but when combined with a

* Correspondence to: Centre for Mental Health Research, Research School of Population Health, 63 Eggleston Road, The Australian National University, Acton ACT 2601 Australia.
E-mail address: philip.batterham@anu.edu.au (P.J. Batterham).

sense of hopelessness that the situation will not change, active suicide ideation (i.e., serious thoughts of taking one's own life) is more likely to emerge. Both perceived burdensomeness and thwarted belongingness are considered cognitive states that vary across time and situations (Van Orden et al., 2010).

A recent systematic review described the findings from 66 studies that tested the IPTS and reported mixed support for the theory (Ma et al., 2016). This review included studies with a range of research designs and population groups, although the results found an over-reliance on studies with school or university samples (40.9%) or clinical samples (30.3%), and a lack of longitudinal data testing the IPTS predictions (three studies). Testing the IPTS hypotheses using undergraduate student samples may not be reflective of the broader population context in which suicide behaviours emerge, and clinical samples are restricted only to the minority of individuals who seek care (Bruffaerts et al., 2011). Therefore, there is an important need for further research that tests the IPTS in representative community-based samples. Moreover, cross-sectional research cannot establish the direction of the associations between interpersonal factors and suicide ideation. That is, suicidal ideation may lead to increased interpersonal challenges, rather than thwarted-belongingness and perceived-burdensomeness acting as causal factors in the development of suicidality. Longitudinal research is required to establish the extent to which elevated thwarted belongingness and perceived burdensomeness are in fact antecedents of suicidal thoughts and behaviours. To our knowledge, no study has investigated Joiner's theory longitudinally in a community sample (Ma et al., 2016). Three studies have tested the IPTS in a longitudinal context, but each sampled a specific population (adolescents and university students) thus the generalisability of the findings are limited (Czyz et al., 2015; Kleiman et al., 2014a, 2014b).

A previous cross-sectional analysis in the present large community sample found support for Joiner's hypotheses. Specifically, the interaction between proxy measures representing thwarted belongingness and perceived burdensomeness were found to predict suicide ideation (i.e. suicidal ideation increased when both variables were present at higher levels) (Christensen et al., 2013). Previous research has highlighted that there may be gender and/or age differences in the applicability of the IPTS (Czyz et al., 2015; Christensen et al., 2013). For example, Christensen et al. (2013) found TB to be significantly associated with suicide ideation in males and young adults only. As the theory assumes equivalent explanatory power across subgroups of the population, further examination of potential differences is necessary to test the validity of this assumption and to investigate whether more nuanced tailoring of the IPTS to different subgroups might better inform suicide prevention. Since publication of the Christensen et al. (2013) article, an additional wave of data has been collected which allows the opportunity to longitudinally investigate the IPTS across a four year period. Following on from the findings reported by Christensen et al. (2013), the current study aims to longitudinally test Joiner's hypotheses in relation to suicidal ideation in a large community sample. More specifically, the current study aimed to:

- (1) test whether the two-way interaction between measures of TB and PB was significantly associated with suicide ideation four years later,
- (2) test whether the longitudinal effects of interpersonal factors (TB and PB) on suicide ideation were consistent within gender and age groups, and,
- (3) test whether increases in interpersonal risk (TB and PB) over the four year period were associated with increased prevalence of suicidal ideation or behaviours.

Based on the IPTS predictions, it was hypothesised that the interaction terms tested in aim 1 would be significantly associated with suicidal thoughts assessed four years later. It was hypothesised that the interaction terms tested in aim 1 would be significant in all three age

cohorts assessed four years later (aim 2).

1. Method

1.1. Participants

Data were extracted from the Personality and Total Health (PATH) Through Life project, a large longitudinal cohort study that measures a range of physical health, mental health, cognitive and personality characteristics across the lifespan using three narrow-age cohorts (Anstey et al., 2011). Potential participants were selected at random from the electoral rolls of Canberra ACT and Queanbeyan NSW Australia, according to three age cohorts: 'young' aged 20–24 years, 'mid-life' aged 40–44 years, and 'older' aged 60–64 years. Data are collected at four yearly intervals and to date, four waves of data have been collected (Anstey et al., 2011). A total of 7485 invitees completed the baseline assessment representing 58.6% ($n = 2404$) of the invited 20s cohort, 64.6% ($n = 2530$) of the invited 40s, and 58.3% ($n = 2551$) of the invited 60 s. Gender was evenly split at baseline due to a stratified sampling design: 50.9% of respondents were female ($n = 3813$) and 49.1% male ($n = 3672$).

The data included in the current analyses were collected at Wave 3 2007–2010) when participants were aged 28–32 years, 48–52 years, or 68–72 years, and at Wave 4 (2011 and 2015) when participants were aged 32–36 years, 52–56 years, or 72–76 years. A total of 4650 participants completed the survey at both waves 3 and 4, but of these, 4545 completed all the necessary items for the current analyses (completers). Compared to baseline the current sample represented 50.3% ($n = 1209$) of the 20s cohort, 69.2% ($n = 1751$) of the 40s cohort, and 62.2% ($n = 1585$) of the 60 s cohort. The 40s cohort were significantly more likely to complete all necessary items compared to the 20s ($\chi^2 = 187.6$, $p \leq 0.001$), reflecting a shift to fully-online assessment in the 20s cohort only, and females were more likely to have completed than males ($\chi^2 = 17.8$, $p \leq 0.001$). Compared to non-completers, participants who completed the survey reported a significantly lower baseline depression score ($t = 7.7$, $p < 0.001$), a significantly lower anxiety score ($t = 5.0$, $p < 0.001$), and on average had a greater number of years in education ($t = 11.4$, $p < 0.001$). They were also less likely to report active suicide ideation at baseline ($\chi^2 = 15.9$, $p \leq 0.001$), but were no less likely to report a suicide plan ($\chi^2 = 3.7$, $p = 0.05$) or attempt ($\chi^2 = 0.68$, $p = 0.41$) at baseline.

1.2. Procedure

Participants were typically interviewed either at their home or at a research centre within The Australian National University (ANU). As part of this interview self-report measures were completed by participants on an electronic computer using Surveycraft software, and cognitive and physical health tests were administered by trained interviewers. Participants who had moved internationally at follow-up time-points completed the questionnaire either via a paper survey returned by mail or an internet survey. The full 20s cohort completed the Wave 4 assessment exclusively online. See Anstey and colleagues (2011) for a detailed description of the PATH study procedure. The project was approved by the Human Research Ethics Committee at the ANU.

1.3. Measures

1.3.1. Outcome variables

The outcome suicidal ideation variables were derived from three yes/no items included in the Psychiatric Symptom Frequency scale (PSF; Lindelow et al., 1997) measured at Wave 4. Suicide ideation was used to operationalise the construct of suicide desire outlined by the IPTS (Van Orden et al., 2008).

1.3.1.1. Passive Suicide Ideation. This outcome was assessed as a 'yes'

Table 1

Sample characteristics at Wave 3 by reported suicidal thoughts/behaviours at Wave 4.

| | No suicidal thoughts/behaviours (<i>n</i> = 3983) | | Suicidal thoughts/behaviours (<i>n</i> = 562) | | χ^2 | <i>p</i> |
|---------------------------------|---|-----------|---|-----------|-----------------|-----------------|
| | Frequency | Percent | Frequency | Percent | | |
| Gender = female | 2090 | 52.5 | 314 | 55.9 | 2.28 | 0.13 |
| Age | | | | | 49.1 | < 0.001 |
| 20s cohort | 1026 | 25.8 | 183 | 32.6 | | |
| 40s cohort | 1494 | 37.5 | 257 | 45.7 | | |
| 60s cohort | 1463 | 36.7 | 122 | 21.7 | | |
| Marital status | | | | | 43.8 | < 0.001 |
| Married | 2598 | 65.3 | 300 | 53.5 | | |
| Separated/divorced/widowed | 699 | 17.6 | 102 | 18.2 | | |
| Single, never married | 684 | 17.2 | 159 | 28.3 | | |
| Suicidal ideation (wave 3) | 213 | 5.3 | 247 | 44.1 | 810.5 | < 0.001 |
| Suicide plan/attempt (wave 3) | 12 | 0.3 | 29 | 5.2 | 131 | < 0.001 |
| | Mean | SD | Mean | SD | <i>t</i> | <i>p</i> |
| Years of education (wave 1) | 14.55 | 2.26 | 14.64 | 2.27 | 0.89 | 0.38 |
| Perceived burdensomeness factor | − 0.15 | 0.85 | 0.91 | 1.25 | 19.64 | < 0.001 |
| Thwarted belongingness factor | − 0.08 | 0.92 | 0.39 | 1.18 | 9.00 | < 0.001 |
| Self-harm factor | − 0.08 | 0.75 | 0.33 | 1.56 | 6.08 | < 0.001 |
| Goldberg Depression | 1.81 | 2.01 | 3.87 | 2.55 | 18.33 | < 0.001 |
| Goldberg Anxiety | 2.68 | 2.45 | 4.78 | 2.65 | 17.70 | < 0.001 |

response to any of the three suicidal ideation items ('felt life was hardly worth living', 'thought would be better off dead', 'thought about taking own life'), assessed on the basis of the previous 12 months. Subsidiary sensitivity analysis tested whether findings were consistent when including only the first two ideation items.

1.3.1.2. Active suicide ideation. Participants who reported having 'thought about taking their own life' in the past 12 months were considered as having experienced active ideation.

1.3.2. Predictor variables

1.3.2.1. Thwarted belongingness (TB) and perceived burdensomeness (PB). Proxy measures for the TB and PB variables were constructed using a principal components analysis from items previously identified by Christensen et al. (2013), as the Interpersonal Needs Questionnaire (INQ), a validated scale measuring TB and PB, was not administered at wave 3. The TB variable was computed from four items measuring supportive interactions with friends and family (e.g., friends make you feel cared for, family express interest in how you are doing) (Schuster et al., 1990). The items loaded well onto one component (all > 0.7), explained 58.5% of the variance, and had good internal consistency (Cronbach's $\alpha = 0.76$) (Christensen et al., 2013). The PB variable was computed from two items measuring rumination (think about feeling passive and unmotivated, think about shortcomings and mistakes) (Nolen-Hoeksema and Morrow, 1991) and one patient health questionnaire item (feel bad about self) (Spitzer et al., 1999). These items were chosen to reflect feelings of failure and the burden these feelings cause (Christensen et al., 2013), consistent with the original definition of PB (Joiner, 2005). The items loaded well onto one component (all > 0.7) explaining 63.3% of the variance, and had good internal consistency (Cronbach's $\alpha = 0.71$) (Christensen et al., 2013). The variables used to assess TB and PB were computed by saving regression factor scores derived from the Principal Components Analysis. The scores were therefore standardised with a mean of 0, standard deviation of 1. When compared to the validated INQ TB and PB subscales in a sample drawn at Wave 4, both proxy variables had adequate convergent validity (TB $r = 0.65$, PB $r = 0.61$).

To describe the sample, demographic characteristics (self-reported years of education and marital status, in addition to age cohort and gender) and Goldberg Depression and Anxiety Scale scores (Goldberg et al., 1988) were reported and compared for participants with and without suicidal thoughts or behaviours.

1.4. Analysis

Comparisons between individuals with and without suicidal thoughts/behaviours were tested using chi-square statistics for dichotomous variables, and independent-samples *t*-tests for continuous variables. To test study aims 1 and 2, hierarchical binary logistic regression analyses with listwise deletion was used. Only 105 participants were excluded from analyses on the basis of partial data at one or both time points. Predictor variables were added to the model incrementally, with the main effects of TB and PB entered first and the two-way interaction added subsequently (TB \times PB). Model fit was assessed at each step using chi-square goodness of fit tests. Only the results from the final models were reported, with all predictors entered simultaneously. The Johnson-Neyman technique was used to explore significant interactions between the predictor variables. This technique identified the value of one predictor based on the changes in significance level ($p < 0.05$) of the second predictor variable. The technique was applied using the SPSS macro PROCESS, Release 2.16.1 (Hayes, 2013).

Finally, to examine variation in the interpersonal factors over time (aim 3), a reliable change score was calculated using the formula given by Jacobson and Truax (1991). Significant reliable change was observed for an individual if their increase or decrease in TB and PB scores between Waves 3 and 4 was greater than the standard error for the difference between these two scores multiplied by 1.96. Due to changes in the survey related to participant burden, only the 20s cohort ($n = 1199$) received all of the measures used to assess TB and PB at both Waves 3 and 4, so this analysis assessing change from Wave 3 to Wave 4 was restricted to the 20s subsample. Participants with no reliable change over time were further divided into those that had an initial (Wave 3) score above the median (high unchanged) or below the median (low unchanged). The relationship between the reliable change categories and outcome variables were explored using a Bonferroni-adjusted chi-squared test. Analyses were conducted using SPSS for Windows, Version 22.0 (IBM Corp, 2013).

2. Results

2.1. Sample characteristics

Table 1 presents sample characteristics, mental health symptomology and IPTS risk factors at wave 3 by reported suicide thoughts/behaviours at wave 4. Respondents reporting suicidal thoughts/

Table 2
Suicidality at Wave 4 by age cohort.

| | Passive ideation, n (%) | Active ideation, n (%) | Plan, n (%) | Attempt, n (%) | Plan and/or attempt, n (%) |
|-----------------|-------------------------|------------------------|-------------|----------------|----------------------------|
| 20s (n = 1209) | 181 (15.0%) | 106 (8.8%) | 14 (1.2%) | 3 (0.2%) | 15 (1.2%) |
| 40s (n = 1751) | 257 (14.7%) | 110 (6.3%) | 27 (1.5%) | 8 (0.5%) | 28 (1.6%) |
| 60 s (n = 1585) | 119 (7.5%) | 36 (2.3%) | 14 (0.9%) | 5 (0.3%) | 14 (0.8%) |

behaviours had, on average, significantly greater TB and PB scores compared to participants who did not report suicidal thoughts/behaviours ($p < 0.001$ for all measures). The average Goldberg Depression and Goldberg Anxiety score for respondents reporting suicidal thoughts/behaviours exceeded the mean clinical cut-off for risk of depression or anxiety (Jorm et al., 2005). Respondents who reported no suicidal thoughts/behaviours, on average, reported scores below the clinical threshold for depression or anxiety. Respondents who reported suicide ideation at wave 3, suicide plan/attempt at wave 3, or who were never married at wave 3 were more likely to report suicidality at wave 4. Furthermore, respondents in the 20s and 40s cohorts were significantly more likely to report suicide thoughts/behaviours at wave 4 compared to the 60 s cohort.

Table 2 presents the number of respondents in the sample reporting suicidality by age cohort. A total of 557 participants indicated passive suicide ideation, and of these, 252 reported active suicide ideation. A total of 57 respondents reported making a plan or a suicide attempt. Of these, only 16 reported a suicide attempt, and two of these participants indicated a suicide attempt without a plan.

2.2. Testing the predictions of the IPTS

2.2.1. Passive and active suicidal ideation

Table 3 presents the logistic regression model testing the role of TB, PB and their two-way interaction at Wave 3 on passive and active suicide ideation at Wave 4, with all three age cohorts combined. The main effects of TB and PB were significantly associated with passive and active ideation. Accounting for TB, PB and their interaction, a one-unit increase in TB (e.g., moving from a mean score of 3–4) was associated with 37% increased odds of passive ideation and 24% increased odds of active ideation. PB appeared to have a stronger effect, with a one-unit increase associated with 2.5 times the odds of passive suicidal ideation and 2.4 times the odds of active ideation after four years.

There was a significant negative interaction between TB and PB for passive ideation only, indicating a diminishing effect of TB as PB increased. Further exploration using the PROCESS macro revealed that the relationship between TB and passive suicide ideation was no longer significant when PB was approximately 2 SD above the mean (1.94; range = −1.09, 4.45), covering approximately 6.3% of the sample. The interaction is plotted in the Supplementary Fig. 1, which indicates that increasing TB had a positive association with passive ideation only in the presence of low PB. The overall models for passive and active

ideation were both significant (Passive: $\chi^2 = 538.1$, $p = < 0.001$; Active: $\chi^2 = 266.5$, $p = < 0.001$). Outcomes for passive ideation were unchanged when only the first two suicidal items were included in the definition of passive ideation.

2.2.2. Models within age cohorts

Models were re-estimated within each age cohort to examine the consistency of the findings across the adult lifespan. Significant main effects for TB and PB on passive ideation were observed in all age cohorts (TB: OR range = 1.29–1.48, $p \leq 0.001$; PB: OR range = 2.18–2.79, all $p < 0.001$), although their interaction was not significant for any age cohort. For active ideation, PB was significant for all age cohorts (PB: OR range = 2.10–2.51, all $p < 0.001$), while TB was significant only for the 40s cohort (OR = 1.37, 95% CI: 1.11–1.68, $p = 0.003$) and no significant interaction effect was observed.

2.2.3. Models by gender

Models were re-estimated within males and females to examine the consistency of the findings by gender. Significant main effects for TB and PB on passive ideation were observed in both genders (TB: OR_{male} = 1.33, CI: 1.15–1.53, OR_{female} = 1.48, CI: 1.28–1.70; PB: OR_{male} = 2.99, CI: 2.53–3.53, OR_{female} = 2.26, CI: 2.01–2.54, $p < 0.001$; for all), although their interaction was only significant for females (OR = 0.88, CI: 0.80–0.97, $p = 0.01$). The interaction effect for females is illustrated in Supplementary Fig. 2, which suggests a marginally greater effect of TB at high levels of PB. For active ideation, PB was significant for males and females (OR_{male} = 2.79, CI: 2.32–3.36, $p < 0.001$; OR_{female} = 2.13, CI: 1.84–2.47, $p < 0.001$), while the effects of TB and the TB \times PB interaction were not significant.

2.3. Reliable change in TB and PB

Table 4 presents the relationships between change in TB and PB from Waves 3–4 with suicide outcomes at Wave 4.

2.3.1. Thwarted belongingness

Of the 20s cohort ($n = 1199$), 54 participants (4.5%) had a reliable increase in TB between Waves 3 and 4, 45 (3.7%) had a reliable decrease, 507 (42.3%) reported high TB at Wave 3 (based on median split) that remained unchanged, and 593 (49.5%) reported low TB at Wave 3 that remained unchanged. Based on Bonferroni-adjusted pairwise comparisons using chi-squared statistics, compared to the low unchanged category, increased TB and high unchanged TB were significantly associated with passive ideation at wave 4, while only increased TB was associated with active suicide ideation.

Excluding participants with suicidal thoughts or behaviours at Wave 3 ($n = 163$), 944 respondents had no suicidality, 99 had incident passive ideation and 57 had incident active ideation. Among this subgroup, in comparison to the low unchanged category, increased TB remained significantly associated with passive and active suicide ideation.

2.3.2. Perceived burdensomeness

Of the 20s cohort ($n = 1179$), 44 participants (3.7%) reported a significant increase in PB between Waves 3 and 4, 124 (10.5%) reported

Table 3
Main effects and two-way interaction of predictor variables for passive and active suicide ideation, across all age cohorts.

| | Passive ideation (n = 4545) | | | | | Active ideation (n = 4544) | | | | |
|-------------------------------|-----------------------------|------|---------|------|------------|----------------------------|------|---------|------|------------|
| | Estimate | SE | p | OR | 95% CI | Estimate | SE | p | OR | 95% CI |
| Intercept | − 2.27 | 0.06 | < 0.001 | 0.10 | | − 3.20 | 0.08 | < 0.001 | 0.04 | |
| Thwarted belongingness (TB) | 0.32 | 0.05 | < 0.001 | 1.37 | 1.24, 1.51 | 0.22 | 0.08 | 0.004 | 1.24 | 1.07, 1.41 |
| Perceived burdensomeness (PB) | 0.93 | 0.05 | < 0.001 | 2.53 | 2.30, 2.77 | 0.86 | 0.06 | < 0.001 | 2.36 | 2.11, 2.64 |
| TB \times PB | − 0.10 | 0.04 | 0.012 | 0.91 | 0.84, 0.98 | − 0.07 | 0.05 | 0.123 | 0.93 | 0.85, 1.02 |

Table 4

Associations of reliable change in TB/PB over 4 years and prevalence of active suicidal ideation and plan/attempt at Wave 4.

| Change category | Change in thwarted belongingness, wave 3–4 | | | Change in perceived burdensomeness, wave 3–4 | | |
|--------------------------------------|--|----------------------------|----------------------------|--|----------------------------|----------------------------|
| | <i>n</i> | Passive ideation, W4 | Active ideation, W4 | <i>n</i> | Passive ideation, W4 | Active ideation, W4 |
| Reliable increase | 54 | 18 (33.3%) | 14 (25.9%) | 44 | 17 (38.6%) | 12 (27.3%) |
| Reliable decrease | 45 | 8 (17.8%) | 4 (8.9) | 124 | 31 (25.0%) | 18 (14.5%) |
| High, unchanged | 507 | 94 (18.5%) | 50 (9.8) | 590 | 110 (18.6%) | 69 (11.7) |
| Low, unchanged | 593 | 60 (10.1%) | 38 (6.4) | 421 | 18 (4.3%) | 7 (1.7) |
| <i>Difference between categories</i> | | $\chi^2 = 30.6, p < 0.001$ | $\chi^2 = 24.6, p < 0.001$ | | $\chi^2 = 73.4, p < 0.001$ | $\chi^2 = 55.5, p < 0.001$ |

a significant decrease, 590 (50.0%) reported high unchanged, and 421 (35.7%) reported low unchanged. Bonferroni-adjusted pairwise chi-squared tests revealed that compared to the low unchanged category, increased PB, high unchanged PB, and decreased PB were all significantly associated with passive and active suicide ideation.

Excluding participants with suicidal thoughts or behaviours at Wave 3 ($n = 158$), compared to the low unchanged category, all three categories remained significantly associated with active ideation, and increased PB remained significantly associated with passive ideation.

3. Discussion

The present study was one of the largest to examine the predictions of the IPTS with regard to suicidal ideation, and the first to longitudinally test predictions of the IPTS in a community sample. The findings indicate mixed support for the theory. Significant effects of TB, PB, and their interaction were observed for passive suicidal ideation, which is consistent with the theory's predictions for passive ideation (Van Orden et al., 2010). However, the significant interaction suggested a diminishing effect of TB as PB increased, contrary to the theory that would predict a synergistic interaction. Although the finding is inconsistent with the broader IPTS literature, it is consistent with cross-sectional data from the 40s cohort of the present sample (Christensen et al., 2013). The finding may indicate that participants with high PB may be less at risk of subsequent suicidal ideation if they are less concerned about their social connections, or that individuals with high TB may possess other protective characteristics. Additional research is warranted to examine whether this finding may relate to subgroups of the population, or whether the effect of high TB on suicidal ideation might be mediated by factors such as hope (Hollingsworth et al., 2016), relatedness, competency or autonomy (Tucker and Wingate, 2014).

Furthermore, the theory hypothesizes the simultaneous presence of TB and PB to be predictive of active suicidal ideation (Van Orden et al., 2010). No such interaction effect was found for active ideation in the present sample. This finding may be related to the need for TB and PB to be enduring and for the individual to experience hopelessness about the presence of these interpersonal factors (Van Orden et al., 2010). Nevertheless, given the null interaction effects, it is unlikely that further restricting the definitions of these constructs on the basis of hopelessness would result in a stronger effect, as observed in previous cross-sectional research using the same cohort (Christensen et al., 2013). The current study found that reliable increases in TB and PB over four years were associated with increased risk of suicidal thoughts and behaviours, suggesting that increases in these risk factors within an individual are as concerning as high levels of TB or PB at one time-point.

The observed effects of TB and PB on suicidal ideation were not consistent by age group or gender. Effects tended to be strongest in the mid-life 40s cohort (aged 52–56 at the time of the Wave 4 assessment) and among females. It is possible that females and adults in mid-life may be reliant on a smaller circle of interpersonal relationships, suggesting that these groups might therefore be more strongly impacted by interpersonal challenges (Liebler and Sandefur, 2002). It is also likely that power to detect effects within subgroups was limited, given the modest numbers of participants with active ideation, plans or attempts

within subgroups of the sample. The findings are somewhat inconsistent with the cross-sectional findings (Christensen et al., 2013), which found stronger effects of TB among males than females. The differences suggest that the time course of interpersonal challenges may have differential impact on subgroups of the population. Regardless, the lack of consistency across subgroups of age or gender requires further investigation (particularly among the 20s subgroups with highest prevalence of suicidal thoughts and behaviours), as the theory should be applicable across the adult population.

The findings are consistent with the broader literature, which suggests that evidence for the IPTS is dependent on the type of suicide outcome used, how it is operationalised, characteristics of the sample, and research design (Hill and Pettit, 2014; Ma et al., 2016). Only 12 studies have reported on the interaction effect between TB and PB on suicidal ideation, with the majority (eight studies) finding a significant effect (Ma et al., 2016). Only one of these studies was longitudinal (Kleiman et al., 2014b), with two other longitudinal studies finding no significant interaction effects (Czyz et al., 2015; Kleiman et al., 2014a), suggesting the possibility of reverse causation (i.e., that suicidal ideation may further increase interpersonal disconnection).

3.1. Implications

The findings have important implications for future research and for public health and clinical approaches to suicide prevention. Some of the predictions of the IPTS are not consistently supported in the literature, and may therefore be dependent on the sample (i.e., only relevant to certain subgroups; Ma et al., 2017) and dependent on how suicide outcomes and the interpersonal constructs are operationalised (Batterham et al., 2015; Czyz et al., 2015; Ma et al., 2016). In addition, the interpersonal factors may be dynamic and interrelated, such that modifying PB may lead to negative effects on TB (Czyz et al., 2015). More precise measurement of the interpersonal constructs and suicide outcomes are required for more consistent outcomes, although the improvement of measurement tools may require additional research on the aspects of TB, PB and capability that drive associations with suicidal thoughts or behaviours. For example, the self-hatred aspect of PB described by Van Orden et al. (2010) is not currently captured by the Interpersonal Needs Questionnaire, although it may be integral in the development of suicidal thinking. Moving from observational studies to intervention studies is also needed to provide clearer evidence for whether modification of TB and PB is feasible and whether it impacts on suicide outcomes. Focusing on the settings where the IPTS has most support may be one way to target interventions. Further refinement of the IPTS or exploration of more complex theories of suicidal behaviour may also be warranted.

3.2. Limitations

This study provides an important longitudinal test of the IPTS in a community-based sample. However, there were some limitations of the current study that should be further examined in future research. The lengthy time frame between assessments (four years) may have reduced power to find effects, as described previously in a review of suicide risk

factors (Franklin et al., 2017). Such a period may be inadequate for capturing the dynamic interplay between these factors, which may vary over much briefer periods. The one-year recall of suicidal thoughts and behaviours may also be problematic as it did not cover the full four-year period of follow-up, although it may also be noted that lengthy periods may increase recall bias. The search for robust risk factors for suicidal behaviour may hinge on examining shorter time frames within high-risk samples. Nevertheless, based on the findings in Table 4, TB and PB levels remained stable over four years for > 80% of participants, suggesting that there is a considerable trait-like component to these constructs. These findings support the possibility that long-term effects of the interpersonal constructs may be observable. Another limitation was that the study commenced before the Interpersonal Needs Questionnaire and Acquired Capability for Suicide scales had been validated, so proxy measures were used to assess the interpersonal risk factors rather than purpose-designed measures. The psychometric properties of the present measures of TB and PB supported their validity, but no measure of capability for suicide was sufficiently robust to enable testing of the IPTS predictions for suicidal behaviour. Additional limitations include the small number of participants reporting suicidal behaviours, which limited power to detect effects, and the lack of objective or implicit corroboration of suicidal thoughts or behaviours.

3.3. Conclusion

In conclusion, the present study found that the predictions of the IPTS were partially supported for passive ideation over four years in a large community-based sample. The effects of the interpersonal constructs on active ideation were limited. Reliable increases in TB and PB were associated with significant increases in suicidal thoughts. Given the paucity of longitudinal research testing the IPTS, further research is required to better identify the role of interpersonal risk factors in predicting suicide outcomes. Specifically, the dynamic nature of the interpersonal risk factors necessitates detailed research elucidating the interplay of these risk factors over time, characterising subgroups most impacted and identifying appropriate time frames for interpersonal interventions.

Acknowledgements

The authors are grateful to Kaarin Anstey, Peter Butterworth, Simon Easteal, Patricia Jacomb, Karen Maxwell, and the PATH interviewers, for their contributions to the PATH study.

Funding

The study was supported by National Health and Medical Research Council (NHMRC) grants 973302, 179805, 350833, 157125 and Australian Research Council grant 130101705. PJB, ALC and HC are supported by NHMRC Fellowships 1083311, 1122544 and 1056964.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.jad.2017.10.005>.

References

Anstey, K.J., Christensen, H., Butterworth, P., Easteal, S., Mackinnon, A., Jacomb, T.,

- Maxwell, K., Rodgers, B., Windsor, T., Cherbuin, N., 2011. Cohort profile: the PATH through life project. *Int. J. Epidemiol.* 1–10.
- Australian Bureau of Statistics, 2015. 3303.0 - Causes of Death, Australia, 2015, 3303.0 - Causes of Death, Australia, 2015. Australian Bureau of Statistics.
- Batterham, P.J., Calear, A.L., Spijker, B.A., 2015. The specificity of the interpersonal-psychological theory of suicidal behavior for identifying suicidal ideation in an online sample. *Suicide Life-Threat. Behav.* 45, 448–460.
- Bruffaerts, R., Demyttenaere, K., Hwang, I., Chiu, W.T., Sampson, N., Kessler, R.C., Alonso, J., Borges, G., de Girolamo, G., de Graaf, R., Florescu, S., Gureje, O., Hu, C., Karam, E.G., Kawakami, N., Kostyuchenko, S., Kovess-Masfety, V., Lee, S., Levinson, D., Matschinger, H., Posada-Villa, J., Sagar, R., Scott, K.M., Stein, D.J., Tomov, T., Viana, M.C., Nock, M.K., 2011. Treatment of suicidal people around the world. *Br. J. Psychiatry* 1–7.
- Christensen, H., Batterham, P.J., Soubelet, A., Mackinnon, A.J., 2013. A test of the Interpersonal Theory of Suicide in a large community-based cohort. *J. Affect. Disord.* 144, 225–234.
- Curtin, S.C., Warner, M., Hedegaard, H., 2016. Data Brief 241: Increase in Suicide in the United States, 1999–2014. Centers for Disease Control and Prevention, United States.
- Czyz, E.K., Berona, J., King, C.A., 2015. A prospective examination of the interpersonal-psychological theory of suicidal behavior among psychiatric adolescent inpatients. *Suicide Life-Threat. Behav.* 45, 243–259.
- Franklin, J.C., Ribeiro, J.D., Fox, K.R., Bentley, K.H., Kleiman, E.M., Huang, X., Musacchio, K.M., Jaroszewski, A.C., Chang, B.P., Nock, M.K., 2017. Risk factors for suicidal thoughts and behaviors: a meta-analysis of 50 years of research. *Psychol. Bull.* 143, 187–232.
- Goldberg, D., Bridges, K., Duncan-Jones, P., Grayson, D., 1988. Detecting anxiety and depression in general medical settings. *Br. Med. J.* 297 (6653), 897–899.
- Hayes, A.F., 2013. Introduction to mediation, moderation, and conditional process analysis: a regression-based approach. Guilford Press, New York, NY.
- Hill, R.M., Pettit, J.W., 2014. Perceived burdensomeness and suicide-related behaviors in clinical samples: current evidence and future directions. *J. Clin. Psychol.* 70, 631–643.
- Hollingsworth, D.W., Wingate, L.R., Tucker, R.P., O'Keefe, V.M., Cole, A.B., 2016. Hope as a moderator of the relationship between interpersonal predictors of suicide and suicidal thinking in African Americans. *J. Black Psychol.* 42 (2), 175–190.
- Jacobson, N.S., Truax, P., 1991. Clinical significance: a statistical approach to defining meaningful change in psychotherapy research. *J. Consult. Clin. Psychol.* 59, 12–19.
- Joiner, T., 2005. Why people die by suicide, First paperback ed. Harvard University Press, United States of America.
- Jorm, A.F., Windsor, T., Dear, K., Anstey, K., Christensen, H., Rodgers, B., 2005. Age group differences in psychological distress: the role of psychosocial risk factors that vary with age. *Psychol. Med.* 35, 1253–1263.
- Kleiman, E.M., Law, K.C., Anestis, M.D., 2014a. Do theories of suicide play well together? Integrating components of the hopelessness and interpersonal psychological theories of suicide. *Compr. Psychiatry* 55, 431–438.
- Kleiman, E.M., Riskind, J.H., Stange, J.P., Hamilton, J.L., Alloy, L.B., 2014b. Cognitive and interpersonal vulnerability to suicidal ideation: a weakest link approach. *Behav. Therapy* 45, 778–790.
- Liebler, C.A., Sandefur, G.D., 2002. Gender differences in the exchange of social support with friends, neighbors, and co-workers at midlife. *Soc. Sci. Res.* 31 (3), 364–391.
- Lindelow, M., Hardy, R., Rodgers, B., 1997. Development of a scale to measure symptoms of anxiety and depression in the general UK population: the psychiatric symptom frequency scale. *J. Epidemiol. Commun. Health* 51, 549–557.
- Ma, J., Batterham, P.J., Calear, A.L., Han, J., 2016. A systematic review of the predictions of the interpersonal-psychological theory of suicidal behavior. *Clin. Psychol. Rev.* 46, 34–45.
- Ma, J., Batterham, P.J., Calear, A.L., Han, J., 2017. Suicide risk across latent class subgroups: a test of the generalizability of the Interpersonal Psychological Theory of Suicide. *Suicide Life Threat Behav.* (in press).
- Nolen-Hoeksema, S., Morrow, J., 1991. A prospective study of depression and posttraumatic stress symptoms after a natural disaster: the 1989 Loma Prieta Earthquake. *J. Personal. Soc. Psychol.* 61, 115.
- Rogers, J.R., 2001. Theoretical grounding: The “missing link” in suicide research. *J. Couns. Dev.* 79, 16–25.
- Schuster, T.L., Kessler, R.C., Aseltine Jr, R.H., 1990. Supportive interactions, negative interactions, and depressed mood. *Am. J. Commun. Psychol.* 18, 423–438.
- Spitzer, R.L., Kroenke, K., Williams, J.B., 1999. Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study. *JAMA* 282, 1737–1744.
- Tucker, R.P., Wingate, L.R., 2014. Basic need satisfaction and suicidal ideation: A self-determination perspective on interpersonal suicide risk and suicidal thinking. *Arch. Suicide Res.* 18 (3), 282–294.
- Van Orden, K.A., Witte, T.K., Cukrowicz, K.C., Braithwaite, S.R., Selby, E.A., Joiner Jr, T.E., 2010. The interpersonal theory of suicide. *Psychol. Rev.* 117, 575–600.
- Van Orden, K.A., Witte, T.K., Gordon, K.H., Bender, T.W., Joiner Jr, T.E., 2008. Suicidal desire and the capability for suicide: tests of the interpersonal-psychological theory of suicidal behavior among adults. *J. Consult. Clin. Psychol.* 76, 72–83.
- World Health Organization, 2014. Preventing suicide: a global imperative. Luxembourg.