Mortality in people with psychotic disorders in Finland: A population-based 13-year follow-up study

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ABSTRACT

Objectives: We conducted a population based study aiming at finding predictors of mortality in psychotic disorders and evaluating the extent to which sociodemographic, lifestyle and health-related factors explain the excess mortality.

Methods: In a nationally representative sample of Finns aged 30–70 years (n = 5642), psychotic disorders were diagnosed using structured interviews and medical records in 2000–2001. Information on mortality and causes of death was obtained of those who died by the end of year 2013. Cox proportional hazards models were used to investigate the mortality risk.

Results: No people with affective psychoses (n = 36) died during the follow-up, thus the analysis was restricted to non-affective psychotic disorders (NAP) (n = 106). Adjusting for age and sex, NAP was statistically significantly associated with all-cause mortality (hazard ratio (HR) 2.99, 95% CI 2.03–4.41) and natural-cause mortality (HR 2.81, 95% CI 1.85–4.28). After adjusting for sociodemographic factors, health status, inflammation and smoking, the HR dropped to 2.11 (95% CI 1.10–4.05) for all-cause and to 1.98 (95% CI 0.94–4.16) for natural-cause mortality. Within the NAP group, antipsychotic use at baseline was associated with reduced HR for natural-cause mortality (HR 0.25, 95% CI 0.07–0.96), and smoking with increased HR (HR 3.54, 95% CI 1.07–11.69).

Conclusions: The elevated mortality risk in people with NAP is only partly explained by socioeconomic factors, lifestyle, cardio-metabolic comorbidities and inflammation. Smoking cessation should be prioritized in treatment of psychotic disorders. More research is needed on the quality of treatment of somatic diseases in people with psychotic disorders.

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1. Introduction

Schizophrenia shortens the lifespan of those affected by up to 20–30 years (Olfson et al., 2015; Laursen et al., 2014). The excess mortality is mainly due to diseases and medical conditions, the leading causes being cardiovascular diseases, cancer, respiratory diseases and diabetes (Crump et al., 2013a; Suvisaari et al., 2013; Termorshuizen et al., 2013; Olfson et al., 2015). Studies indicate that during recent decades, the mortality gap between people with serious mental illness and the general population has at best narrowed only by a small amount (Wahlbeck et al., 2011), or has in fact increased (Saha et al., 2007; Olfson et al., 2015; Lumme et al., 2016; Osby et al., 2016).

Several factors predispose people with psychotic disorders to an increased risk of somatic diseases. Antipsychotic medication causes weight gain and increases the risk of metabolic syndrome, type 2 diabetes mellitus (T2DM), and cardiovascular disease (Foley and Morley, 2011). Sedentary lifestyle and poor diet, both common among people with psychotic disorders, further add to the metabolic burden (Dipasquale et al., 2013; Stubbs et al., 2016). Low income (McCallum et al., 2013) and living alone (Koskinen et al., 2007) are associated with excess mortality in the general population, and these factors may

also contribute to excess mortality in people with psychotic disorders. Low-grade inflammation associated with schizophrenia (Potvin et al., 2008; Dickerson et al., 2013; Miller et al., 2014; Fernandes et al., 2016a) could be a peripheral marker of elevated mortality risk, as it is in the general population (Emerging Risk Factors Collaboration et al., 2010).

In people with psychotic disorders, the mortality from medical conditions is disproportionately high compared to morbidity (Crump et al., 2013a). This applies both to cardiovascular diseases and to cancer (Kisely et al., 2013). Both under-detection (Crump et al., 2013a) and poorer treatment (Kisely et al., 2013) of medical conditions contribute. In this study, we investigated mortality in non-affective psychosis (NAP) during a 13-year follow-up using data from the nationally representative Health 2000 Survey. We aimed to find predictors of mortality in NAP. Specifically, we wanted to see whether excess mortality in psychotic disorders can be explained by previously known sociodemographic and health-related factors. Further, we hypothesized that C-reactive protein (CRP) predicts mortality also in NAP but is not an independent predictor when somatic risk factors are controlled for.

2. Methods

2.1. Study design

The Finnish Health 2000 Survey (BRIF8901) sample consisted of 8028 persons aged 30 years or older. A nationally representative sample was achieved using a two-stage stratified cluster sampling procedure. The data were collected between September 2000 and June 2001. The survey consisted of an interview, a health examination and a shortened version of the Munich version of the Composite International Diagnostic Interview (M-CIDI) (Wittchen et al., 1998). Register information on the whole sample was collected to supplement interview and health examination data (Aromaa and Koskinen, 2004).

In the Psychoses in Finland study, we screened persons from the Health 2000 Survey sample for possible psychotic disorder and interviewed them using the research version of the Structured Clinical Interview for DSM-IV (SCID-I) (First et al., 2002). Persons were invited to participate in the SCID-I interview using the following screening criteria: (1) self-reported psychotic disorder, (2) a diagnosis of possible or definite psychotic disorder based on the physician's health examination, (3) psychotic or manic symptoms in the M-CIDI interview, (4) hospital treatment of any psychotic disorder according to the Hospital Discharge Register, (5) entitled to free outpatient antipsychotic medication, (6) disability pension due to psychotic disorder, and (7) mood-stabilizing medication use without a diagnosis of epilepsy or other neurological disease. Detailed description about sensitivity and specificity of these screens is reported in Perala et al. (2007).

The participation rate to the SCID-I was 63.4%. In addition, we obtained all lifetime hospital and outpatient case records from psychiatric and primary care units for all Health 2000 participants. Using all available information, J.S., J.P., and S.I.S. made the final DSM-IV based diagnoses and assessed whether people had a current psychiatric treatment contact (Perala et al., 2007).

The Health 2000 Survey and the Psychoses in Finland study were approved by the Ethics Committees of the National Public Health Institute (the National Institute for Health and Welfare since 2009) and the Hospital District of Helsinki and Uusimaa. Participants gave a written informed consent after having received a complete description of the study.

2.2. Study population

In the analysis, we excluded (1) persons aged 70 years and older to avoid confounding our analysis with the high mortality of the oldest age groups and (2) persons with substance-induced psychotic disorders or psychotic disorders due to a general medical condition. The original study sample included 6334 persons aged under 70 years, from whom 5642 (89.1%) had participated in the Health 2000 study and were followed up in the current study. Weights were used to correct for non-response, as described in Section 2.5.

In this study, we investigated people with NAP, including schizophrenia, schizophreniform disorder, schizoaffective disorder, delusional disorder, brief psychotic disorder and psychotic disorder not otherwise specified. Descriptive data are reported from people with affective psychosis (bipolar I disorder or major depressive disorder with psychotic features) as well, but a predictor analysis was not possible due to no deaths in this group in people aged under 70 years.

2.3. Predictors of mortality

2.3.1. Antipsychotic medication

Participants reported their current medication at baseline and that information was used to code the antipsychotic medication use. Participants had brought their prescriptions or medications to the interview to assist in recording medication use.

2.3.2. Socioeconomic factors

Marital status was coded as married or cohabiting, or unmarried (divorced, never-married or widowed) at baseline. The registers of the Finnish Tax Administration were used to determine family income, adjusted for family size and divided into quintiles.

2.3.3. Lifestyle and health variables

Body mass index (BMI) was calculated as weight (kg) divided by the square of height (m). Participants were categorized as current smokers or nonsmokers based on their own report at baseline.

2.3.4. Chronic somatic diseases

T2DM was diagnosed according to the WHO 1999 criteria (World Health Organization Expert Committee, 1999). The diagnostic procedure for possible or definite coronary heart disease (CHD) based on health examination, electrocardiogram, and register data as described in Kattainen et al. (2006).

Diagnosis of metabolic syndrome was based on The National Cholesterol Education Program's Adult Treatment Panel III criteria (Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults, 2001).

The detailed diagnostic process for these conditions and for the laboratory and other measures are described in supplementary methods.

2.3.5. Low-grade inflammation

Low-grade inflammation was analyzed using a categorical variable as measured by the highest quintile of CRP concentration (2.43 mg/L) as a cut-off.

2.4. Information on mortality and causes of death

Information on mortality up to December 31st 2013 and causes of death were obtained from the Cause of Death statistics kept by Statistics Finland. The statistics contain data from death certificates completed either by the treating physician or by the physician who performed the autopsy. The medicolegal autopsy rate in Finland is exceptionally high (Lunetta et al., 2007), and the Cause of Death statistics is considered reliable.

Causes of death were classified into natural causes (ICD-10 A00–R99), including alcohol-related diseases and accidental poisoning by alcohol (F10, G312, G4051, G621, G721, I426, K292, K70, K852, K860, O354, P043, Q860, X45), and unnatural causes, including suicide (X60–X84, Y870) and other unnatural causes (V01–X44, X46–X59, X85–Y86, Y871–Y89).

2.5. Statistical analyses

Between-group comparisons of clinical and sociodemographic variables were performed with Pearson's χ^2, the Fisher exact test, the Student's t-test or the Mann–Whitney U test. $P < 0.05$ was used to denote statistical significance.

We used SUDAAN software, Release 11.0.1, in statistical analysis, taking into account the two-stage cluster sampling design. Sampling design was taken into account in all statistical analyses, and post-stratification weights were applied to adjust for non-response in the baseline study. Analyses within the psychosis group, as well as the checking of the proportional hazards assumption for the survival analysis carried out in SUDAAN, were conducted using SAS software, Version 9.3 for Windows.

To investigate the effect of different variables on mortality, seven Cox regression models were built using SUDAAN's SURVIVAL procedure. All models were adjusted for age and sex. Model I included the diagnosis of NAP, model II NAP and antipsychotic medication use. In models III-VI, we added one significant group of explanatory variables to model II that could potentially contribute to the excess mortality in NAP: chronic inflammation (CRP) in model III, marital status and income in model IV, lifestyle-related factors (BMI and smoking) in model V, and chronic diseases (T2DM, metabolic syndrome and CHD) in model VI. In model VII, all these variables were entered simultaneously in the model. For the final model, we checked the proportional hazards assumption by running the same model with SAS's PHREG procedure, and the Kolmogorov-type supremum test indicated that the proportional hazards assumption held for all variables. These analyses were done separately for all-cause mortality and for mortality from diseases and medical conditions.

Factors predicting mortality in people with psychotic disorder were analyzed with Cox's proportional hazards model, using SAS's PHREG procedure. Since there were only 106 people with NAP, sampling design was not taken into account in these analyses. The same variables were used as in model VII for the total sample, with the exception of CHD due to the small number of cases. This analysis was done separately for all-cause mortality and for mortality from diseases and medical conditions.

3. Results

Demographic and clinical characteristics in the NAP group, in the affective psychosis group, and in the group without psychosis diagnosis are shown in Table 1. In the affective psychosis group, there were no deaths during the follow-up and thus, in the analysis of predictors of mortality, we focused on NAP. Among participants with NAP, there were altogether 25 deaths (Supplementary Table 1). Deaths by natural causes made up 84% (21/25) of the total number of deaths in the NAP group, and cancer (32%) and cardiovascular disease (24%) were the most common causes of death.

In the NAP group, those who died during the follow-up were older, had a higher prevalence of T2DM, and were more often living alone than those who survived (Table 2).

Table 3 presents the mortality hazard ratios (HR) from Cox regression models during the follow-up adjusted with seven different sets of variables. Diagnosis of NAP was a significant predictor of all-cause mortality even after adjusting for all sociodemographic and health-related variables (HR 2.11, 95% CI 1.10–4.05).

In the Cox model for natural-cause mortality, the mortality HR for NAP was from 2.0 to 2.8, depending on the adjusting variables (Table 4). When adjusting for all the relevant variables (Model VII), the mortality HR for NAP lost its statistical significance (HR 1.98, 95% CI 0.94–4.16). In all the other models, NAP was a significant predictor for natural-cause mortality. Full models are presented in Supplementary Tables 2 and 3.

Table 1

Demographic and clinical characteristics (weighted prevalences and 95% confidence intervals (CI)) of the non-affective psychosis group, the affective psychosis group and the group without psychosis diagnosis at study baseline.

Characteristic	Non-affective psychosis (n = 106[a]), % (95% CI)	Affective psychosis (n = 36[a]), % (95% CI)	No psychosis (n = 5500[a]), % (95% CI)
Age			
30–40	17.5 (11.4–25.9)	18.1 (8.9–33.3)	29.1 (27.9–30.3)
>40–50	32.6 (24.3–42.1)	39.8 (25.1–56.6)	28.9 (27.7–30.1)
>50–60	32.1 (23.9–41.6)	25.8 (14.1–42.3)	26.3 (25.1–27.5)
>60–70	17.8 (11.3–27.0)	16.4 (7.6–31.9)	15.7 (14.7–16.8)
Sex			
Male	42.5 (32.7–52.9)	63.2 (46.7–77.1)	49.8 (48.5–51.2)
Female	57.5 (47.2–67.3)	36.8 (22.9–53.3)	50.2 (48.9–51.5)
Married or cohabiting	33.9[b] (25.7–43.3)	59.3 (42.5–74.2)	74.2[c] (73.0–75.5)
Lowest income quintile	50.5 (40.6–60.4)	22.0 (11.3–38.4)	18.5 (17.3–19.8)
Antipsychotic medication	58.1 (49.0–66.7)	29.9 (16.3–48.3)	0.7 (0.5–1.0)
Body mass index			
<25	31.2[d] (23.2–40.4)	25.1 (14.0–40.8)	38.9[e] (37.6–40.3)
25–30	27.4[d] (19.6–36.9)	45.9 (31.3–61.4)	39.8[e] (38.5–41.1)
>30	41.4[d] (32.2–51.3)	29.0 (16.1–46.4)	21.3[e] (20.3–22.4)
Smoking	40.0[f] (30.6–50.2)	29.0 (16.3–46.0)	26.4[g] (25.3–27.5)
High C-reactive protein[h]	43.6[i] (32.8–54.9)	18.4[j] (8.2–36.1)	19.6[k] (18.5–20.7)
Coronary heart disease	4.8 (2.1–10.6)	3.1 (0.4–19.2)	5.3 (4.6–6.0)
Metabolic syndrome	46.4[l] (35.9–57.3)	24.1[m] (12.4–41.5)	27.6[n] (26.2–29.0)
Type 2 diabetes mellitus	18.0 (11.9–26.3)	2.7 (0.4–16.8)	4.2 (3.7–4.7)

[a] Except where otherwise indicated.
[b] n = 105.
[c] n = 5483.
[d] n = 103.
[e] n = 5470.
[f] n = 105.
[g] n = 548.
[h] Highest C-reactive protein concentration quintile (CRP > 2.43 mg/L).
[i] n = 87.
[j] n = 32.
[k] n = 5097.
[l] n = 99.
[m] n = 34.
[n] n = 5268.

Table 2

Comparison of demographic and clinical characteristics between those who died during the follow-up and those who survived in the non-affective psychosis group.

Characteristic	Dead % (n = 25/106, 23.6%)	Alive % (n = 81/106, 76.4%)	Statistics
Sex (% females)	48.0 (12/25)	38.3 (31/81)	$\chi^2 = 0.75$, p = 0.39
Age at baseline (mean, SD)	55.9, SD 9.3	48.8, SD 10.0	t = −3.13, p = 0.002
Married or cohabiting	16.0 (4/25)	40.0 (32/80)	$\chi^2 = 4.87$, p = 0.03
Active treatment contact	65.2 (15/23)	74.0 (54/73)	$\chi^2 = 0.66$, p = 0.42
C-reactive protein (mg/l) (median, min-max)	2.17, 0.00–28.3[a]	1.47, 0.00–16.0[b]	U = 751.50, p = 0.17
Antipsychotic use	60.0 (15/25)	58.0 (47/81)	$\chi^2 = 0.03$, p = 0.86
Body mass index (kg/m^2)	28.6, SD 5.28[c]	28.9, SD 6.10[d]	t = 0.22, p = 0.83
Proportion diagnosed with T2DM	36.0 (9/25)	12.3 (10/81)	p = 0.014 (Fisher's exact test)
Proportion diagnosed with CHD	4.0 (1/25)	4.9 (4/81)	p = 1.000 (Fisher's exact test)
Metabolic syndrome	62.5 (15/24)	41.3 (31/75)	$\chi^2 = 3.28$, p = 0.07
Smoking	56.0 (14/25)	35.0 (28/80)	$\chi^2 = 3.50$, p = 0.06
Lowest income quintile	56.0 (14/25)	49.4 (40/81)	$\chi^2 = 0.34$, p = 0.56

Abbreviations: χ^2, Pearson's chi square test; t, Student's *t*-test; U, Mann-Whitney U test; T2DM, type 2 diabetes mellitus; CHD, coronary heart disease.

[a] Information available n = 18.
[b] Information available n = 69.
[c] Information available n = 24.
[d] Information available n = 79.

Within the NAP group, antipsychotic use at baseline was associated with reduced HR for natural-cause mortality (HR 0.25, 95% CI 0.07–0.96), and smoking with increased HR (HR 3.54, 95% CI 1.07–11.69), whereas none of the variables was a significant predictor of all-cause mortality (Supplementary Tables 4 and 5). A separate model was not done for mortality from unnatural causes because of their low frequency in the NAP group.

4. Discussion

In this study, we found an almost 3-fold increase in the mortality HR for those diagnosed with NAP during a 13-year follow-up compared to the general population. The HR decreased to 2.1 when adjusting for all relevant sociodemographic and lifestyle variables and for somatic diseases. The increased mortality of people diagnosed with NAP was mostly due to natural causes. Accidents and suicide accounted for 16% of total number of deaths in the NAP group. Smoking increased the mortality HR for natural-cause mortality in the NAP group while antipsychotic use decreased it.

We observed an increased mortality HR in people with NAP in accordance with previous literature (Olfson et al., 2015; Suvisaari et al., 2013). When smoking, obesity, socioeconomic factors, chronic conditions and inflammation were taken into account, the HR associated with NAP dropped from three to two, suggesting that these factors explain some but not all excess mortality related to NAP. Worse quality of treatment may be one contributing factor. In previous studies, worse quality of treatment has been particularly evident for cardiovascular diseases and cancer, which were the most common causes of death in the NAP group. For example, a previous Finnish study found that patients with NAP with CHD were much less likely to receive coronary revascularization than other people with CHD (Manderbacka et al., 2012). Studies from other countries have found poorer quality of cancer treatment in people with psychotic disorders (Bergamo et al., 2014;

Ishikawa et al., 2016) and a similar observation has been made in Finland (K. Manderbacka, personal communication). Poor participation in cancer screenings may be an additional factor contributing to increased mortality from cancer (Weinstein et al., 2016).

Within the NAP group, smoking was significantly associated with excess mortality risk, which is consistent with previous studies (Dickerson et al., 2016; Tam et al., 2016).

The low prevalence of smoking in Finland as compared to several other countries further stresses its importance for excess mortality. Unfortunately, smoking cessation is still often neglected in clinical practice, although there are effective ways to support quitting (Stubbs et al., 2015). Our results highlight the importance of smoking prevention and cessation to decrease the mortality of people with serious mental illness.

Recent meta-analyses show that CRP is higher in psychotic disorders than in the general population, and this has been used as evidence for a systemic inflammatory disorder (Fernandes et al., 2016a; Fernandes et al., 2016b). Also in our study, CRP was elevated in the NAP group. Consistent with previous studies (Emerging Risk Factors Collaboration et al., 2010) CRP was a risk factor for excess mortality in our sample in the total population. The NAP group showed a trend towards higher CRP concentration for those who died during the follow-up. However, CRP was not an independent predictor of mortality, although the modest power does not allow us to exclude any independent effect. Given the sampling at age of 30 or later, the data are not suitable for detecting possible systemic inflammatory processes at onset of a psychotic disorder.

Antipsychotic treatment at baseline in people with NAP was associated with lower mortality risk. In our previous study, antipsychotic use was associated with elevated mortality risk in people who did not have a psychotic disorder but not in people with psychotic disorder (Suvisaari et al., 2013). Only about 60% of persons with NAP were using antipsychotics at baseline, and slightly more had an active psychiatric treatment contact. The low rate of self-reported antipsychotic use

Table 3

Cox proportional hazards model for all-cause mortality in people diagnosed with non-affective psychosis (n = 106) adjusted with a different set of variables in each model.

Model I[a] HR (95% CI)	p	Model II[b] HR (95% CI)	p	Model III[c] HR (95% CI)	p	Model IV[d] HR (95% CI)	p	Model V[e] HR (95% CI)	p	Model VI[f] HR (95% CI)	p	Model VII[g] HR (95% CI)	p
2.99 (2.03–4.41)	<0.001	2.44 (1.44–4.14)	<0.001	2.58 (1.38–4.81)	0.0029	2.22 (1.30–3.80)	0.0035	2.28 (1.26–4.11)	0.0063	2.41 (1.33–4.39)	0.0039	2.11 (1.10–4.05)	0.0253

Abbreviations: HR, hazard ratio; CI, confidence interval; p, p-value.

[a] Adjusted for sex and age.
[b] Adjusted in addition for antipsychotic use.
[c] Adjusted in addition for C-reactive protein concentration.
[d] Adjusted for (b), marital status and income.
[e] Adjusted for (b), body mass index and smoking status.
[f] Adjusted for (b), type 2 diabetes mellitus, metabolic syndrome and coronary heart disease.
[g] Adjusted for all variables in a–f.

Table 4
Cox proportional hazards model for natural-cause mortality in people diagnosed with non-affective psychosis (n = 106) adjusted with a different set of variables in each model.

Model I[a]		Model II[b]		Model III[c]		Model IV[d]		Model V[e]		Model VI[f]		Model VII[g]	
HR (95% CI)	p	HR (95% CI)	p	HR (95% CI)	p	HR (95% CI)	p	HR (95% CI)	p	HR (95% CI)	p	HR (95% CI)	p
2.81	<0.001	2.29	0.0055	2.44	0.0125	2.10	0.0142	2.09	0.0273	2.23	0.0198	1.98	0.0704
(1.85–4.28)		(1.28–4.10)		(1.21–4.92)		(1.16–3.80)		(1.09–4.03)		(1.14–4.38)		(0.94–4.16)	

Abbreviations: HR, hazard ratio; CI, confidence interval; p, p-value.

[a] Adjusted for sex and age.
[b] Adjusted in addition for antipsychotic use.
[c] Adjusted in addition for C-reactive protein concentration.
[d] Adjusted for (b), marital status and income.
[e] Adjusted for (b), body mass index and smoking status.
[f] Adjusted for (b), type 2 diabetes mellitus, metabolic syndrome and coronary heart disease.
[g] Adjusted for all variables in a–f.

may reflect the typically low adherence to medication in people with psychotic disorders (Velligan et al., 2009). While diagnoses of psychotic disorders were lifetime diagnoses and included disorders that were in remission and no longer required treatment, treatment drop-outs were also common (Suvisaari et al., 2009). Therefore, the protective effect of antipsychotic treatment may indicate the importance of treatment adherence in general.

The main strengths of this study are the large and representative population-based sample, high participation rate and diagnostic screening using many sources of information. We had extensive measurements of somatic and sociodemographic factors from the baseline. Information on causes of death in Finland is reliable.

A limitation of the study is that during the follow-up, we had no information on mental health, antipsychotic use or other potential factors affecting mortality. Another limitation is the small sample size in survival analyses done within the NAP group, which resulted in wide confidence intervals. It was somewhat surprising to recognize that no deaths were detected within the study period among patients with a psychotic mood disorder. Previous studies have reported an increased mortality risk for patients with mood disorders as compared to the general population (Harris and Barraclough, 1997; Roshanaei-Moghaddam and Katon, 2009; Crump et al., 2013b), but to a lesser extent than in schizophrenia (Chesney et al., 2014; Kessing et al., 2015; Walker et al., 2015). However, we have previously observed in this sample that in contrast to NAP, people with affective psychoses did not have elevated risk of T2DM, metabolic syndrome or CHD (Suvisaari et al., 2007; Suvisaari et al., 2008; Suvisaari et al., 2010). The difference to other studies in mood disorders might partly be explained by the long duration of follow-up (Walker et al., 2015), differences in received somatic treatment (Manderbacka et al., 2012) and the fact that the sampling was done for people 30 years and older excluding thus those who committed suicide at earlier phase of illness.

5. Conclusions

People with non-affective psychosis have elevated mortality risk, which is only partly explained by socioeconomic factors, lifestyle, cardiometabolic comorbidities and inflammation. Smoking was the single most important factor contributing to mortality within the NAP group. More research is needed on the quality of treatment of somatic diseases in people with psychotic disorders. Since smoking cessation (Stubbs et al., 2015; Tidey and Miller, 2015) and personalized treatment of diabetes (Larsen et al., 2016) are effective interventions to reduce mortality, they should be prioritized in the treatment of people with psychotic disorders.

Conflict of interest

Jaakko Keinänen owns shares in pharmaceutical company Orion. All other authors declare that they have no conflicts of interest.

Contributors

Jaana Suvisaari, Jonna Perälä and Samuli Saarni designed the study protocol of the Psychoses in Finland study and were responsible for diagnostic assessment of psychotic

disorders. Jaakko Keinänen, Jaana Suvisaari and Outi Mantere designed the study protocol of the mortality risk assessment, managed the literature searches and analyses and wrote the first draft of the manuscript. Tommi Härkänen, Jaana Suvisaari and Jaakko Keinänen undertook the statistical analyses. All authors contributed to and have accepted the final manuscript.

Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.schres.2017.04.048.

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