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Supplementary Material

Article Title: Long-Term Suicidal Ideation Profiles in Late-Life Depression and Their Association With Suicide Attempt or Death by Suicide

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Appendix 1 Missing data, censoring, follow-up times

Proportion of missing data was aggregated by group and time and inspected for any trends or patterns. Missingness of suicidal ideation scores took 3 forms: missing both current and worst ideation when other information was collected at an assessment, missing either the current or the worst ideation when the other was reported for the same assessment point, and censoring of follow-up (because of the unequal time in study, or because of death). The first two types of missingness occurred in 3% and 1% of the assessment points, respectively, and no differences were found among recruitment groups in these types of missingness. Censoring due to late enrollment in the study was considered to be random. Censoring by death could not be considered random, as the risk factors for death, whether natural death or suicide, are not independent from those for suicidal ideation or behavior, and was considered a competing risk when comparing risk of suicide attempt among profiles.

Differences in the number of assessment points and in overall time in study may lead to bias and incorrect conclusions both in the LPA analysis of subject level aggregates, and in the survival analysis models. Such imbalances were tested for baseline age, suicidal ideation, and suicidal behavior. The number of assessment points was mildly inversely correlated with baseline age (Spearman $r = -0.14$, $p = 0.011$), and, partly as a consequence, for all group comparisons. Sensitivity analyses adjusting for baseline age were run and their results are reported in the main text or in this Supplement. If subjects at higher levels of ideation and higher risk of attempt were more likely to die earlier, one would expect an inverse correlation between number of assessment points, and risk or ideation severity, however, baseline suicide attempters and suicide ideators had significantly more follow-up assessments than non-suicidal depressed controls (median=5.5 vs. 4, Kruskal-Wallis $\chi^2 = 9.79$, $df = 2$, $p = 0.007$).

The four ideation profiles derived in this study did not differ on the length of time from baseline until the end of follow-up suicidal ideation assessments (Kruskal-Wallis

$\chi^2=6.00$, $df=3$, $p=0.111$), or the length of time in study for the competing risk model (time from baseline until death or February 19, 2021, whichever was earlier (Kruskal-Wallis $\chi^2=3.69$, $df=3$, $p=0.297$). Of note, significantly more assessment points were used for the aggregated ideation measures for *Chronic severe ideators* than for the other subjects (median= 6 vs. 5, Wilcoxon $W=8985$, $p=0.003$), and the difference persisted after adjusting for the profile's younger baseline age ($b=0.83$, $SE=0.28$, $t=2.95$, $df=334$, $p=0.003$). However, the absence of differences in the number of assessment points among the three other profiles indicates that classification was likely independent from the amount of ideation timepoints available per subject.

Appendix 2. Time trend analysis

Time trends in ideation were tested in a subsample of $N=276$, including the *Fast-remitting* group, but excluding the *Low/non-ideator* group, and also subjects with fewer than 3 assessment points. Both current and worst ideation for the remaining subjects was severely zero-inflated and also right-skewed. Zero-inflated Poisson mixed-effects regression identified significant decreasing trend in the severity and increase in zero-inflation of worst ideation over (log-transformed) time in study measured in months (conditional model: $b=-0.81/\log\text{-month}$, $SE=0.07$, $z=-11.9$, $p<0.001$; zero-inflation: $b=0.39$, $SE=0.09$, $z=4.19$, $p<0.001$). However, no significant time trend remained after the baseline assessment was removed (conditional model: $b=-0.10/\log\text{-month}$, $SE=0.11$, $z=-0.85$, $p=0.394$; zero-inflation: $b=0.27$, $SE=0.21$, $z=1.27$, $p=0.206$), indicating that the declining ideation time trend was mostly due to differences between baseline and follow-up. For current ideation there was a similar significant decline in severity and increase in zero-inflation when baseline was included (conditional model: $b=-1.14$, $SE=0.09$, $z=-12.7$, $p<0.001$; zero-inflation: $b=0.43$, $SE=0.10$, $z=4.49$, $p<0.001$), however, the increased zero-inflation over time persisted after removing the baseline point (conditional model: $b=0.21$, $SE=0.14$, $z=1.49$, $p=0.137$; zero-inflation: $b=0.64$, $SE=0.25$, $z=2.58$, $p=0.010$).

Supplementary Table 1. Comparison of Baseline Characteristics of 4 derived profiles (P1-P4) and 2 pre-defined clusters (C0 and C5)

	No ideation (C0) N=61	Low ideators (P1) N=16	Chronic severe ideators (P2) N=93	Highly variable ideators (P3) N=63	Remitting ideators (P4) N=43	Baseline ideation only (C5) N=61	P-value	Post-hoc pairwise differences
Age	66.97 (9.35)	65.56 (7.47)	62.89 (7.55)	64.05 (8.14)	65.91 (9.59)	67.13 (9.51)	0.020	P2<C5
Gender (M):	24 (39.34%)	6 (37.50%)	37 (39.78%)	30 (47.62%)	23 (53.49%)	34 (55.74%)	0.273	
Caucasian	49 (80.33%)	13 (81.25%)	79 (84.95%)	53 (84.13%)	35 (83.33%)	52 (86.67%)	0.627	
Education	14.52 (2.69)	14.12 (2.66)	14.16 (2.53)	14.30 (3.17)	14.47 (3.00)	14.36 (2.73)	0.974	
SES per capita	20460.14 (15008.55)	24526.79 (21088.31)	19951.97 (14452.85)	20048.91 (17172.88)	24560.48 (19393.77)	29402.43 (22321.95)	0.076	
Depression severity^a (no suicide item)	17.48 (3.43)	19.12 (5.43)	21.05 (5.06)	19.19 (5.67)	20.24 (6.12)	19.00 (5.34)	0.002	P2>C0
Premorbid IQ^b	124.07 (119.46)	103.14 (19.53)	114.30 (101.78)	109.39 (14.54)	104.82 (14.53)	124.95 (136.67)	0.884	
Physical Illness Severity^c	9.21 (4.43)	9.71 (4.60)	8.67 (3.96)	9.11 (4.93)	10.19 (4.85)	8.15 (3.97)	0.277	
Current Ideation	0.00 (0.00)	0.69 (1.54)	19.14 (6.74)	17.91 (9.53)	17.16 (11.22)	15.89 (10.97)	<0.001	C0 & P1< P2 & P3 & P4 & C5
Worst Ideation	0.00 (0.00)	0.19 (0.40)	24.11 (6.77)	22.37 (8.68)	17.32 (11.24)	17.38 (11.02)	<0.001	C0 & P1< P4 & C5 < P2 & P3
Anxiety Disorder (Lifetime)^d	37 (60.66%)	8 (50.00%)	65 (71.43%)	47 (78.33%)	25 (60.98%)	31 (50.82%)	0.016	P3>C5
Anxiety Disorder (Current)^d	33 (54.10%)	7 (43.75%)	58 (63.74%)	40 (66.67%)	19 (46.34%)	27 (44.26%)	0.052	
Substance Use Disorder (Lifetime)^d:	19 (31.15%)	4 (25.00%)	49 (53.85%)	31 (51.67%)	21 (51.22%)	21 (34.43%)	0.012	No pairwise differences
Substance Use Disorder (Current)^d:	4 (6.56%)	0 (0.00%)	15 (16.48%)	8 (13.33%)	5 (12.20%)	5 (8.20%)	0.275	
Baseline history of attempt	0 (0.00%)	0 (0.00%)	56 (60.22%)	38 (60.32%)	19 (44.19%)	31 (50.82%)	<0.001	C0 & P1< P2 & P3 & P4 & C5

Number of baseline attempts	0.00 (0.00)	0.00 (0.00)	1.38 (1.83)	0.97 (1.15)	0.77 (1.11)	0.72 (0.94)	0.016	P2>C5
Maximum lethality of baseline attempts^c	-	-	4.05 (2.11)	3.54 (2.10)	3.35 (2.43)	3.45 (2.28)	0.450	

Notes: ^aHamilton Rating Scale for Depression - 17 Item (HRSD); ^bWechsler Test of Adult Reading; ^cCumulative Illness Rating Scale-Geriatric (CIRS-G); ^dStructured Clinical Interview for DSM-IV (SCID); ^eBeck Lethality Scale (BLS)

Supplementary Table 2. Differences among the 4 final profiles, covarying for baseline age. P-values were adjusted using Benjamini adjustment for multiple testing, and pairwise comparisons used Tukey's HSD method.

Dependent Variable	F(3)	P-value	Effect size	Adjusted P-value	Pairwise comparison
Personality & Social Characteristics					
Personality Dimensions^a					
Neuroticism	11.78	<0.001	0.42	<0.001	CI>RI&LI, VI>LI
Introversion	8.06	<0.001	0.35	<0.001	CI>VI&RI&LI
Openness	1.64	0.1808	0.16	0.2213	
Agreeableness	1.58	0.1961	0.15	0.2324	
Conscientiousness	3.64	0.0136	0.23	0.022	RI>CI
Borderline Traits^b					
Total	9.07	<0.001	0.39	<0.001	CI>RI&LI
Identity Problems	8.53	<0.001	0.38	<0.001	CI>RI&LI
Affective Instability	8.19	<0.001	0.37	<0.001	CI>VI&RI&LI
Negative Relationships	2.83	0.0397	0.23	0.0568	
Impulsivity	5.05	0.0022	0.29	0.0044	CI>RI&LI
Interpersonal Problems^c					
Interpersonal Sensitivity	10.81	<0.001	0.38	<0.001	CI>RI&LI
Interpersonal Ambivalence	6.49	<0.001	0.26	<0.001	CI>VI&RI&LI
Interpersonal Aggression	4.4	0.0048	0.25	0.009	CI>RI&LI
Interpersonal Support^d					
Low Self Esteem	11.92	<0.001	0.38	<0.001	CI>RI&LI, VI>LI
Low Belonging	7.85	<0.001	0.33	<0.001	CI>RI&LI
Low Appraisal	5.26	0.0015	0.26	0.0032	CI>RI&LI
Low Tangible	10.14	<0.001	0.33	<0.001	CI>VI&RI&LI
Social Problem Solving^e					
Total	6.48	<0.001	0.28	<0.001	CI&RI>LI
Positive Problem Orientation	3.77	0.0111	0.23	0.0185	RI&LI>CI
Negative Problem Orientation	6.88	<0.001	0.28	<0.001	CI>RI&LI, VI>LI
Rational Problem-Solving	2.02	0.1667	0.17	0.1386	
Impulsivity/Carelessness	4.88	0.0025	0.23	0.0048	CI>RI&LI
Avoidance	3.49	0.016	0.20	0.0247	CI>LI

Burdensomeness^f	11.83	<0.001	0.41	<0.001	CI>VI&RI&LI
Impulsivity					
Barratt Impulsiveness Scale^g					
Attentional	5.2	0.002	0.35	0.0042	CI>RI&LI
Motor	1.25	0.2937	0.17	0.3325	
Nonplanning	3.47	0.0167	0.22	0.025	CI>RI&LI
Impulsive Behavior Scale^h					
Negative Urgency	9.61	<0.001	0.36	<0.001	CI>RI&LI
Lack of Premeditation	4.07	0.0076	0.26	0.0131	CI>RI&LI
Lack of Perseveration	2.67	0.0485	0.20	0.0676	
Positive Urgency	7.54	<0.001	0.30	<0.001	CI>RI&LI
Suicidal Ideation					
Current					
Baseline ideation	92.08	<0.001	0.92	<0.001	CI&VI&RI>LI
Variability (RMSSD)	140.48	<0.001	1.15	<0.001	CI>VI&RI&LI; VI>LI
Mean	197.36	<0.001	1.37	<0.001	CI>VI&RI&LI
Maximum	310.59	<0.001	1.72	<0.001	CI>VI&RI&LI; VI>LI
Proportion of 0	131.31	<0.001	1.12	<0.001	CI<VI&RI<LI
Standard Deviation	125.16	<0.001	1.09	<0.001	CI>VI&RI&LI; VI>LI
Worst					
Baseline ideation	141.98	<0.001	1.15	<0.001	CI&VI>RI>LI
Variability (RMSSD)	93.22	<0.001	0.95	<0.001	CI&VI>RI&LI
Mean	160.93	<0.001	1.27	<0.001	CI>VI>RI&LI
Maximum	240.9	<0.001	1.54	<0.001	CI>VI>RI&LI
Proportion of 0	176.31	<0.001	1.3	<0.001	CI<VI<RI<LI
Standard Deviation	93.29	<0.001	0.95	<0.001	CI&VI>RI&LI
Cognition					
Dementia Rating Scaleⁱ					
Total	2.35	0.0729	0.18	0.0951	
Attention	1.08	0.3569	0.11	0.4040	
Initiation and perseverance	2.05	0.1072	0.17	0.1368	
Construction	1.01	0.3904	0.11	0.4183	
Conceptualization	0.29	0.8304	0.05	0.8591	
Memory	2.49	0.0608	0.18	0.0829	
Executive Function^j	1.57	0.1975	0.12	0.2324	
Premorbid IQ (WAIS-IV)^k	1.16	0.3273	0.12	0.3637	

Notes: ^aNEO Five Factor Inventory; ^bPersonality Assessment Inventory- Borderline; ^cInventory of Interpersonal Problems; ^dInterpersonal Support Evaluation List; ^eSocial Problem Solving Inventory; ^fPerceived Burdensomeness; ^gBarratt Impulsiveness Scale (BIS-11); ^hUrgency, Premeditation, Perseverance, Sensation seeking and Positive urgency impulsive behavior scale; ⁱDementia Rating Scale total score; ^jExecutive Interview; ^kWechsler Test of Adult Reading

Abbreviations: CI=Chronic severe ideators; LI=Low/non-ideators; RI=Fast-remitting ideators; RMSSD= root mean successive squared deviations, VI=Highly variable ideators,

Supplementary Table 3. Differences among the 4 profiles in binary characteristics, covarying for baseline age

Dependent Variable	Deviance (df=3)	P-value
Presence of Past Suicidal Behavior	353.67	0.1815
Gender	458.38	0.0678
Substance Use Disorders		
Lifetime	440.84	<0.001
Current	225.47	0.0012
Anxiety Disorder		
Lifetime	416.56	<0.001
Current	442.63	0.0025

Supplementary Table 4. Mean score of variables on radar plots

Dependent Variable	Low/non-ideators (N=77) M (SD)	Chronic severe ideators (N=93) M (SD)	Highly variable ideators (N=63) M (SD)	Fast-remitting ideators (N=104) M (SD)
A. Personality & Social Characteristics				
Neuroticism	34.34 (8.45)	43.95 (9.03)	39.91 (11.00)	36.23 (8.50)
Introversion*	37.32 (6.94)	31.02 (7.08)	35.47 (8.35)	36.48 (7.55)
Identity Problems	6.97 (3.66)	10.42 (3.73)	9.00 (4.69)	7.10 (3.76)
Affective Instability	6.47 (3.19)	9.31 (3.25)	7.32 (4.36)	6.12 (3.76)
Interpersonal Sensitivity	6.23 (4.14)	9.78 (4.37)	7.93 (4.42)	6.15 (4.02)
Interpersonal Ambivalence	4.53 (4.23)	7.54 (4.98)	4.86 (4.76)	5.04 (4.74)
Low Tangible*	8.64 (2.78)	5.95 (3.12)	7.96 (3.10)	7.82 (3.25)
Low Belonging*	8.08 (2.91)	5.53 (2.58)	6.75 (3.08)	7.40 (3.35)
Low Appraisal*	8.78 (2.64)	6.95 (2.93)	7.82 (2.69)	8.47 (2.89)
Low Self Esteem*	6.66 (2.78)	4.07 (2.42)	4.93 (2.43)	5.89 (2.85)
Negative Problem Orientation	6.21 (3.62)	9.38 (4.48)	8.95 (4.76)	7.30 (4.96)
Burdensomeness	1.19 (1.70)	3.90 (2.99)	3.49 (3.21)	2.32 (2.54)
B. Impulsivity				
Attentional Impulsivity	16.30 (3.47)	19.68 (3.17)	17.70 (4.00)	16.62 (4.99)
Positive Urgency	21.94 (7.05)	28.17 (9.00)	25.71 (9.20)	23.21 (8.59)
Negative Urgency	24.95 (6.82)	31.56 (6.93)	28.33 (7.62)	26.36 (7.69)
Lack of Premeditation	20.42 (4.94)	24.21 (6.37)	22.04 (6.09)	21.12 (6.48)
PAIBOR - Impulsivity	3.34 (2.91)	5.97 (4.22)	5.25 (4.37)	3.88 (3.15)
Aggression	3.82 (3.45)	5.95 (3.96)	4.65 (3.89)	3.91 (3.53)
C. Ideation				
Current				

Baseline ideation	0.14 (0.74)	19.14 (6.74)	17.91 (9.53)	16.41 (11.04)
Variability (RMSSD)	0.11 (0.33)	6.91 (4.09)	1.48 (2.11)	0.65 (1.36)
Mean	0.04 (0.11)	8.91 (5.21)	0.78 (0.97)	0.47 (0.83)
Maximum	0.19 (0.65)	17.16 (6.99)	2.53 (3.53)	1.23 (2.45)
Proportion of 0	0.97 (0.08)	0.19 (0.24)	0.70 (0.31)	0.77 (0.34)
Standard Deviation	0.08 (0.25)	5.76 (3.76)	1.15 (1.69)	0.48 (1.02)
Worst				
Baseline ideation	0.04 (0.19)	24.11 (6.77)	22.37 (8.68)	17.35 (11.06)
Variability (RMSSD)	0.20 (0.59)	7.44 (4.87)	7.25 (5.72)	0.69 (1.39)
Mean	0.08 (0.26)	12.10 (6.31)	6.23 (5.54)	0.52 (0.87)
Maximum	0.35 (0.96)	19.98 (7.47)	13.74 (8.86)	1.30 (2.46)
Proportion of 0	0.96 (0.09)	0.12 (0.20)	0.33 (0.29)	0.75 (0.35)
Standard Deviation	0.16 (0.48)	5.78 (3.85)	5.55 (4.34)	0.51 (1.01)

Note: * indicates variables that have been reversed to risk direction on radar plots.

Abbreviations: PAIBOR= Personality Assessment Inventory-Borderline Scale, RMSSD= root mean successive squared deviations

Supplementary Table 5. Competing Risk model results for pairwise profile comparisons of the risk of suicidal behavior after baseline (unadjusted and age-adjusted models). Significance levels displayed were not adjusted for multiple comparisons.

Contrast	Group comparison of cumulative incidence^a		Competing Risk Regression, adjusted by age^b			
	Statistic	P-value	HR	95%CI	z	P-value
CI vs. LI	23.62	<0.001	99345 ^c	- ^c	48.76	<0.001
VI vs. LI	10.92	0.001	48828 ^c	- ^c	27.93	<0.001
RI vs LI	3.84	0.050	16758 ^c	- ^c	20.88	<0.001
CI vs. VI	3.15	0.076	2.02	0.91-4.49	1.73	0.083
CI vs. RI	16.59	<0.001	5.75	2.25-14.7	3.65	<0.001
VI vs. RI	3.50	0.061	3.21	1.03-10.1	2.01	0.045

Notes: ^a Gray's test for the equality of cumulative incidence functions across groups. Not adjusted for any covariate, but adjusts for the competing risk of natural/accidental death.

^b Proportional subdistribution hazards regression model of Fine and Gray (1999), with age as a covariate.

^c Hazard ratios for comparisons to the Low/non-ideators (LI) approach infinity as there are no events of interest in that group

Abbreviations: CI=Chronic severe ideators; LI=Low/non-ideators; RI=Fast-remitting ideators; VI=Highly variable ideators,

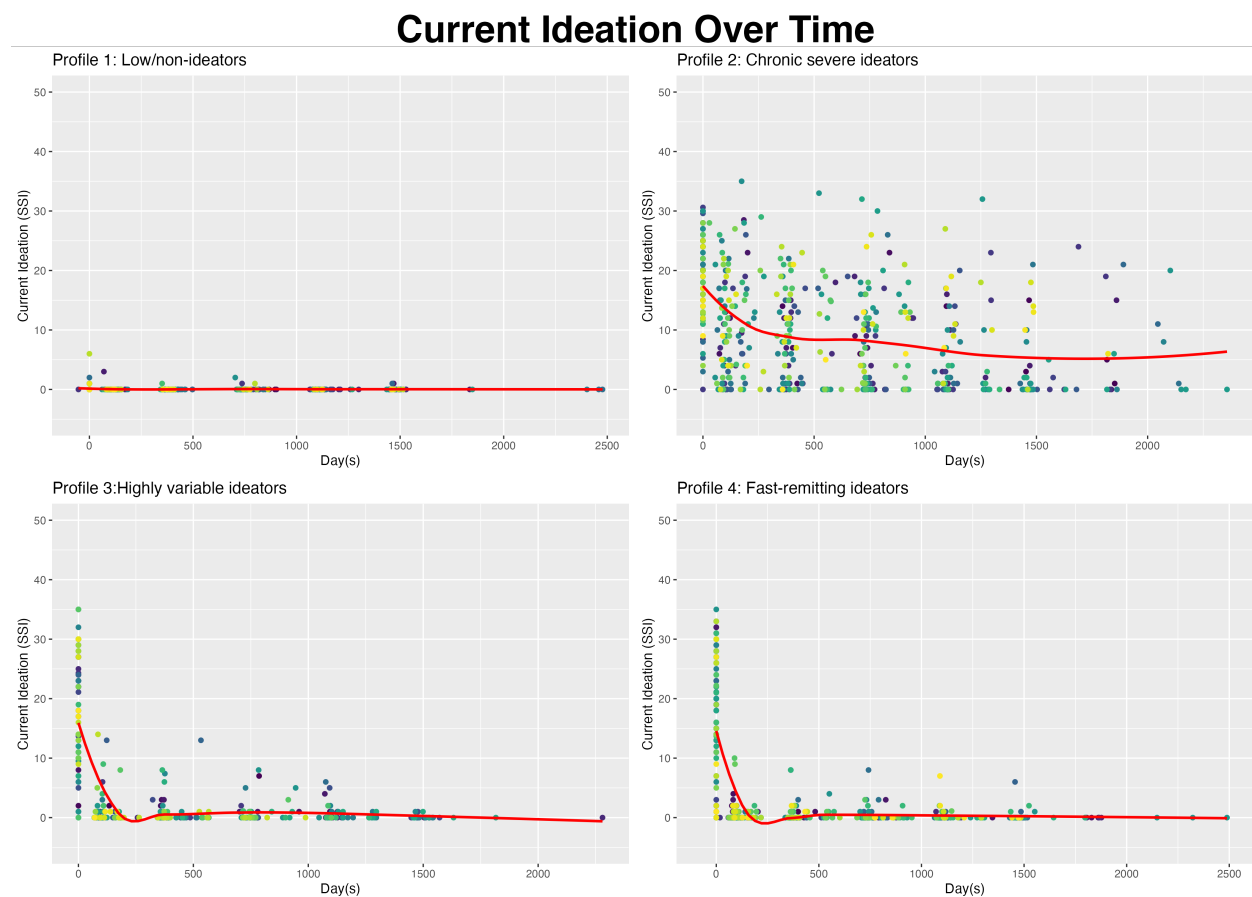
Supplementary Table 6. Latent Profile Analysis: profile centroids (mean for each variable used to derive profiles). Only subjects used in the LPA are included, as opposed to similar statistics in table Supplementary Table 4.

Study Timepoint	Ideation aggregate	Timeframe	Low ideators (C1)	Chronic severe ideators (C2)	Highly variable ideators (C3)	Remitting ideators (C4)
Baseline		Current	0.69	19.14	17.91	17.16

		Worst	0.19	24.11	22.37	17.32
Follow-up	Mean	Current	0.17	8.91	0.78	1.14
		Worst	0.38	12.10	6.23	1.25
	Maximum	Current	0.94	17.16	2.53	2.98
		Worst	1.69	19.98	13.74	3.14
	Proportion of 0	Current	0.88	0.19	0.70	0.45
		Worst	0.80	0.12	0.33	0.40
	Standard. Deviation	Current	0.39	5.76	1.15	1.17
		Worst	0.78	5.78	5.55	1.24
	Variability (RMSSD)	Current	0.51	6.91	1.48	1.57
		Worst	0.95	7.44	7.25	1.68

Abbreviations: RMSSD= root mean successive squared deviations

Supplementary Figure 1. Graphs of current ideation over time in final 4 profiles



Supplementary Figure 2. Graphs of worst ideation over time

Worst Ideation Over Time

