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Consistency of trajectories of suicidal ideation and depression symptoms: Evidence from a randomized controlled trial

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Background: Depression is a risk factor for suicidal ideation. However, suicidal ideation can occur in the absence of depression and treating depression may not reduce suicidal thinking. This study tested whether trajectories of suicidal thinking are concordant with trajectories of depressive symptoms and sought to identify factors associated with these trajectories.

Methods: Participants were community-based Australian adults ($N = 418$, 77% female) enrolled in a randomized controlled trial evaluating the effectiveness of an online cognitive–behavioral intervention for suicidal ideation. Separate linear growth mixture models were estimated across 12 months of follow-up to identify longitudinal trajectories of suicidal ideation and depression symptoms. Predictors of latent class membership were tested using logistic regression models.

Results: Two-class models were found to have optimal fit for both suicidal thinking and depressive symptoms. Trajectory classes of suicidal ideation were: (1) moderate severity decreasing over time; and (2) high severity remaining stable over time. Depression trajectories were: (1) moderate severity with a small decrease over time; and (2) high severity that decreased moderately over time. Lower perceived burdensomeness was associated with having a greater decrease in both suicidal thinking and depression. More severe mental health symptoms were associated with less decrease in depression symptoms but not with suicidal ideation trajectory.

Conclusion: Class membership across the two outcomes and predictors of class membership were found to be largely independent. The lack of coupling in trajectories and predictors suggests that changes in suicidal thinking may occur independently of changes in depression.

KEYWORDS
cognitive behavioral therapy, depression, online, suicidal ideation, trajectories

1 | INTRODUCTION

Depression is often considered to be a strong risk factor for suicidal thinking, suicide attempt, and suicide deaths (Cavanagh, Carson, Sharpe, & Lawrie, 2003; Harris & Barraclough, 1997; Nock et al., 2009; Nock, Hwang, Sampson, & Kessler, 2010). However, the relationship between these two outcomes may be due to common underlying risk factors for depression and suicidal thinking, including interpersonal factors (Van Orden et al., 2010; Van Orden, Witte, Gordon, Bender, & Joiner, 2008), negative life events (Liu, 2017; Liu & Miller, 2014), or underlying psychological vulnerabilities such as low self-efficacy or mastery (Christensen, Batterham, Mackinnon, Donker, & Soubelet, 2014), neuroticism (Hakulinen et al., 2015; Mandelli et al. 2015), and high rumination (Hsu et al., 2015; Morrison & O'Connor, 2008; Rogers & Joiner, 2017, 2018). The relationship may also reflect a structural

role of suicidal thinking as a symptom in the diagnostic criteria of depression. Higher use of antidepressant treatment is correlated with lower suicide rates at the county level (Gibbons, Hur, Bhaumik, & Mann, 2005), possibly reflecting common biological mechanisms including the role of the HPA axis and serotonergic systems in both depression and suicide (Mann, 2003).

However, suicidal ideation frequently occurs outside depressive states. Symptoms of other mental disorders (Batterham, Calear, Christensen, Carragher, & Sunderland, 2018; Nock et al., 2010), hopelessness (Beck, Steer, Beck, & Newman, 1993), trauma (Sarchiapone, Carli, Cuomo, & Roy, 2007), substance use (Nock et al., 2009, 2010), physical health conditions (Goodwin, Kroenke, Hoven, & Spitzer, 2003; Scott et al., 2010) and a range of other psychosocial factors demonstrate clear independent associations with suicidal thoughts after accounting for depression symptoms. Suicide risk also fluctuates

within the course of a depressive episode and a range of factors mediate suicide risk among individuals experiencing depression (Malone, Haas, Sweeney, & Mann, 1995). Similarly, certain clusters of depression symptoms appear to be more strongly tied to suicidal thinking than others (Keilp et al., 2018). Evidence from clinical trials suggests that suicidal thinking does not always remit after successful depression treatment (Christensen et al., 2013). The effects of depression treatments on suicidality are inconsistent (Cuijpers et al., 2013), with clearest evidence for the effectiveness of interpersonal therapy (IPT) and certain antidepressant medications (Weitz, Hollon, Kerkhof, & Cuijpers, 2014). Conversely, the effectiveness of treatments for suicidal thoughts are only partially explained by changes in depression symptoms (Grunebaum et al., 2018).

Together, this body of evidence suggests that suicidal thinking may, at the individual level, occur independently of depressive symptomatology. While public health initiatives to reduce depression may have broad subsidiary benefits for suicide prevention, treating individuals for depression symptoms may not be the most-efficient approach for suicide prevention, with suicide-specific interventions required. Nevertheless, there remains limited evidence around whether suicidal thinking and depression symptoms follow similar trajectories over the episode of illness.

To better understand the relationship between depression and suicidal thinking, there is a need for prospective longitudinal research that examines whether depression symptoms are linked to suicidal ideation over time. If a causal relationship between depression and suicidal thinking exists, it would be expected that individuals who experience decreases in depressive symptoms would also have decreasing suicidal thoughts, and vice-versa, such that the measures would be tethered over time. There has been an increasing interest in analyzing longitudinal trajectories of mental health symptoms to identify subgroups with distinctive patterns of symptoms, including depressive symptoms (see Musliner, Munk-Olsen, Eaton, & Zandi, 2016) and suicidal thoughts (e.g., Kasckow et al., 2016; Madsen, Karstoft, Secher, Austin, & Nordentoft, 2016a; Madsen, van Spijker, Karstoft, Nordentoft, & Kerkhof, 2016b). However, we are not aware of studies that have analyzed these factors together to examine whether tethering occurs.

The current study used data from a randomized controlled trial (RCT) of an online cognitive behavioral therapy (CBT) program that aimed to reduce suicidal thinking in a community-based sample. The primary outcomes of the study have been published (van Spijker et al., 2018), indicating that depression symptoms and suicidal thinking decreased significantly in both the internet CBT intervention and attention-matched control groups, with no significant between-group effects. We aimed to test whether trajectories of suicidal thinking were concordant with trajectories of depressive symptoms over 12 months, using linear growth mixture modelling (Muthén & Muthén, 2000) to identify latent classes of trajectories in suicidal thinking and depression symptoms. This method enabled the detection of multiple underlying subgroups within the sample that had differential change in suicidal ideation and/or depressive symptoms over time (Ram & Grimm, 2009). It was then possible to test whether participants with an improving trajectory of suicidal ideation also had improvements in depressive symptoms. The secondary aim was to identify whether

demographic and mental health factors associated with improving trajectories of suicidal thinking were similar to those implicated in improvements in depression symptoms. As the data were from an RCT, the effect of intervention was also modelled as a predictor of trajectory.

2 | MATERIALS AND METHODS

2.1 | Participants and procedure

The study was a 2-arm randomized controlled trial delivered entirely online. It compared an internet-based cognitive–behavioral treatment program for suicidal thinking, Living with Deadly Thoughts (LwDT), and an attention-matched control condition, Living Well. Full details of the study methodology are provided in the trial protocol (van Spijker et al., 2015) and primary outcomes paper (van Spijker et al., 2018), with a summary provided below.

Participants were assessed at four time points: baseline, post intervention (6 weeks after baseline), and 6- and 12-month follow-up. Participants were recruited between November 2013 and December 2015 through online media forums including websites, social-networking websites, and advertising on search engines. A link to a welcome screen included an invitation to provide consent and complete the online screening procedure. Eligibility criteria were as follows: aged 18–65 years, valid email address, reliable internet access, located in Australia, fluent in English, no history of a diagnosed psychotic disorder, currently experiencing suicidal thoughts, and no suicide attempts in the past month. No restrictions were placed on the severity of suicidal thinking or depression. Ethical approval was obtained from the human research ethics committees of the University of New South Wales (HC13117) and the Australian National University (2012/471). The trial was registered at Australia New Zealand Clinical Trials (ACTRN12613000410752).

2.2 | Measures

Outcomes for the growth mixture models were suicidal ideation and depression symptoms. Suicidal ideation was based on scores obtained on the Suicidal Ideation Attributes Scale (SIDAS) (van Spijker et al., 2014), which can range from 0 to 50 with higher scores indicating more severe ideation. Depression symptoms were assessed using the Center for Epidemiological Studies Depression scale (CES-D) (Radloff, 1977), with possible scores ranging from 0 to 60 and higher scores indicating more depression symptoms. The CES-D does not include items directly assessing suicidal ideation.

A number of self-report variables were included as candidates in regression models to identify factors associated with latent class membership. Demographic variables included age in years, gender, years of education, relationship status, employment status, and location. Mental health variables included measures of generalized anxiety symptoms (Generalized Anxiety Disorder-7 scale (GAD-7); range 0–21 (Spitzer, Kroenke, Williams, & Löwe, 2006)), insomnia severity (Insomnia Severity Index (ISI); range 0–28 (Morin, Belleville, Bélanger,

& Ivers, 2011)), alcohol use (Alcohol Use Disorders Identification Test-Consumption scale (AUDIT-C); range 0–12 (Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998)), and interpersonal needs comprising perceived burdensomeness (PB) and thwarted belongingness (TB) measured using the 12-item version of the Interpersonal Needs Questionnaire (INQ; ranges of 7–49 and 5–35 for PB and TB, respectively (Van Orden et al., 2008)). Higher scores on each of the mental health scales indicate greater symptoms or challenges. Suicidal ideation was also included as a candidate in the depression trajectory model only, and depression symptom was included as a candidate in the suicidal ideation trajectory model only.

2.3 | Analysis

Distinct trajectories of suicidal ideation and depression symptoms were identified using linear growth mixture models (GMM) estimated across the 12 months of the study using all available data from the four measurement occasions. GMM is used to identify latent classes of individuals with different longitudinal trajectories, based upon a set of continuous variables measured longitudinally that include all available data under the missing-at-random assumption (Muthén & Muthén, 2000). The approach combines growth modeling with latent class analysis, recognizing that there is heterogeneity of individual trajectories in symptoms over time and that such heterogeneity may be classified into a discrete number of latent classes. The primary criterion used to identify the optimal number of latent classes was the significance of the Bootstrapped Likelihood Ratio Test (BLRT), which is an indicator of whether a model with k latent classes fits significantly better than a model with one fewer ($k–1$) classes (Nylund, Asparouhov, & Muthén, 2007; Peel & McLachlan, 2000). Other considerations in selecting number of latent classes included: lowest Bayesian Information Criterion (BIC), indicating model fit; highest entropy, indicating precision of classification of individuals into profiles; and the size of each latent class, as models with classes that represent <5% of the total sample are hard to identify (Nylund et al., 2007).

Separate GMM analyses were conducted for suicidal thoughts, measure by the SIDAS, and for depression symptoms, using the CES-D. Models with 1–4 classes were estimated. The inclusion of quadratic terms in the GMM models was also explored, but the resulting classes were identical to those identified using linear GMM. After the best fitting model was identified, the characteristics of trajectories in each class were established. Concordance between suicidality and depression trajectory classes was determined by crosstabulation.

Finally, predictors of latent class membership were identified using logistic regression models. As there were many candidate predictors for these models, factors that were not bivariately associated with class membership for either suicidal ideation or depression were excluded from both models. Participants from the control and intervention groups of the RCT were included in the analyses. The primary outcome paper has previously shown no effect of the intervention on suicide or depression outcomes in mixed model repeated measures analyses. Regardless, the effect of the intervention was included in the logistic regression models of trajectory class (irrespective of whether intervention condition had a bivariate relationship) to account for the study design. GMM analyses were conducted in Mplus version 7 (Muthen & Muthen, Los Angeles, CA, USA), while descriptive and regression analyses were conducted in SPSS version 23 (IBM Corp, Chicago, IL, USA).

3 | RESULTS

Table 1 displays the characteristics of the sample ($N = 418$), which had an overall mean age of 40.6 years (SD = 11.9). Most participants were female (77%), not in a relationship (62%), employed (60%), and living in a metropolitan city of Australia (61%). The average level of suicidal ideation and depression symptoms was in the severe range, accompanied by moderate generalized anxiety symptoms, moderate sleep problems, and elevated alcohol consumption.

Fit statistics for the growth mixture models are provided in Table 2, for suicidal ideation and depression trajectories assuming 1–4 classes. For suicidal ideation, a 3-class model was supported on the basis of highest entropy; however, BLRT supported a 2-class model. Membership of the third class in the model was low, comprising less than 3% of the sample. Consequently, the 2-class model was retained. Similarly, a 3-class depression model was supported on the basis on entropy but not BLRT, and the third class represented a small minority (<1%), so the 2-class model was retained.

Class membership was extracted for each participant. Trajectories of SIDAS scores in the two suicidal ideation classes are shown in Figure 1. The two trajectories represent moderate severity of suicidal ideation that decreased significantly over time ("moderate decreasing" seen in 83% of the sample: intercept estimate = 24.2, 95% CI: 22.8, 25.7, $p < 0.001$; slope estimate = −5.0, 95% CI: −5.7, −4.3, $p < 0.001$) and high severity of suicidal ideation that remained stable over time ("high stable" seen in 17% of the sample: intercept estimate = 32.4, 95% CI: 29.3, 35.4, $p < 0.001$; slope estimate = 0.04, 95% CI: −0.9, 1.0, $p = 0.94$). Trajectories of CES-D scores in the two depression classes are shown in Figure 2. The two trajectories represent moderate depression severity that had a small but significant decrease over time ("moderate, small decrease" seen in 19% of the sample: intercept estimate = 27.0, 95% CI: 24.0, 30.0, $p < 0.001$; slope estimate = −2.1, 95% CI: −3.8, −0.4, $p = 0.017$) and high severity of depression that decreased moderately and significantly over time ("high, moderate decrease" seen in 81% of the sample: intercept estimate = 43.3, 95% CI: 41.9, 44.6, $p < 0.001$; slope estimate = −4.0, 95% CI: −4.8, −3.1, $p < 0.001$).

Concordance between latent class membership in the trajectories of suicidal ideation and depression (Table 3) was low (Fisher's exact test: $p < 0.001$; kappa = 0.07). Most participants (65%) started with high scores on the depression measure but relatively moderate scores on the suicidal ideation measure, but with significant decreases in both outcomes. However, 16% of participants had severe depression that remitted, without significant change in suicidal ideation. Similarly, 18% had little decrease in depression but were in the moderate/decreasing suicidal ideation latent class.

TABLE 1 Baseline characteristics of participants in the trial based on condition

	Living with deadly thoughts (Active intervention; n = 207) Mean (SD)		Living well (Attention control; n = 211) Mean (SD)		t	p
Age	39.53	(11.94)	41.73	(11.86)	−1.88	0.060
Years of education	15.13	(2.01)	15.21	(2.10)	−0.41	0.681
SIDAS suicidal ideation	28.03	(9.72)	25.37	(10.54)	2.68	**0.008**
CESD depression	40.82	(9.53)	39.72	(9.70)	1.17	0.243
GAD-7 anxiety	13.40	(4.99)	13.14	(5.15)	0.52	0.602
ISI insomnia	15.44	(5.87)	15.25	(6.05)	0.33	0.741
AUDIT alcohol use	3.13	(2.96)	3.02	(2.95)	0.35	0.725
INQ perceived burdensomeness	30.44	(10.57)	29.20	(10.49)	1.21	0.227
INQ thwarted belongingness	23.31	(6.50)	23.62	(6.18)	−0.50	0.621
	n (%)		**n (%)**		χ^2	p
Gender					0.03	0.865
Male	47	(22.7%)	46	(22.0%)		
Female	160	(77.3%)	163	(78.0%)		
Relationship status					2.44	0.118
In a relationship	87	(42.0%)	73	(34.6%)		
Not in a relationship	120	(58.0%)	138	(65.4%)		
Employment status					1.05	0.789
Part-time	49	(23.7%)	44	(20.9%)		
Unemployed	33	(15.9%)	33	(15.6%)		
Not in labor force	53	(25.6%)	51	(24.2%)		
Full-time	72	(34.8%)	83	(39.3%)		
Location					1.99	0.371
Regional	56	(27.1%)	51	(24.2%)		
Rural/remote	23	(11.1%)	33	(15.6%)		
Metropolitan	128	(61.8%)	127	(60.2%)		

Notes. SIDAS: Suicidal Ideation Attributes Scale; CESD: Center for Epidemiological Studies-Depression; GAD-7: Generalized Anxiety Disorder-7; ISI: Insomnia Severity Index; AUDIT: Alcohol Use Disorders Identification Test; INQ: Interpersonal Needs Questionnaire. Bold values indicate $p < 0.05$ based on independent groups *t*-tests for continuous variables and χ^2 tests for categorical variables, comparing active and control conditions;

Predictors of membership in the "high stable" (relative to the "moderate, decreasing") suicidal ideation latent class are shown in Table 4, and Table 5 shows predictors of membership in the "moderate, small decrease" (relative to the "high, moderate decrease") depression latent class. These models are based on multivariable logistic regression models, excluding factors that had no significant bivariate association with either suicidal ideation or depression class membership. Gender, location of residence, years of education and

TABLE 2 Fit statistics and class membership for the growth mixture models

	Fit statistics			Class membership			
Model	BIC	Entropy	*BLRT*	1	2	3	4
Suicidal ideation models							
2 class	6841.9	0.47	24.2, $p < 0.001$	83.2%	16.7%		
3 class	6848.5	0.52	11.4, $p > 0.99$	73.2%	24.4%	2.4%	
4 class	6858.4	0.47	8.3, $p > 0.99$	35.9%	30.3%	17.2%	16.5%
Depression symptom models							
2 class	7092.5	0.69	26.5, $p < 0.001$	81.1%	18.9%		
3 class	7105.0	0.78	5.7, $p > 0.99$	75.7%	23.7%	0.5%	
4 class	7111.5	0.75	11.5, $p > 0.99$	43.1%	40.9%	15.1%	0.9%

Notes. BIC: Bayesian Information Criterion; BLRT: Bootstrapped Likelihood Ratio Test for *k* versus *k*−1 classes; class membership is sorted from largest to smallest, although class numbers may not correspond to consistent classes across models.
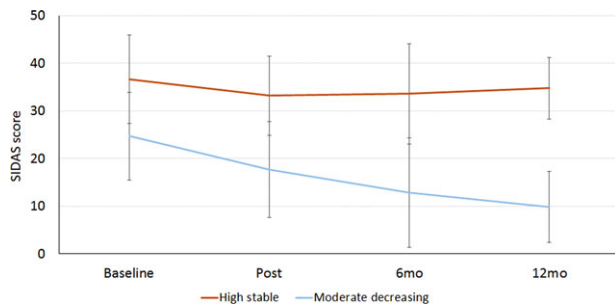
FIGURE 1 Suicidal ideation severity scores for the two suicidal ideation trajectories
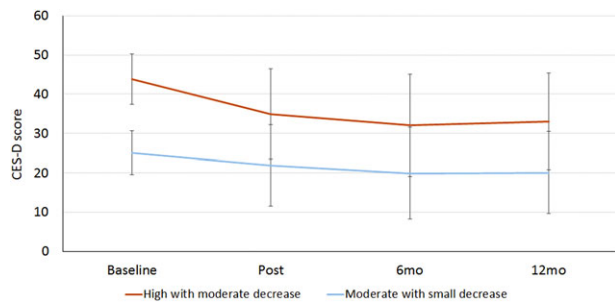
FIGURE 2 Depression scores for the two depression trajectories

TABLE 3 Concordance of group membership in the depression and suicidal ideation trajectory latent classes

	Depression class:	
	Moderate with small decrease	High with moderate decrease
Suicide ideation class:		
Moderate decreasing	76 (18%)	272 (65%)
High stable	3 (1%)	67 (16%)

alcohol use were excluded from the models on this basis. The suicidal ideation model accounted for 20% of variance in class membership while the depression model accounted for 52% of variance in class membership (based on Nagelkerke R^2). Condition in the trial (treatment vs. control) was not significantly associated with membership of latent classes for either outcome, and neither were age, baseline depression symptoms (for the suicidal ideation class model) or baseline suicidal ideation (for the depression class model). The only consistent predictor of class membership in both models was that lower perceived burdensomeness was associated with greater odds of being a member of the latent class where ideation or depression decreased the most. The only other factor associated with suicidal ideation latent class was employment status, with individuals not currently in the labor force (due to retirement, domestic duties, being a student, etc.) more likely to be in the high stable latent class than those in full-time employment. There were several mental health factors associated with membership of the depression latent class with little decrease over time, specifically: more severe generalized anxiety symptoms, more severe insomnia, and greater thwarted belongingness. Not being in a relationship was also associated with little decrease in depression symptoms.

4 | DISCUSSION

This study found evidence for two latent classes of suicidal ideation and two latent classes of depression symptoms in the context of an RCT of a CBT-based online program aiming to reduce suicidal thinking. The characteristics of class membership were different for the two outcomes – that is, those who had greater decreases in suicidal ideation had lower initial severity, while those who had a greater decrease in depression symptoms had higher initial severity. Allocation to receive treatment or control was not associated with class membership, which is consistent with previously reported outcomes of the trial showing no group differences on these outcomes

TABLE 4 Suicidal ideation trajectory: Logistic regression model of predictors of being in the "high stable" latent class

	Estimate	SE	χ^2	df	p	OR
Condition (intervention vs. control)	0.091	0.285	0.101	1	0.750	1.095
Age (years)	−0.012	0.013	0.843	1	0.359	0.988
In a relationship (yes vs. no)	−0.558	0.327	2.908	1	0.088	0.573
Employment status			12.005	3	**0.007**	
PT vs. FT	0.451	0.428	1.113	1	0.292	1.570
Unemployed vs. FT	0.511	0.439	1.358	1	0.244	1.667
NILF vs. FT	1.253	0.372	11.370	1	**0.001**	3.501
CES-D score at baseline	0.027	0.024	1.226	1	0.268	1.027
GAD-7 score at baseline	−0.017	0.036	0.225	1	0.635	0.983
ISI insomnia score at baseline	0.033	0.028	1.425	1	0.233	1.034
Thwarted belongingness, baseline	−0.002	0.026	0.005	1	0.942	0.998
Perceived burdensomeness, baseline	0.059	0.018	10.216	1	**0.001**	1.061
Constant	−4.869	1.123	18.796	1	<0.001	0.008

Notes. OR: odds ratio; PT: part-time; FT: full-time; NILF: not in labor force; CES-D: Center for Epidemiological Studies Depression scale; GAD-7: Generalized Anxiety Disorder-7 scale; ISI: Insomnia Severity Index. Bold values indicate *p* < 0.05.

TABLE 5 Depression trajectory: Logistic regression model of predictors of being in the "small decrease" latent class

	Estimate	SE	χ^2	df	p	OR
Condition (intervention vs. control)	0.224	0.342	0.427	1	0.513	1.251
Age (years)	−0.004	0.014	0.081	1	0.776	0.996
In a relationship (yes vs. no)	−0.883	0.348	6.429	1	**0.011**	0.413
Employment status			6.285	3	0.099	
PT vs. FT	−0.943	0.416	5.124	1	**0.024**	0.390
Unemployed vs. FT	−0.067	0.537	0.016	1	0.901	0.935
NILF vs. FT	0.011	0.462	0.001	1	0.981	1.011
SIDAS score at baseline	0.033	0.019	2.921	1	0.087	1.033
GAD-7 score at baseline	0.188	0.039	23.657	1	**<0.001**	1.207
ISI insomnia score at baseline	0.067	0.031	4.729	1	**0.030**	1.069
Thwarted belongingness, baseline	0.107	0.028	14.227	1	**0.001**	1.113
Perceived burdensomeness, baseline	0.073	0.020	12.957	1	**<0.001**	1.076
Constant	−5.908	1.207	23.954	1	<0.001	0.003

Notes. OR: odds ratio; PT: part-time; FT: full-time; NILF: not in labor force; SIDAS: Suicidal Ideation Attributes Scale; GAD-7: Generalized Anxiety Disorder-7 scale; ISI: Insomnia Severity Index. Bold values indicate $p < 0.05$.

(van Spijker et al., 2018). The independence of class membership across the two outcomes suggested that changes in depressive symptoms did not align closely with changes in suicidal ideation. While only 17% of the sample had severe and unremitting suicidal thoughts throughout the 12 months of the study, 96% of these participants had large reductions in their depression symptoms. Together, the findings suggest that changes in depression are related to but separate from changes in suicidal thinking, implying that different processes or mechanisms underlie these changes. The lack of consistency in trajectories suggests that other factors may be more important than depressive symptoms in reducing suicidal thinking.

The findings may also be related to qualitative differences in the nature of suicidal thinking and depression. It is possible that, for a subset of the population, persistent suicidal thinking may reflect a trait-like characteristic, influenced by factors such as personality (or personality disorders), hopelessness, ruminative style, cognitive function, and aggression (Brezo, Paris, & Turecki, 2006; Mann, Waternaux, Haas, & Malone, 1999). Both depression latent classes had significant decreases over time, suggesting depression may be more readily modifiable or that depression symptoms may represent a more state-like form of psychopathology among individuals experiencing suicidal ideation. A previous review has noted that a chronic trajectory of depression is uncommon, typically seen in fewer than 10% of individuals with depression (Musliner et al., 2016). Greater symptom reductions in the group with more severe initial depression symptoms may have reflected regression to the mean, a phenomenon not observed in the high/stable suicidal ideation group. Further examination of the divergence between suicidal ideation and depression trajectories may assist in better characterizing the factors that maintain chronic suicidal thinking.

The inconsistencies in trajectories of suicidal ideation and depression symptoms were further supported by the regression analyses. Depression symptom trajectories were strongly predicted by a wide range of baseline mental health measures, while only labor force

participation and higher perceived burdensomeness were significantly associated with suicidal ideation trajectories. More variance was accounted for in the depression trajectory model than the suicidal ideation trajectory model, suggesting that it may be harder to predict changes in suicidal thinking than changes in depression, or that other unmeasured factors may have modified suicidal trajectories. Despite the relative independence of the trajectories, it is noteworthy that perceived burdensomeness emerged as the only predictor in common for both outcomes. This is consistent with existing theory and evidence that highlight a lack of social connectedness as a risk factor for suicidal ideation and depression (Ma, Batterham, Calear, & Han, 2016; Slavich & Irwin, 2014), and with social connectedness interventions that aim to reduce suicidal ideation and depression (Calear et al., 2016; Cruwys et al., 2014). Perceived burdensomeness has been found to be particularly pernicious for the development of suicidal thoughts and behaviors, and may constitute an important intervention target (Ma et al., 2016).

While fit statistics for the GMMs identified a 2-class solution for depressive symptoms and suicidal ideation, 3–4 class solutions are more frequently reported in the literature, based on a review of long term trajectories of depressive symptoms (Musliner et al., 2016) and recent studies reporting trajectories of suicidal ideation (Allan, Gros, Lancaster, Saulnier, & Stecker, 2018; Kasckow et al., 2016; Köhler-Forsberg et al., 2017; Madsen et al., 2016a,b). This discrepancy in research findings may be explained by factors such as differences in measures used to assess symptoms, differences in follow-up periods, differences in study design (e.g., observational studies vs. trials, and variable eligibility criteria), and differences in target populations (e.g., clinical vs. population samples). Limitations related to the present sample that may have impacted on the potential to identify more than two distinct trajectories are discussed further below.

From a clinical and public health perspective, the findings of the current study suggest that greater awareness is needed among clinicians that suicidal ideation can occur in the absence of depression

and that treating depression may not be sufficient to reduce suicidal thinking at an individual or population level. While current treatment protocols are organized around mental health diagnoses, suicidality may be more complex to treat than specific mental disorders, perhaps requiring a transdiagnostic or targeted approach to reduce suicide risk (e.g., increasing social connectedness or modifying common vulnerabilities, and not just treating depression). More broadly, findings indicate that factors other than depression are involved in suicidal ideation. For instance, previous researches (Batterham et al., 2018; Nock et al., 2009) has found that symptoms of anxiety, conduct disorder, obsessive compulsive disorder (OCD), and trauma have been associated with suicidal thoughts, as well as an array of other cultural, psychological, and interpersonal risk factors (Christensen et al., 2014; Qin, Agerbo, & Mortensen, 2003). The development of new, targeted interventions that account for a broader conception of suicide risk, rather than focusing primarily on depression, may be more effective in reducing suicidal ideation and deaths than the approaches currently employed.

There are some limitations of this study that should be acknowledged, including that the data were drawn from an RCT which enforced several eligibility criteria, such as having current suicidal ideation. These criteria may have limited the potential of this study to identify trajectories with limited or mild symptomatology of depression or suicidal thinking. In general, symptom levels were found to be relatively severe (van Spijker et al., 2018), which may have further limited the potential to identify more than two distinct trajectories. Fluctuations in suicidal ideation over short periods were not captured by the assessments, which also limited analyses to linear trajectories. While quadratic trajectories were explored in sensitivity analyses, these models did not reveal substantive differences. All assessments were self-report and therefore suicidal behaviors and clinical states could not be independently verified. The sample may not be representative of the population with suicidal thoughts or behaviors, with females slightly over-represented relative to the prevalence of suicidal ideation in this group. Finally, as the focus was on suicidal ideation, the trial was not powered to examine trajectories of suicidal behavior. Trajectories leading to suicide death or suicidal behavior may be distinct to those for suicidal ideation.

5 | CONCLUSION

Class membership for depression and suicidal ideation trajectories were largely independent in the current study. Predictors of class membership differed for suicidal thinking and depression. The lack of coupling in trajectories and predictors suggests that there are a number of factors that drive changes in suicidal thinking, independently of depression, that require further exploration. The identification of these factors may assist in the development of more targeted and effective interventions to reduce suicidal ideation.

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