Reviewer’s report

Title: Changes in mental health services and suicide mortality in Norway: an ecological study

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Reviewer: Kristian Wahlbeck

Reviewer’s report:

This is an interesting manuscript, which evidences that in Norway investment in mental health services has been paralleled by a decrease in suicide rates on national level. In an analysis adjusted for competing explanatory factors, the authors surprisingly did not find a statistically significant association between any of several measures of mental health services and suicide rates on a regional level. This may be due to the restricted measures of mental health services used in this study: three of five measures are characteristics of hospital care and only one measures out-patient care. Previous research has found accessibility of outpatient services, and preponderance of out-patient mental health services, to be connected with suicide rates, but the current study only measures volume of outpatient services.

Major compulsory revisions

Background:
1. The background section is succinct and clear, but for the international reader some more information is needed about the Norwegian context. The strengthening of mental health resources is shortly mentioned in the third paragraph, but authors should be more specific regarding how the new resources were allocated in the mental health care system. A note on the size of the relative increase of the national mental health care budget would be helpful. They should also provide a concise description on how the competing explanatory variables, i.e. alcohol use, unemployment, education level and sales of antidepressants, have developed in Norway during the observation period.

2. As the analyses are based on regions, a table presenting the five regions, their trends in suicide mortality, the development of mental health services variables in each region, and the trends in explanatory variables for each region should be provided. The results of the Poisson regression analysis are difficult to interpret unless such background data is presented.

Methods

3. The results are highly dependent on the choice of explanatory factors, and the authors should be careful in choosing the relevant characteristics of mental health services. The negative outcome of the study may reflect the authors’ choice of mostly hospital-related explanatory variables. The rationale for the choice of mental health services variables used thus needs to be given.
4. The variables used should be more carefully described. It is unclear how “the length of inpatient stays in days per 1000 inhabitants” was calculated. It seems to be the total number of inpatient days, and not the average length of in-patient stay. If so, the naming of the variable needs to be changed, and it would be highly correlated to “the number of psychiatric hospital beds per 1000 inhabitants”. Inclusion of both of these variables is questionable (as they both simply reflect volume of in-patient care).

5. Does “number of outpatient consultations” include consultations by all staff? Does it include mental health consultations in primary care and municipal services?

6. Psychiatrists constitute only a part of the workforce in mental health services, and probable the total number of labour-years (including psychologists, nurses, etc) is more relevant for prevention of suicides. If these data are available, authors should include total labour years of all staff in mental health services instead of psychiatrists' labour years, as their aim is to look at the effect of increased mental health resources, not just the effect of increasing the number of psychiatrists. They might even consider including the number of workforce in out-patient care in the analysis, if such data are available.

7. The authors state that “Regional figures were available from 1998 onwards. For the period before 1998, figures for the whole country were used.” From this description it is not clear how the authors handled the missing data. Did they substitute missing regional data with aggregate national data? This would reduce the impact of region in the log-linear model.

8. It is also not clear whether regional data were available for each of the competing explanatory variables (regional data is not mentioned for alcohol and antidepressant sales). Authors need to more carefully describe their data set.

9. Poverty and deprivation are strongly linked to suicides, but the authors have not included poverty or mean income level among the competing explanatory variables. Is there a rationale for this?

10. Collinearity is the crucial issue in the statistical analysis. Authors should describe more carefully how the dealt with this. What does it mean that they “compared the standard errors of...the [models]?"

Discussion

11. The authors should be more careful in avoiding wording that implies causality. In the first para, they state that “no impact on suicidality mortality was found”. As this ecological study has studied associations, words such as “impact” should be avoided.

12. The discussion focuses on content and quality of treatment given, which is an important topic and may explain the negative finding. However, not just content but also organisation of services deserves to be discussed. Have accessible and varied out-patient interdisciplinary and psychotherapy services been developed (which in previous studies have been linked to reduced suicides) or does the focus remain on standard medical out-patient services?
13. During the period of increase of resources of mental health services, suicide rates declined. In the Poisson regression all of the decline was explained by the competing explanatory factors. However, it cannot be excluded that this was not a result of including mostly in-patient service variables in the analysis. The authors should discuss the impact of their choice of variables in this section.

Conclusions
14. “..these changes had no impact on suicide mortality”. Due to the nature of the study, no interpretations about causality can be made, and the authors should avoid such wordings as “impact.

Minor essential revisions
Abstract
15. In the methods section of the abstract, the authors state that one their mental health service variables was "length of hospital stay". This needs to be corrected, as the mean length of hospital stay was not included in the analysis. The authors probably mean to say “total number of psychiatric in-patient days”?

16. In the results section of the abstract the authors should not only give the total number of suicides during the observation period, but also indicate to the readers the prevailing trend in suicide rates in Norway during the period 1990-2006.

Results
17. In the first paragraph, authors state that “suicide rate declined most from 1990 to 1994 (crude RR = 0.94......)” This seems to be a mistake, as the equivalent rate in Table 1 is RR=0.79.

18. In the first paragraph, the authors state that “major changes in the health services variables were observed in the end of the period 2000-2006”. It is not clear whehter they mean in the end of the period 2000-2006 or in the end of the observation period 1990-2006?

19. The sentence on power analysis (second paragraph) needs to be moved to the methods section. The authors should describe which method was used for the power computation.

20. In the third para of the Results section, the authors say that “the highest suicide mortality was in the...East, ....and West had the lowest suicide mortality. They should specify that this result relates to the second adjusted analysis only.

21. In the third para the authors state “unemployment....was negatively related to suicide mortality”. In the next sentence they say that “decrease in unemployment....predicted a reduction in suicide” :thus the relationship seem to be positive?

22. In the third para the authors mention one-unit increases/decreases. For the sake of readers, the authors should clarify which the units are. (is it for instance a doubling of the number of people with higher education in relation to people with
Discussion

23. In the adjusted analysis, when main explanatory variables have been taken into account, main differences in suicide rates between regions exist (suicide mortality in the West region is 64% of the mortality in the East region). Authors should discuss the reasons for this huge regional variation. Could it be explained by e.g. poverty, which was missing among the variables analysed?

24. It should also be mentioned that in Norway 25% of resources have been allocated to child and adolescent services, which may pay off in decreased suicide rates later only.

Discretionary revisions

Abstract: 25. It seems unnecessary to repeat the listing of mental health services variables in the results section (as they have been listed already in the Methods section of the abstract)

Spelling: 26. In some instances (and inconsistently) the authors use US spelling instead of UK spelling: behavioral -Background, first row; labor -Methods, third paragraph.

References: 27. Reference 14, first author should be “Pirkola” (letter “a” is missing)

Level of interest: An article of importance in its field

Quality of written English: Acceptable

Statistical review: Yes, but I do not feel adequately qualified to assess the statistics.

Declaration of competing interests:

I declare that I have no competing interests.