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Short-term and long-term effects of psychosocial therapy for people after deliberate self-harm: a register-based, nationwide multicentre study using propensity score matching

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Summary

Background **Although deliberate self-harm is a strong predictor of suicide, evidence for effective interventions is missing. The aim of this study was to examine whether psychosocial therapy after self-harm was linked to lower risks of repeated self-harm, suicide, and general mortality.**

Methods **In this matched cohort study all people who, after deliberate self-harm, received a psychosocial therapy intervention at suicide prevention clinics in Denmark during 1992–2010 were compared with people who did not receive the psychosocial therapy intervention after deliberate self-harm. We applied propensity score matching with a 1:3 ratio and 31 matching factors, and calculated odds ratios for 1, 5, 10, and 20 years of follow-up. The primary endpoints were repeated self-harm, death by suicide, and death by any cause.**

Findings **5678 recipients of psychosocial therapy (followed up for 42·828 person-years) were matched with 17 034 individuals with no psychosocial therapy in a 1:8 ratio. During 20 year follow-up, 937 (16·5%) recipients of psychosocial therapy repeated the act of self-harm, and 391 (6·9%) died, 93 (16%) by suicide. The psychosocial therapy intervention was linked to lower risks of self-harm than was no psychosocial therapy (odds ratio [OR] 0·73, 95% CI 0·65–0·82) and death by any cause (0·62, 0·47–0·82) within a year. Long-term effects were identified for repeated self-harm (0·84, 0·77–0·91; absolute risk reduction [ARR] 2·6%, 1·5–3·7; numbers needed to treat [NNT] 39, 95% CI 27–69), deaths by suicide (OR 0·75, 0·60–0·94; ARR 0·5%, 0·1–0·9; NNT 188, 108–725), and death by any cause (OR 0·69, 0·62–0·78; ARR 2·7%, 2·0–3·5; NNT 37, 29–52), implying that 145 self-harm episodes and 153 deaths, including 30 deaths by suicide, were prevented.**

Interpretation **Our findings show a lower risk of repeated deliberate self-harm and general mortality in recipients of psychosocial therapy after short-term and long-term follow-up, and a protective effect for suicide after long-term follow-up, which favour the use of psychosocial therapy interventions after deliberate self-harm.**

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Introduction

Worldwide, suicide accounted for an estimated 804 000 deaths in 2012.[1] The number of suicide attempts is ten to 40 times higher than the number of deaths caused by suicide, implying that between 9 million and 35 million suicide attempts occur annually.[2]

Deliberate self-harm, the suggested new nomenclature for suicide attempt,[3] is strongly linked to reoccurring suicidal behaviour and mortality.[4] Within the first year after self-harming, about 16% of people self-harm again,[5,6] whereas 0·5–1·8% die by suicide,[5,7] and 2·3% die by any cause.[8] WHO emphasises the need for health-care providers to implement suicide prevention through effective management.[1] However, the Cochrane Collaboration and the National Institute for Health and Clinical Excellence conclude that evidence for effective interventions is meagre;[9,10] one obstacle is small sample sizes of previous studies, making it challenging to study death by suicide.[11,12]

Since 1992, psychosocial therapy for people at risk of suicide has been offered in specialised clinics in Denmark. The intervention was at first only available in two cities but became more widespread over time. In 2007, the Danish National Board of Health was possibly the first authority in the world to implement the psychosocial therapy intervention nationally, and suicide prevention clinics continue to emerge (figure 1).

The aim of this study was to examine whether people receiving psychosocial therapy intervention after deliberate self-harm have lower risks of suicidal behaviour and mortality than people not receiving the psychosocial therapy intervention.

Methods

Study design and participants

In this matched cohort study, we used propensity scores to match the people who received psychosocial therapy intervention for self-harm with those who received

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Figure 1: **Location of suicide preventive clinics in Denmark (year of first practice)**
*Clinics included in the study.

standard care between Jan 1, 1992, and Dec 31, 2010. Clinical data for recipients of psychosocial therapy was obtained from the following Danish suicide prevention clinics (years of operation): Odense-adults (1992–2010), Odense-youth (2007–10), Copenhagen (1992–2010), Aarhus including Silkeborg and Randers (1996–2010), Vordingborg (2005–10), Aalborg (2006–10), Amager (2007–10), and Herning (2009–10). At the first psychosocial therapy session, the clinics obtain specific data about their service users, including the user's personal identification (ID) number and whether the reason for referral was an act of deliberate self-harm or suicidal ideation.

In Denmark, citizens are issued with a unique personal ID number which allows for individual-level linkage of information across data sources. We used these personal ID numbers to link clinical data to nationwide registers of sociodemographic and health-related variables from the Danish Civil Register, National Registry of Patients, Psychiatric Central Registry, and Registry of Causes of Death.

The psychosocial therapy group consisted of all people who received the psychosocial therapy intervention after a first episode of deliberate self-harm during the observation period (1992–2010). The suicide prevention clinics receive people who are thought to be at risk of suicide but not in need of psychiatric admission or other outpatient programmes. Participation was conditional on having attended at least one psychosocial therapy session.

The no psychosocial therapy group consisted of all people who presented with an episode of self-harm at any somatic or psychiatric hospital and who had not received the psychosocial therapy intervention. We defined acts of deliberate self-harm using the International Classification of Diseases (ICD): ICD-8 950–959 or ICD-10 X60–X84. The project was approved by the Danish Patient Review Board (3–3013–204), the Danish National Board of Health (6–8011–834), and the Danish Data Protection Agency through Capital Region of Denmark (RHP-2012–01). In view of the obtained permission to use recorded data, informed consent from participants was not required.

Procedures

The psychosocial therapy intervention was focused on suicide prevention. Each of the clinics applied different or combined therapies including cognitive, problem-solving, crisis, dialectical behaviour, integrated care,[13] psychodynamic, systemic, psychoanalytic approaches, and support from social workers. A uniform treatment algorithm was not followed; elements from the listed approaches were chosen on the basis of what was deemed the most promising strategy in each individual case. In effect, national implementation in 2007 did not change the treatment scheme. Patients were referred from somatic and psychiatric emergency departments, general wards, and general practitioners, but self-referral was also accepted. Typically, the clinic would contact people shortly after the referral by telephone to set up the first appointment. The intervention consisted of eight to ten individual sessions in an outpatient care setting.

Standard aftercare after deliberate self-harm consisted of admission to a psychiatric hospital, referral to outpatient treatment or a general practitioner, or discharge with no referral. The main reasons why patients did not receive the psychosocial therapy intervention were if they lived in an area or presented to services at a time at which the psychosocial therapy intervention was not offered, were referred to other treatment (eg, admission to an inpatient mental health unit or outpatient treatment for specific disorders), were not referred, did not want to be referred to suicide preventive treatment, or were already receiving treatment—eg, with a private psychologist.

People in the psychosocial therapy and no psychosocial therapy groups were eligible for inclusion after a first episode of deliberate self-harm taking place on Jan 1, 1992, or later. Because the aim was to assess the effect of the treatment provided in the clinics, the time of origin was set at 10 days after the index attempt (t0) to ensure that contact with a suicide prevention clinic had been established, and was applied to both the psychosocial therapy and no psychosocial therapy group. The follow-up lasted until Dec 31, 2011—ie, 1 year longer than the exposure period, allowing for a follow-up lasting between 1 and 20 years. People were thought to be at risk from the date of inclusion (t0) until migration out of the country, death, the examined outcome, or the end of follow-up—ie, Dec 31, 2011. For instance, a person would be thought at risk of repeated self-harm until the date of an episode of repeated self-harm (or migration, death, or end of study), when the person would be censored.

Outcomes

The primary outcomes were repeated self-harm, death by suicide, and death by any cause. Episodes of repeated self-harm were identified in hospital records. We obtained information about deaths from the Registry of Causes of Death, which registers suicides as ICD-8 950–959 and ICD-10 X60-X84, Y87.

Deliberate self-harm is under-recorded in Danish hospital registers.[6] Therefore, two secondary outcomes were included. The first was probable self-harm, which in addition to self-harm covers events of undetermined intent, accidental poisonings, and injuries to the lower forearm in individuals diagnosed with psychiatric disorders, defined as combinations of an ICD-8 main diagnosis 290–315 and a sub-diagnosis (E85–87, N881–N882, N913–N914), or any diagnosis (E853, E8550–E8552, E893); or an ICD-10 main diagnoses F00–F99 in combination with sub-diagnoses (S51, S55, S59, S61, S65, S69, T36–T50, T52–T60) or any diagnosis (T39, T40 [except T401], T43, T58). The second was probable self-harm, accidental poisonings, and select injuries, covering a wider range of accidental poisonings and injuries to forearm defined as E85–E87, E920, E95, E98, N881–N882, N913–N914, N980–N983, or N986–N989 in ICD-8, and as S51, S55, S59, S61, S65, S69, T36–T60 (except T401), X40–X49, X60–X84, and Y10–Y34 in ICD-10, in addition to the mentioned criteria.

Statistical analysis

We applied propensity score matching to adjust for differences in reported characteristics between the psychosocial therapy and no psychosocial therapy group. We selected matching factors if they were relevant predictors of suicidal behaviour or if they were factors that might cause the values for the psychosocial therapy group to differ from those for the no psychosocial therapy group. The following factors were used for the matching: period (two periods were used: 1992–2000 and 2001–11), sex, country of birth, age group, civil status, has children, level of education (defined as elementary school, vocational training, high school or higher, or missing data), socioeconomic status, urban living area, any psychiatric diagnoses, specific disorders (measured as individual factors: depression; anxiety; personality disorders; post-traumatic stress disorders or other stress-related disorders; schizophrenia spectrum disorders; eating disorders; alcohol misuse disorders; and substance misuse disorders), redeemed antidepressant prescriptions, previous deliberate self-harm (before index episode), more than three previous episodes of deliberate self-harm, method of index episode, placed in foster care by authorities before the age of 18 years, parental history of psychiatric disorder, and parental history of suicidal behaviour (deliberate self-harm or death by suicide), which resulted in 31 binary factors. All factors were measured at t0. The matching was done using the probability score and a greedy matching algorithm that selected the three closest matches, with closeness defined by the propensity score, estimated with a logistic regression predicting psychosocial therapy participation based on the matching factors. An exact match was prioritised for any psychiatric disorder and previous deliberate self-harm, which are both strongly linked to suicidal outcomes.[4]

We calculated incidence rates and odds ratios for each outcome over the short term (1 year of follow-up) and long term (5, 10, and 20 years of follow-up). We calculated the absolute risk reduction and numbers needed to treat to quantify effects. We tested sensitivity to an unobserved confounder with VanderWeele and Arah's approach.[14] We analysed the data with SAS (Statistical Analysis System) software and the gmatch macro for the propensity score matching developed by the Mayo Clinic.[15]

Role of the funding source

The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study, took responsibility for the integrity of the data and the accuracy of the data analysis, and had final responsibility for the decision to submit for publication.

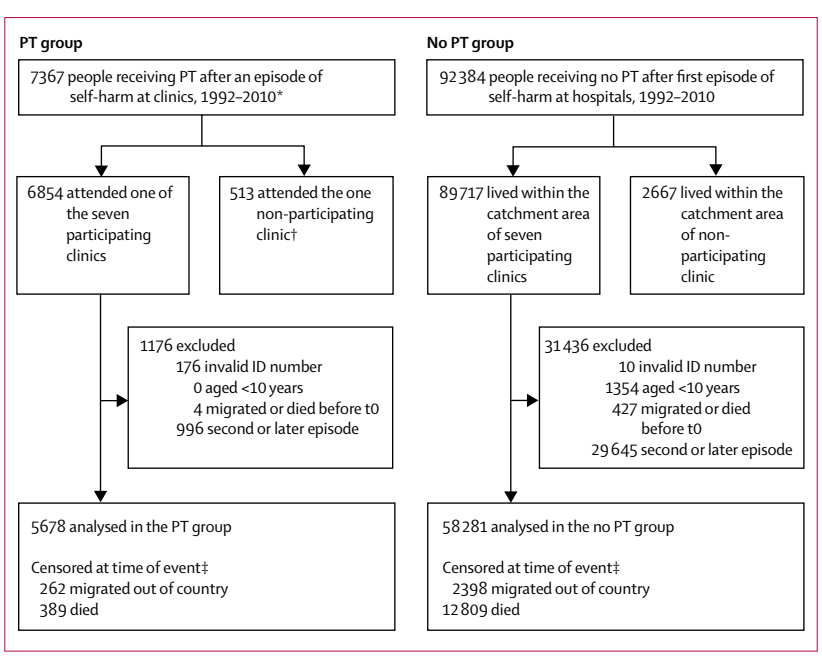

Figure 2: **Flow diagram**

PT=psychosocial therapy. t0=time of origin; the time of origin was set at 10 days after the first episode of self-harm. *Number of people who received PT at the different clinics was as follows: Aalborg (n=441, 6·4%), Aarhus (n=3530, 51·5%), Amager (n=50, 0·7%), Copenhagen (n=522, 7·6%), Herning (n=30, 0·4%), Odense-adults (n=2215, 32·3%), Odense-youth (n=66, 1·0%), and Vordingborg (n=513, 7·0%). †The number of people receiving PT at the non-participating clinic, operating during 2005–10, had to be estimated because of absence of data. During 2009–12, a mean of 138 (SD 31·3) treatment sequences were offered on a yearly basis at the clinic. At similar clinics, 62% of users received treatment after deliberate self-harm, whereas the remaining 38% were seen for suicidal ideation. It is estimated that the clinic offered PT to 513 people after deliberate self-harm during 2005–10. ‡Events during follow-up.

Results

During 1992–2010, an estimated 7367 psychosocial therapy interventions were provided to people after deliberate self-harm at the suicide prevention clinics in Denmark (figure 2). The seven participating clinics provided 6854 (93·0%) psychosocial therapy interventions. Of these, 180 (2·7%) were excluded because they were linked to participants who had invalid ID numbers, migrated, or died. Furthermore, 996 (14·9%) were a second or later psychosocial therapy intervention provided to the same person and, thus, not included.

Overall, 5678 recipients of psychosocial therapy were included. 3231 (56·9%) people in the psychosocial therapy group were referred to the suicide prevention clinics from emergency departments or hospitals; 572 (10·1%) from general practitioners, 619 (10·9%) were self-referrals, 418 (7·4%) were referred from other unspecified locations, and 838 (14·8%) had missing data.

	PT group (n=5678)	No PT group (n=58 281)		Matched no PT group (n=17 034)	
	n (%)	n (%)	Standardised. difference in means*	n (%)	Standardised difference in means*
Period					
1992–2000	1689 (29·7%)	31 408 (53·9%)	0·528	5307 (31·2%)	0·031
2001–11†	3989 (70·3%)	26 873 (46·1%)	..	11 727 (68·8%)	..
Sex					
Male individuals	1757 (30·9%)	25 923 (44·5%)	0·293	5286 (31·0%)	0·002
Female individuals†	3921 (69·1%)	32 358 (55·5%)	..	11 748 (69·0%)	..
Born in Denmark	5082 (89·5%)	53 141 (91·2%)	0·054	15 332 (90·0%)	0·016
Age group‡					
10–14	276 (4·9%)	2186 (3·8%)	0·052	872 (5·1%)	0·012
15–24†	2370 (41·7%)	16 527 (28·4%)	..	6448 (37·9%)	..
25–49	2448 (43·1%)	26 770 (45·9%)	0·057	7758 (45·5%)	0·049
50–64	472 (8·3%)	7583 (13·0%)	0·170	1601 (9·4%)	0·039
65+	112 (2·0%)	5215 (8·9%)	0·501	355 (2·1%)	0·008
Civil status					
Never married	3696 (65·1%)	31 386 (53·9%)	0·236	10 553 (62·0%)	0·066
Married or cohabiting†	1239 (21·8%)	14 819 (25·4%)	..	4005 (23·5%)	..
Divorced or widowed	729 (12·8%)	11 878 (20·4%)	0·225	2411 (14·2%)	0·039
Missing civil status	14 (0·2%)	198 (0·3%)	0·019	65 (0·4%)	0·027
Has children	2210 (38·9%)	26 683 (45·8%)	0·141	7341 (43·1%)	0·086
Highest obtained education					
Elementary school, vocational training†	4298 (75·7%)	43 889 (75·3%)	..	12 938 (76·0%)	..
High school or higher	863 (15·2%)	7076 (12·1%)	0·085	2401 (14·1%)	0·031
Missing data	517 (9·1%)	7316 (12·6%)	0·120	1695 (10·0%)	0·029
Socio-economic status					
Working	2246 (39·6%)	14 755 (25·3%)	0·291	6210 (36·5%)	0·063
Unemployed or receiving disability pension	1086 (19·1%)	13 703 (23·5%)	0·111	3681 (21·6%)	0·063
Others†	2080 (36·6%)	18 507 (31·8%)	..	6256 (36·7%)	..
Missing data	266 (4·7%)	11 316 (19·4%)	0·697	887 (5·2%)	0·025
Urban living area§	3289 (57·9%)	20 586 (35·3%)	0·458	8985 (52·7%)	0·105
Any psychiatric diagnoses¶	4093 (72·1%)	27 675 (47·5%)	0·549	12 279 (72·1%)	0·000
Specific diagnoses					
Depression‖	950 (16·7%)	8211 (14·1%)	0·071	3106 (18·2%)	0·040
Anxiety, personality disorders, PTSD, and other stress-related disorders‖	503 (8·9%)	7008 (12·0%)	0·111	1770 (10·4%)	0·054
Schizophrenia spectrum disorders‖	81 (1·4%)	3746 (6·4%)	0·422	253 (1·5%)	0·005
Eating disorders‖	64 (1·1%)	599 (1·0%)	0·009	238 (1·4%)	0·026
Alcohol misuse‖	319 (5·6%)	5806 (10·0%)	0·189	1102 (6·5%)	0·037
Substance abuse‖	120 (2·1%)	2762 (4·7%)	0·182	390 (2·3%)	0·012
Redeemed antidepressant prescriptions	1685 (29·7%)	14 296 (24·5%)	0·113	5554 (32·6%)	0·064

(Table 1 continues on next page)

	PT group (n=5678)	No PT group (n=58 281)		Matched no PT group (n=17 034)	
	n (%)	n (%)	Standardised difference in means*	n (%)	Standardised difference in means*
(Continued from previous page)					
Deliberate self-harm					
Previous self-harm episode¶	517 (9·1%)	6 543 (11·2%)	0·074	1551 (9·1%)	0·000
>3 previous self-harm episodes	86 (1·5%)	1 324 (2·3%)	0·062	260 (1·5%)	0·001
Determined method of index episode**	4 (0·1%)	427 (0·7%)	0·250	11 (0·1%)	0·002
Placed in foster care by authorities	696 (12·3%)	8 000 (13·7%)	0·045	2240 (13·2%)	0·027
Parental history of psychiatric disorder	1061 (18·7%)	9 314 (16·0%)	0·069	3169 (18·6%)	0·002
Parental history of suicidal behaviour	1611 (28·4%)	11 069 (19·0%)	0·208	4554 (26·7%)	0·036

PT=psychosocial therapy. PTSD=post-traumatic stress disorder.*The standardised difference in means between the PT and no PT group was calculated as difference in means of the PT and no PT group divided by the SD of the PT group for each of the matching factors, expressed numerically. †Reference group: this group was used as reference group for the other levels of the same factor. ‡Mean age of PT group was 30·1 years (SD 13·8) years; mean age of no PT group was 36.6 years (SD 17·6) years; mean age of matched no PT group was 31·1 years (SD 14·4). §Living in an urban area (Copenhagen, Aarhus, Odense, or Aalborg). ¶This factor was exactly matched. ||We used the following International Classification of Diseases (ICD) codes to define specific disorders: depression (ICD-8: 296 29809 29819 3004 30119; ICD-10: F30–39); anxiety, personality disorders, post-traumatic stress disorders, or other stress-related disorders (ICD-8: 300 301; ICD-10:F40–43 F60–62); schizophrenia spectrum disorders (ICD-8: 295 297 29829 29839 29889 29899 29905 29909 30109 30129; ICD-10: F20–29); eating disorders (ICD-8: 7840 3065; ICD-10: F50); alcohol misuse disorders (ICD-8: 291 303; ICD-10: F10); substance misuse disorders (ICD-8: 304; ICD-10: F11–19). **The following means of suicide attempt were defined as determined methods of index episodes: hanging, firearms, jumping from a high place, fire, and jumping in front of train.

Table 1: **Characteristics of propensity matching factors**

	PT group (n=5678)			No PT group (n=58 281)				Matched no PT group (n=17 034)			
	n (%)	Person-years	Rate	n (%)	Person-years	Rate	p value	n (%)	Person-years	Rate	p value
Deliberate self-harm											
1 year	382 (6·7%)	5384	7095	5384 (9·2%)	53 451	10 073	<0·0001	1536 (9·0%)	15 816	9712	<0·0001
5 years	758 (13·3%)	21 205	3575	9756 (16·7%)	218 472	4466	<0·0001	2765 (16·2%)	62 674	4412	<0·0001
10 years	881 (15·5%)	31 730	2777	11 292 (19·4%)	350 546	3221	<0·0001	3128 (18·4%)	94 581	3307	<0·0001
20 years	937 (16·5%)	36 752	2549	12 020 (20·6%)	450 236	2670	0·1685	3254 (19·1%)	111 031	2931	0·0001
Probable self-harm											
1 year	551 (9·7%)	5295	10 406	7097 (12·2%)	52 395	13 545	<0·0001	2130 (12·5%)	15 446	13 790	<0·0001
5 years	1105 (19·5%)	20 168	5479	13 201 (22·7%)	208 302	6337	<0·0001	3815 (22·4%)	59 512	6411	<0·0001
10 years	1257 (22·1%)	29 736	4227	15 434 (26·5%)	329 241	4688	0·0003	4290 (25·2%)	88 805	4831	<0·0001
20 years	1320 (23·2%)	34 402	3837	16 500 (28·3%)	419 357	3935	0·3700	4468 (26·2%)	103 892	4301	0·0002
Probable self-harm, accidental poisoning, and select injury											
1 year	790 (13·9%)	5156	15 323	9669 (16·6%)	50 862	19 010	<0·0001	2935 (17·2%)	14 948	19 634	<0·0001
5 years	1660 (29·2%)	18 560	8944	19 404 (33·3%)	190 631	10 179	<0·0001	5589 (32·8%)	54 511	10 253	<0·0001
10 years	1920 (33·8%)	26 337	7290	23 094 (39·6%)	288 193	8013	<0·0001	6414 (37·7%)	78 439	8177	<0·0001
20 years	2016 (35·5%)	29 893	6744	24 966 (42·8%)	355 362	7026	0·0671	6724 (39·5%)	90 070	7465	<0·0001
Death by suicide											
1 year	38 (0·7%)	5614	677	675 (1·2%)	56 778	1189	0·0006	147 (0·9%)	16 775	876	0·1531
5 years	70 (1·2%)	23 435	299	1333 (2·3%)	249 457	534	<0·0001	282 (1·7%)	71 268	396	0·0343
10 years.	83 (1·5%)	36 250	229	1646 (2·8%)	414 642	397	<0·0001	348 (2·0%)	110 939	314	0·0096
20 years	93 (1·6%)	42 828	217	1850 (3·2%)	544 602	340	<0·0001	370 (2·2%)	131 902	281	0·0267
Death by any cause											
1 year	63 (1·1%)	5614	1122	2175 (3·7%)	56 778	3831	<0·0001	301 (1·8%)	16 775	1794	0·0006
5 years	203 (3·6%)	23 435	866	6555 (11·2%)	249 457	2628	<0·0001	907 (5·3%)	71 268	1273	<0·0001
10 years	301 (5·3%)	36 250	830	9919 (17·0%)	414 642	2392	<0·0001	1347 (7·9%)	110 939	1214	<0·0001
20 years	391 (6·9%)	42 828	913	12 903 (22·1%)	544 602	2369	<0·0001	1641 (9·6%)	131 902	1244	<0·0001

PT=psychosocial therapy. The statistical difference was calculated using the two proportion z-test.

Table 2: **Number of outcomes, exposure, and rates per 100 000 length of by follow-up**

On the basis of 3960 (69·7%) people for whom information was available, the median and mean number of days between suicide attempt and first session of the psychosocial therapy intervention was 8 days (IQR 3–14) and 14·2 days (SD 35·7), respectively, whereas the median length of interventions was 74 days (IQR 30–136).

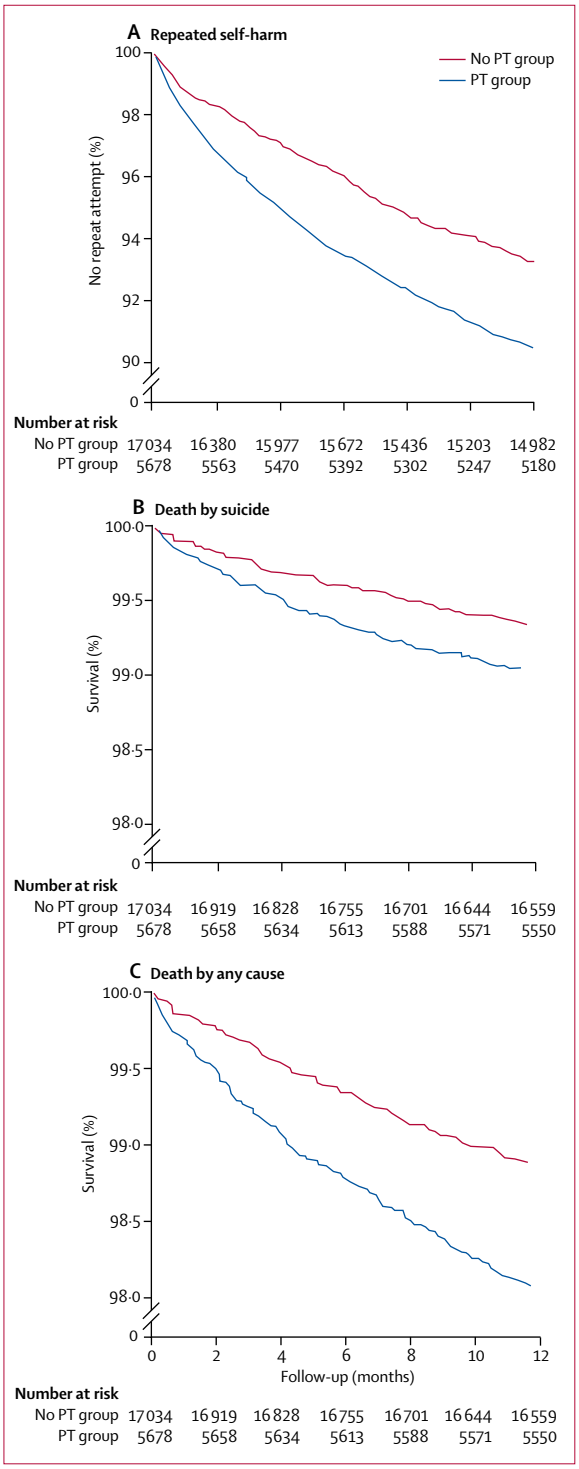

Figure 3: **Kaplan-Meier curves presenting probability of deliberate self-harm (A), death by suicide (B), and death by any cause (C)**

The no psychosocial therapy group consisted of 58 282 individuals recorded with a first episode of self-harm. With a 1:3 ratio, 17034 people from the no psychosocial therapy group were matched to the psychosocial therapy group (table 1). Across the matching factors, the standardised differences ranged from 0·009 to 0·697 before matching and 0 to 0·105 after matching, suggesting few differences between the psychosocial therapy and matched no psychosocial therapy group.

During the first year of follow-up, 382 (6·7%) recipients of psychosocial therapy were recorded with a repeated deliberate self-harm episode compared with 1536 (9·0%) in the matched no psychosocial therapy group (table 2). The corresponding rates were 7095 per 100 000 for the psychosocial therapy group and 9712 per 100 000 for the matched no psychosocial therapy group (Z=–5·781, 95% CI 6383–7806; p<0·0001). We noted fewer events in the psychosocial therapy group than in the matched no psychosocial therapy group when we included a wider range of diagnoses indicative of self-harm. The suicide rate did not significantly differ between groups after the first year, while 1122 and 1824 per 100000 (Z=–1·429, 95% CI 462–892; p=0·1531) died by any cause in the psychosocial therapy and matched no psychosocial therapy groups, respectively.

At the 10 year follow-up, 881 (15·5%) of psychosocial therapy recipients had remitted with a self-harm episode compared with 3128 (18·4%) in the matched no psychosocial therapy group. Fewer deaths by suicide were reported in a 10 year follow-up in the psychosocial therapy group in which the suicide rate was 229 per 100 000 compared with 314 per 100 000 in the matched no psychosocial therapy group (Z=–2·582, 95% CI 180–278; p=0·0096). Fewer deaths of any cause occurred in the psychosocial therapy group than in the matched no psychosocial therapy group with 301 (5·3%) and 1347 (7·9%) dying, respectively. The Kaplan-Meier curves show the timely distribution of probabilities for not remitting with a self-harm episode and survival during the first year of follow-up (figure 3).

After 1 year of follow-up, we noted a lower risk of repeated self-harm in the psychosocial therapy group than in the matched no psychosocial therapy group (odds ratio [OR] 0·73, 95% CI 0·65–0·82) (table 3). The absolute risk reduction (ARR), measuring how much the risk of self-harm is reduced in those who received therapy, was 2·3% (95% CI 1·5–3·1%). The number needed to treat (NNT) was 44 (95% CI 33– 67), suggesting that treatment of 44 people would prevent one self-harm episode within a year. If we apply this NNT to our cohort of 5678 recipients of psychosocial therapy, it implies that repeated self-harm was prevented in 129 people.

Although proportionally fewer suicide deaths occurred in the psychosocial therapy group than in the matched

comparison group during the first year of follow-up, the difference was not statistically significant (OR 0·77, 95% CI 0·54–1·11). The psychosocial therapy intervention was, however, associated with lower general mortality (OR 0·62, 95% CI 0·47–0·82; ARR 0·7%, 0·3–1·0%; NNT 153, 101–312), resulting in 37 avoided deaths within the first year.

In the long term—ie, at the 20 year follow-up—a lower risk of repeated self-harm was reported than in those who did not receive therapy (OR 0·84; 95% CI 0·77–0·91; ARR 2·6%, 1·5–3·7%; NNT 39, 27–69), suggesting that 145 repeated episodes of self-harm were avoided. The psychosocial therapy intervention was linked to a lower risk of suicide compared with no psychosocial therapy (OR 0·75, 95% CI 0·60–0·94; ARR 0·5%, 0·1–0·9%; NNT 188, 108–725), equivalent to 30 prevented suicide deaths. A statistically significant reduction was also noted for death by any cause (OR 0·69; 95% CI 0·62–0·78; ARR 2·7%, 2·0–3·5%; NNT 37, 29–52), corresponding to 153 avoided deaths.

Subgroup analysis showed that the psychosocial therapy intervention was linked to fewer repeated self-harm episodes in female individuals than was no psychosocial therapy, but not in male individuals (table 4). Adolescents and young adults (age 10–24 years) seemed to benefit from the psychosocial therapy intervention, whereas results were diverse for older adults (table 4). Irrespective of preceding episodes of self-harm before the index episode, the psychosocial therapy group had a lower risk of dying by suicide than did the no psychosocial therapy group (first episode: OR 0·47 95% CI 0·26–0·88; several episodes: OR 0·75; 95% CI 0·59–0·96).

Sensitivity to an unobserved confounder was examined for one of the weaker effects identified (repeated self-harm after 20 years follow-up); a binary unobserved confounder with a prevalence of 50% would need to be 1·8 times more likely to be associated with participation in psychosocial therapy than with no participation and double the likelihood of the outcome to change the study conclusions. For a stronger effect (death by any cause within 1 year), an unobserved confounder would need to triple the likelihood of participating in the psychosocial therapy programme and double the likelihood of the outcome to render the results non-significant (appendix).

Discussion

This study is, to our knowledge, the largest follow-up study of a psychosocial therapy intervention offered after deliberate self-harm. The psychosocial intervention was associated with a reduced risk of repeated self-harm and general mortality in the short and long term (panel). A lower risk of subsequent suicide was noted in the psychosocial therapy group than in the matched no psychosocial therapy group during the long-term follow-up. Specifically women, young age groups, and people

	Events (n [%])	Odds ratio (95% CI)	Absolute risk reduction (95% CI)	Number needed to treat (95% CI)	Events avoided (n)
Deliberate self-harm					
1 year	382 (6·7%)	0·73 (0·65–0·82)	2·3% (1·5%–3·1%)	44 (33–67)	129
5 years	758 (13·3%)	0·80 (0·73–0·87)	2·9% (1·8%–3·9%)	35 (26–55)	162
10 years	881 (15·5%)	0·82 (0·75–0·89)	2·8% (1·7%–4·0%)	36 (26–58)	157
20 years	937 (16·5%)	0·84 (0·77–0·91)	2·6% (1·5%–3·7%)	39 (27–69)	145
Probable self-harm					
1 year	551 (9·7%)	0·75 (0·68–0·83)	2·8% (1·9%–3·7%)	36 (27–54)	157
5 years	1105 (19·5%)	0·84 (0·78–0·90)	2·9% (1·7%–4·1%)	35 (25–58)	162
10 years	1257 (22·1%)	0·84 (0·79–0·91)	3·0% (1·8%–4·3%)	33 (24–57)	172
20 years	1320 (23·2%)	0·85 (0·79–0·91)	3·0% (1·7%–4·3%)	34 (24–59)	167
Probable self-harm, accidental poisonings, and select injuries					
1 year	790 (13·9%)	0·78 (0·71–0·85)	3·3% (2·3%–4·4%)	31 (23–45)	183
5 years	1660 (29·2%)	0·85 (0·79–0·90)	3·6% (2·2%–5·0%)	28 (21–46)	202
10 years	1920 (33·8%)	0·85 (0·79–0·90)	3·8% (2·4%–5·3%)	27 (19–42)	210
20 years	2016 (35·5%)	0·84 (0·79–0·90)	4·0% (2·5%–5·4%)	26 (19–40)	218
Death by suicide					
1 year	38 (0·7%)	0·77 (0·54–1·11)			
5 years	70 (1·2%)	0·74 (0·57–0·97)	0·4% (0·1%–0·8%)	237 (131–1290)	23
10 years	83 (1·5%)	0·71 (0·56–0·91)	0·6% (0·2%–1·0%)	173 (105–492)	32
20 years	93 (1·6%)	0·75 (0·60–0·94)	0·5% (0·1%–0·9%)	188 (108–725)	30
Death by any cause					
1 year	63 (1·1%)	0·62 (0·47–0·82)	0·7% (0·3%–1·0%)	153 (101–312)	37
5 years	203 (3·6%)	0·66 (0·56–0·77)	1·7% (1·2%–2·3%)	58 (43–87)	97
10 years	301 (5·3%)	0·65 (0·57–0·74)	2·6% (1·9%–3·3%)	39 (31–53)	145
20 years	391 (6·9%)	0·69 (0·62–0·78)	2·7% (2·0%–3·5%)	37 (29–52)	153

Table 3: **Odds ratios and absolute risk measures by length of follow-up**

	Events (n [%])	Odds ratio (95% CI)
Males individuals (n=1757)		
Deliberate self-harm	290 (16·5%)	0·96 (0·83–1·11)
Death by suicide	51 (2·9%)	0·86 (0·63–1·18)
Female individuals (n=3921)		
Deliberate self-harm	647 (16·5%)	0·73 (0·67–0·81)
Death by suicide	42 (1·1%)	0·57 (0·41–0·79)
Age 10–24 years (n=2646)		
Deliberate self-harm	379 (14·3%)	0·67 (0·59–0·75)
Death by suicide	12 (0·5%)	0·50 (0·27–0·93)
Age 25–49 years (n=2448)		
Deliberate self-harm	475 (19·4%)	0·90 (0·81–1·01)
Death by suicide	54 (2·2%)	0·74 (0·54–0·99)
Age ≥50 years (n=584)		
Deliberate self-harm	12 (0·5%)	0·91 (0·70–1·19)
Death by suicide	153 (29·6%)	0·91 (0·59–1·41)
First episode of self-harm (n=5161)		
Deliberate self-harm	784 (15·2%)	0·93 (0·75–1·15)
Death by suicide	81 (1·6%)	0·47 (0·26–0·88)
Several episodes of self-harm (n=517)		
Deliberate self-harm	153 (29·6%)	0·77 (0·71–0·84)
Death by suicide	12 (2·3%)	0·75 (0·59–0·96)

Table 4: **Odds ratios for subgroup analysis with respect to deliberate self-harm and death by suicide**

See Online for appendix

with a first episode of self-harm seemed to benefit from the psychosocial therapy intervention. Based on the calculated numbers needed to treat, as many as 145 repeated self-harm episodes and 153 deaths, 30 by suicide, might have been prevented by the psychosocial therapy intervention offered in Denmark.

The proportions of people who repeated self-harm within the first year in the psychosocial therapy and non-psychosocial therapy groups were below the range of 16% or higher as reported by a previous systematic review.[5] Deliberate self-harm is known to be under-recorded in Danish hospital registries,[6] but even when we used wider definitions of self-harm, we still noted that a lower than expected proportion of people repeated self-harm. However, we have no reason to think that the under-recording should differ between the psychosocial therapy and no psychosocial therapy groups; thus, the relative difference denoted by the ORs is assumed to be valid.

Panel: Research in context

Systematic review

We searched Medline and Google Scholar on March 11, 2014, for the terms ["psychotherapy or intervention", or "intervention or therapy", or "treatment or therapeutics", or "trial or psychotherapies"] and ["self-harm or self-injury" or "self-poisoning or attempted suicide"], in titles or as MESH (Medical Subject Headings) terms in English-language studies published after 1990. We identified 863 papers. We assessed abstracts, a Cochrane review,[9] a review by the National Institute for Clinical Excellence,[10] and reference lists, resulting in 36 relevant papers. We prioritised randomised controlled trials and high-evidence-level studies of all age groups examining suicidal behaviour as an outcome using large samples or follow-up.

High quality studies examining different psychosocial interventions, such as postcard interventions,[16,17] so-called green cards,[18] cognitive therapy,[19,20] brief intervention,[21] assertive outreach,[22] and integrated care,[23] have been done. Most studies measured intervention effects on repeated self-harm. [16–20,22,23] Little evidence of effective interventions exists; a previous Danish randomised controlled trial of a local clinic identified a protective effect on repeated suicide attempts.[23] Other promising findings of psychosocial interventions were limited to select patient groups—ie, dialectic behaviour therapy for individuals with borderline personality disorders[24] and group-therapy for people younger than 14 years.[25] A large-scale study from Taiwan compared intervention recipients with those who apparently declined participation, making interpretation complicated.[26] The main obstacle for previous studies has been small sample sizes; only one randomised study, done in developing countries in which standard care might have been sparse, documented an effect on death by suicide.[21,26]

Interpretation

This study is, to our knowledge, the largest observational, national study of psychosocial therapy for people at risk of suicide done so far. Assessment of treatment effects on death by suicide, which essentially is the event of interest, was possible. People in the psychosocial therapy group had lower risks of repeated self-harm and general mortality within 1 year of follow-up. In the long term, reduced risks of repeated self-harm, death by suicide, and death by any cause were reported. Conclusive evidence hinges on randomised assignment of treatment; previous estimates of a study sample of 45 000 people[27] are supported by our study, but implies severe practical challenges. The findings of this study suggest that at least 145 episodes of repeated self-harm and 153 deaths, 30 by suicide, were prevented by the offered psychosocial therapy intervention.

The psychosocial therapy intervention seemingly prevents repeated self-harm and other related non-fatal outcomes. Results from previous studies from Denmark using data from individual clinics identified reductions in repeated suicide attempts when comparing psychosocial intervention to standard care,[23] but these reductions were not noted in a randomised study assessing an add-on intervention.[22]

A lower risk of dying by suicide was reported in the psychosocial therapy group than in the no psychosocial therapy group in the long term, whereas in the short term, the difference between groups was not statistically significant. Previously, a brief intervention offered in developing countries identified a protective effect on the outcome of suicide, but findings cannot be generalised.[21] An estimated 22 500 individuals would be needed in each intervention group to document an effect on suicide.[27] About 23 000 person-years were recorded in the 5-year follow-up in which we noted an effect.

A protective effect was identified for general mortality; apparently no previous intervention study has examined death by any cause as an outcome of an intervention, although a history of self-harm is associated with a higher risk of all-cause mortality.[28,29] The subgroup analysis showed effects for women, younger age groups, and people with several self-harm episodes. Previous work has noted positive effects for very young people.[25]

The small treatment effects could be because people in the psychosocial therapy group were included irrespective of the length of the provided treatment, and many are known to interrupt treatment prematurely as shown by the wide IQR for the median length of intervention—ie, 30–136.[30] Also, because the risk of remission is high immediately after an episode of self-harm,[29] initial cases of repeated self-harm during the first 10 days were missed, making our rates conservative. The fact that a long-term effect was reported contests the possibility of an iatrogenic effect of the psychosocial therapy intervention—eg, that the conversational value of the treatment was the effective element in the treatment.

The strengths of the study were the large number of participants and the long follow-up, which enabled assessment of death by suicide. The multicentre approach reduced potential bias. The use of national register data ensured uniform data collection, minimum loss to follow-up, and reduced informer bias. Furthermore, the findings were representative of all age groups. Both hospitals and suicide preventive clinics used the WHO definition of self-harm and thereby improved the validity of the assessment. Finally, the clinical data was collected at the first session, ensuring that the people in the psychosocial therapy group did actually attend one or more sessions of psychosocial therapy.

The psychosocial therapy intervention was offered in all regions; however, proximity to a suicide clinic would probably affect the probability of receiving treatment; hence, why we matched participants with respect to their

urban living area. The assumption that the pool of comparisons had a sufficient number of participants with similar characteristics seems fair. About 41% of people in the no psychosocial therapy group were enrolled from regions with no operating clinics at the time and, thus, could not have received any offer of treatment.

The main limitation was that randomisation was not possible. People attending treatment at the clinics might represent a select group with respect to willingness and motivation to make a difference in their lives, leading to a self-selection bias, although the matching intended to adjust for this. Because of the nature of the data, we could not obtain complete information about treatment sessions and length of treatment and assess differences in referral practice, and we do not have any indication about what elements of the psychosocial therapy intervention might have been effective. Also, the number of people recorded with psychiatric diagnoses during previous mental health contacts might be an underestimate of the actual number of people with mental health disorders at the time that they present with deliberate self-harm. Furthermore, data for compliance to treatment with psychotropic medication would have been useful. Only a subsample of people who of self-harm go to hospital; others might consult a general practitioner or not seek help at all.

People who present with deliberate self-harm constitute a high-risk group for later suicidal behaviour and fatal outcomes, so preventive efforts are important; yet, implemented specialised support after self-harm is rare. Our findings support that psychosocial therapy intervention after deliberate self-harm is associated with a lower risk of repeated self-harm, dying by suicide, and dying by any cause. For the evidence to be conclusive the intervention needs to be assessed in a randomised controlled trial; however, these findings might be the best evidence available and provide a sound basis for policy makers who wish to limit suicidal behaviour and fatal events in an accessible high-risk group, which, in many countries, receives little support.

We identified substantial indications that psychosocial therapy intervention reduced risks of later self-harm episodes and fatal outcomes. During the observation period, the psychosocial therapy group had significantly reduced risks of repeated self-harm and general mortality compared with the matched no psychosocial therapy group. A lower risk of dying by suicide was reported in long-term follow-up periods. Implementation of psychosocial therapy interventions should be considered for people at risk of suicide as a result of these promising findings.

Contributors

All authors were actively involved in conceptualising the research plan and designing data collection sheets for clinical data. AE, BDL, ACN, KJL, AW, MH, CMP, JHW, CL, CM, and MN monitored the clinical data collection and are guarantors of the clinical data. AE, BDL, ACN, KJL, AW, MH, CMP, JHW, CL, CM, and MN were actively engaged in processing clinical data from patient journals and creating electronic files in each of the suicide prevention clinics. AE, EAS, PQ, ES, and MN discussed and decided on data analysis techniques, matching criteria, and discussed progress of the analysis. AE and EAS did the actual data management and analysis. All authors contributed to the discussion of findings and their interpretations. AE drafted and revised the manuscript on the basis of comments provided by all authors. All authors have approved the final version of the manuscript. AE is the final guarantor of the study.

Declaration of interests

We declare no competing interests.

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