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National Suicide Rates 1961–2003: Further Analysis of Nordic Data for Suicide, Autopsies and Ill-Defined Death Rates

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Key Words
Antidepressants · Autopsies · Suicides · Ill-defined deaths

Abstract
Background: Concerns about the risk-benefit ratio of treatment with antidepressants in the light of recent evidence pointing to a risk of suicide induction during the course of treatment with antidepressants. These concerns have led to a series of recent studies exploring national rates of suicide and correlating these with data on antidepressant consumption. ***Methods:*** We have compared suicide rates in the Nordic countries with autopsy and ill-defined death rates, and antidepressant sales, during the period 1961 through to 2003. ***Results:*** There is a close correlation between suicide rates and both autopsy and ill-defined death rates. ***Conclusions:*** The role of autopsies and other factors in the registration of a death as a suicide appear to need further clarification.

Introduction

In response to concerns that antidepressants might precipitate suicidality in vulnerable individuals [1], there has been recent interest in reviewing national rates of suicide to see whether these are increasing or decreasing. There has been a particular focus on correlating changes in suicide rates with selective serotonin re-uptake inhibitor (SSRI) antidepressant consumption.

Such studies have led to claims that antidepressant usage has brought about falls in suicide rates in Sweden [2, 3], in the United States [4–7], in Australia [8], in Finland [9], and more generally in all countries where antidepressant use has increased [10]. McKeown et al. [11] have recently reviewed suicide rates by age group from the United States and argued that further studies are needed to shed light on what now appears to be a clearly declining suicide rate across age groups.

In contrast, there have been claims that suicide rate is unchanged in Italy [12], and Iceland [13] and that while it has fallen in Sweden, Norway, Finland and Denmark this fall cannot be linked to increased antidepressant use [14]. Recent data in Finland points to an association with increased suicide attempts but reduced suicide completions [15]. In Ireland increased antidepressant use is associated with increased national suicide rates [16]. More generally Hotopf et al. [17] have argued that increased antidepressant use, even if effective at reducing the risk of suicide, would not be likely to provide a convincing signal at the national level, and Gunnell and Ashby [18] have shown how falling national suicide rates could accommodate a treatment-induced increased rate of suicide in vulnerable patients.

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While superficially appealing, there are significant problems in attempting to extrapolate from suicide rates and antidepressant usage rates to causal links between these two variables. First correlation does not prove causation. This problem has traditionally been recognized in terms of the risk it poses of committing an 'ecological fallacy' – that is highlighting linkages between unrelated variables. Second, there are problems with determining just what antidepressant consumption data mean. Failure to take this into account means research risks producing misleading correlations or missing correlations that may be of importance. Third, no studies in this domain can be of any value if there are doubts over the reliability of national suicide rates. This paper seeks to explore a hitherto unreported methodological input to the determination of national suicide rates, namely the role that autopsy rates may have in influencing apparent suicide rates.

Methods

We have sought out data on the numbers of autopsies and suicides as well as deaths coded under the terminology 'ill-defined or unknown causes of mortality' over the period 1961 to 2001–2004 in Norway, Sweden, Denmark and Finland (the Nordic countries). Data on the numbers of autopsies, the numbers of suicides and the numbers of deaths from ill-defined or unknown causes from 1961, or as early as data were available, were obtained from Statistics Norway (http://www.ssb.no), the National Board of Health and Welfare (Sweden; http://www.socialstyrelsen.se), the National Board of Health (Denmark; http://www.sst.dk), and Statistics Finland (http://www.stat.fi).

The data on number of suicides and other deaths for Norway, Sweden and Finland were available up to 2004, and for Denmark up to 2001. Data on number of autopsies were available from 1963 to 2004 for Norway, 1961 to 2003 for Sweden, 1982 to 2001 for Denmark, except for 1997, and 1963 to 2005 for Finland.

We plotted separate graphs for each of the four countries for suicide rates, for ill-defined and unknown death rates and for autopsy rates to enable us to compare time trends in numbers of autopsies done to determine the cause of death with trends in the numbers of registered suicides and rates of ill-defined deaths.

Ill-defined deaths is a category used in the national statistics of all four Nordic countries. It includes the following International Classification of Disease (ICD-10) codes: R96 (other sudden death, cause unknown, involving instantaneous death, without sign of disease), R98 (unattended death), and R99 (other ill-defined and unspecified causes of mortality) (http://www3.who.int/icd/currentversion/fr-icd.htm). The codes R96, 98 and 99 were coded under ICD-7 from 1961 to 1968 as 795, and under ICD-8 from 1969 to 1985 as 795 and 796, and under ICD-9 from 1986 to 1995 as 798 and 799. We have excluded all contributions to these figures from sudden infant deaths (R95, and earlier codes).

Results

The data on autopsy, suicide and ill-defined death rates for the four Nordic countries are presented in figures 1A–D, and for the four countries combined in figure 2.

The Norwegian statistics show that after a plateau from 1979 to 1989, the number of autopsies began to decline sharply from the point when SSRIs were introduced (fig. 1A). As autopsy rates have fallen, so ill-defined death rates have risen. In Sweden, the numbers of autopsies have been steadily declining since the beginning of the 1970s (fig. 1B), and an even sharper decline from 1988. At the same time ill-defined death rates have risen. The Danish statistics show a steady decline in the number of autopsies from 1983 (fig. 1C), as well as a decline in the suicide rate and a variable increase in ill-defined death rates. In Finland, after a steep rise in the number of autopsies from 1962, there was a plateau from 1972 to 1990, a fall of 13% between 1990 and 1994 and thereafter the number of autopsies stabilised (fig. 1D). The suicide, ill-defined death and autopsy rates have shown the least variation in Finland.

For Norway, the coefficient for the correlation between autopsy and suicide rates in the years between 1963 and 2004 was $r = 0.50$; the correlation for Sweden for the years between 1961 and 2004 was $r = 0.94$; the correlation for Denmark for the years between 1982 and 2001 was $r = 0.96$, and for Finland for the years between 1969 and 2005 was $r = 0.33$. The correlation between autopsy and suicide rates for all four Nordic countries for the years for which complete datasets are available for all four countries, 1982–2001, was $r = 0.91$.

The coefficients for correlation between suicide rates in each of these countries and ill-defined death rates are as follows. For Norway the correlation between 1961 and 2004 is $r = -0.76$; for Sweden the correlation for the years between 1961 and 2004 is $r = -0.86$; for Denmark the correlation for the years between 1982 and 2001 is $r = -0.43$; for Finland the correlation for the years 1969–2005 is $r = 0.08$. The correlation between suicide and ill-defined death rates for the four Nordic countries combined for the years 1982–2001 is $r = -0.66$.

When autopsies are correlated with ill-defined deaths, the coefficients of correlation for Norway for the years 1961–2004 are $r = -0.24$; for Sweden for the years 1961–2004, the correlation is $r = -0.83$; for Denmark for the years 1982–2001, the correlation is $r = -0.51$; for Finland for the years 1969–2005, the figure is -0.12. For all four Nordic countries for the years 1982–2001, the correlation for autopsies and ill-defined deaths is $r = -0.74$.

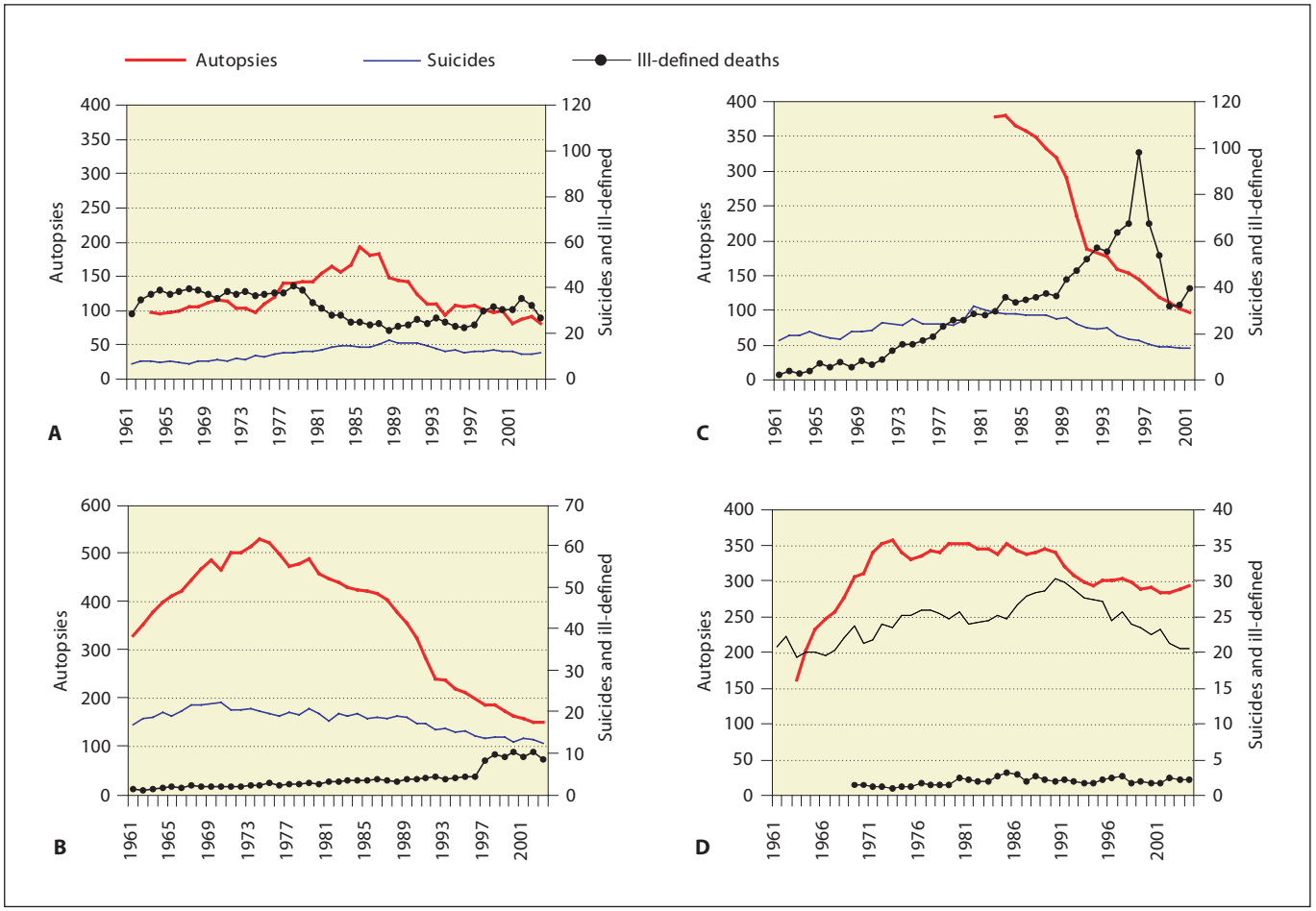

Fig. 1. Annual autopsy, suicide and ill-defined death rates (per 100,000) in Norway (**A**), Sweden (**B**), Denmark (**C**) and Finland (**D**).

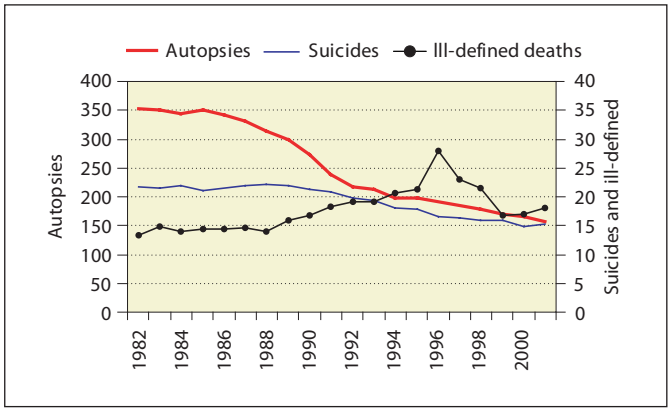

Fig. 2. Annual autopsy, suicide and ill-defined death rates (per 100,000) in the Nordic countries.

Discussion

It has been suggested that SSRI usage cannot induce suicides in line with the rates of excess suicides found in randomised controlled trials and other studies because the continuing growth of scripts issued has been accompanied at least in some instances by a fall in suicide rates [7, 11]. However for a number of reasons, some of which are highlighted by these data, contributing factors to registered suicide rates need to be delineated before the precise nature of any relationship can be determined.

The data on autopsies, suicides and undetermined deaths from the Nordic countries outlined here points to the problematic nature of national suicide rates. These national rates should be regarded as rates for registered suicides rather than for all suicides. It has been recognized for some time in a number of countries that 'the

reproducibility of diagnoses on death certificates is so poor that information from the Registry of Causes of Death is of little use for administrative or scientific purposes' [19–21]. One reason for this is likely to be declining autopsy rates.

There have been efforts within the Nordic countries to improve autopsy rates, but there are clearly pressures in the opposite direction, namely to reduce autopsy rates in the developed world, probably in part by virtue of a greater confidence in pre-mortem diagnostic technologies. These tensions have also been apparent in the USA: 'The possibility that a given autopsy will reveal important unsuspected diagnoses has decreased over time, but remains sufficiently high that encouraging ongoing use of the autopsy appears warranted' [22]. Despite this autopsy rates in the United States have fallen from 50% of deaths in teaching hospitals in the 1960s to 5% now, in part perhaps because teaching hospitals no longer need to do autopsies for accreditation purposes.

It appears from our data that, with the possible exception of Finland, autopsy rates began to decline in the Nordic countries around the same time as suicide rates began to decline and both rates declined further around the time of the introduction of the SSRIs and other newer antidepressants. There was a corresponding increase in the numbers of ill-defined deaths. Conversely suicide rates rose in the 1960s and 1970s in the three countries for which we have data during periods when the autopsy rate was rising, but this was also a period when antidepressant prescription rates were also rising. If data for the period from 1960 to 1990 were taken into account in recent studies of antidepressant usage and national suicide rates, it seems unlikely that the correlations reported between antidepressant usage and suicide rates would be so striking.

The data offered here suggest that for structural reasons diagnoses of suicides may have been less likely in the Nordic countries from 1988 onwards. This decreased likelihood seems unlikely to have had anything to do with the increased usage of antidepressants, pointing to the risks in all correlational studies.

It is possible, however, that increased antidepressant usage might have led to increases in the numbers of open verdicts returned at inquest for instance and thus an increase in the numbers of ill-defined deaths. This is particularly likely to be the case if antidepressants induce a different kind of suicide in terms of its impulsivity or other characteristics to traditional suicides. In this case, such deaths may be coded under the heading of accidents or as open verdicts for some years.

If there is a causal link between autopsy rates and registered suicide rates, it is likely to run from autopsies to suicides and not in reverse. Declining suicide rates are unlikely to lead to a fall in autopsy rates, in that relatively small changes in suicide rates could not produce the fall in autopsy rates noted here. But a large fall in autopsy rates could entirely account for the observed changes in suicide rates.

If national suicide rates are dependable and not influenced by factors such as migration, or changes in autopsy practice, there still remains a problem in linking the massive growth in SSRI antidepressant usage with national suicide rate in that antidepressant usage may give a misleading indication of the growth in the numbers of persons on antidepressants and more particularly the numbers of new patients starting an antidepressant annually [23].

As we have outlined elsewhere, a key problem in correlating data on antidepressant use with suicides lies in the fact that the amount of drug consumed bears an uncertain relationship with the numbers of people treated. Once this problem is considered, it immediately becomes clear that, in the case of drugs like the antidepressants, a decreasing proportion of drug usage will over the life of a drug be devoted to new patients and an increasing proportion to patients who are on longer-term or repeat treatment, who are not at risk of treatment-induced suicide. It is quite possible that after a drug group is on the market for some years that drug consumption could increase dramatically while the number of new patients treated each year remains roughly constant. If the profile of those treated, furthermore, contains an increasing proportion of less severely ill patients, patients who are anxious rather than depressed for example, then increased treatment consumption might be expected to be linked to a constant number of individuals at risk but a falling national suicide rate, even though treatment induces suicidality [23].

The converse would apply to a cohort of patients at risk from a hazard from long-term treatment. Indiscriminately correlating drug consumption with a hazard is likely to be relatively uninformative whatever that hazard might be. Notwithstanding this, the data reported here show that Nordic suicide rates were falling prior to any increase in SSRI consumption, and any effort to explain what is happening must take this point into account.

In conclusion, this study points to robust correlations between suicide and autopsy rates when viewed over the 40-year timeframe in which antidepressants have been available. Having criticised antidepressant consumption

studies as correlational and indicated one factor that might give rise to such correlations, we have tried to avoid a comparable mistake. The statistical package used to generate these correlations throws up figures for statistical significance, which would conventionally be described as highly significant, but we have not cited p values as this has not been a hypothesis-generated study.

One such hypothesis that these data suggest is that there might for example be a threshold rate of autopsies above which there will be a decreasing yield of suicides and below which there will be a significant impact on the numbers of suicides detected. If this were the case the link between autopsy and suicide rates would in fact be even stronger than the data here indicate but establishing that it is the case would require a specific study. Further studies in this area, as McKeown et al. [11] suggest, should ideally be driven by specific hypotheses.

Competing Interests

S.R., G.A. and J.L.N. have no competing interests. D.H. has multiple competing interests, having been a clinical trialist, consultant and speaker for most major pharmaceutical companies over the past 10 years, a speaker/consultant for Astra-Zeneca, Lundbeck and Teva in the past 2 years, and an expert witness in 15 cases involving antidepressant-linked suicide or homicide over the past 10 years.

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