Influence of psychotherapist density and antidepressant sales on suicide rates

Kapusta ND, Niederkrotenthaler T, Etzersdorfer E, Voracek M, Dervic K, Jandl-Jager E, Sonneck G. Influence of psychotherapist density and antidepressant sales on suicide rates.

Objective: Antidepressant sales and suicide rates have been shown to be correlated in industrialized countries. The aim was to study the possible effects of psychotherapy utilization on suicide rates.
Method: We assessed the impact of antidepressant sales and psychotherapist density on suicide rates between 1991 and 2005. To adjust for serial correlation in time series, three first-order autoregressive models adjusted for per capita alcohol consumption and unemployment rates were employed.
Results: Antidepressant sales and the density of psychotherapists in the population were negatively associated with suicide rates.
Conclusion: This study provides evidence that decreasing suicide rates were associated with both increasing antidepressant sales and an increasing density of psychotherapists. The decrease of suicide rates could reflect a general improvement in mental health care rather than being caused by antidepressant sales or psychotherapist density alone.

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Significant outcomes

- This study implies that antidepressant sales were associated with suicide rates.
- The decrease in suicide rates can alternatively be explained by increased psychotherapist density in a model adjusted for unemployment and per capita alcohol consumption.
- The high correlation of antidepressant sales and psychotherapist density suggests a common underlying factor which could be responsible for the decrease in suicide rates.

Limitations

- Ecological studies can only find associations.
- The interpretation of the results has to consider multicollinearity between antidepressant sales and psychotherapist density.
- The results challenge the hypothesis that antidepressants are solely responsible for the decrease in suicide rates, but further examination of the influence of psychotherapy on suicide rates is needed as psychotherapist density may not properly reflect psychotherapy utilization.

Introduction

Suicide is the result of a complex interplay of biological, psychological, social and cultural factors. At the aggregate level, suicide rates have been shown to be influenced by unemployment rates (1–3) and per capita alcohol consumption (4, 5). In addition, a number of studies suggest an impact of increasing antidepressant sales on decreasing suicide rates (6–12); although several studies support this hypothesis only partially (13–15), others do not (16, 17). The Food and

Drug Administration (FDA) black box warning on antidepressant use initiated a scientific controversy about the safety of antidepressants (18). Associations of antidepressant sales and suicide rates gained increased interest because of the controversy and support the evidence for the suicide-preventive effects of antidepressant intake. Such associations, however, are prone to misinterpretation, when derived from unadjusted models (19).

The evidence drawn from the seminal Gotland study (20) and their replications (21, 22) supports the fact that education of general practitioners in the diagnosis and treatment of depression increases antidepressant use and decreases suicide rates. Moreover, the general availability of healthcare services seems to influence the diagnosis and treatment of depression (23) and it has been reported that suicide rates correlate with access to healthcare facilities, including psychiatrists and other physicians (24). However, there is evidence that, besides antidepressants, psychotherapy is effective in the treatment of depression (25, 26) and in suicide prevention (27). In the USA, a national trend of increased psychotherapeutic treatment has been discussed as a possible moderating variable of suicide rates (11); an increase in the visits to psychotherapists for mood disorders correlated with a decrease in suicide rates (28). A recent study of prepaid health plan register data showed that the number of suicide attempts decreases among persons either starting antidepressant medication or psychotherapy (29). As psychotherapy has become an integral part of the treatment of mental disorders and mood disorders, and is often seen as an alternative or adjunct to medication, it would be interesting to shed light on the possible influence of psychotherapeutic treatment on suicide rates.

Aims of the study

The aim of the study was to evaluate three multivariate statistical models with respect to decrease in suicide rates in Austria, with antidepressant use, psychotherapist density, alcohol consumption and unemployment as predictor variables.

Material and methods

Data

Data on the number of suicides per year as well as on the size of the general population were obtained from Statistics Austria. In Austria, a death certificate must be issued for every deceased person. An autopsy has to be performed on all persons who did not consult a physician in the 10 days prior to death by a physician authorized by the local health authority (30). Given the fact that low autopsy rates may negatively affect suicide rates (31), it has to be mentioned that the rate of autopsies in Austria is relatively high compared with the international average (32). A recent study reported an average autopsy rate of 29% in Austria between 1991 and 2000 (30). Figures on the unemployment rates were obtained from the Organization for Economic Cooperation and Development (OECD). Statistics on alcohol consumption per capita were obtained from the Austrian Alcohol Coordination and Information Center (33). The Austrian Institute of Health provided figures on the official numbers of psychotherapists registered by the Austrian Ministry of Health and Women (34). In Austria, after the enactment of a psychotherapy law in 1991 that regulated the training and qualification criteria for the profession of psychotherapists for the first time nationwide (35), the number of psychotherapists grew steadily. The initial registration process of active psychotherapists lasted 2 years. A prelegislation survey on the number of persons providing psychotherapy estimated that approximately 3000 (39.6 per 100 000) persons would qualify for the registration process (36). Therefore, the psychotherapist density in 1991 and 1992 from Table 1 has been adjusted to the calculated growth of the psychotherapist density between 1993 and 2005 ($y = 0.264x + 2.082$) to reduce the registration bias. Statistics on antidepressant sales were obtained from IMS Health Austria (Vienna), an independent international agency that monitors the pharmaceutical market. All antidepressants, regardless of class, were included in the analysis. Data on over-the-counter package sales were converted to defined daily doses (DDD/1000 inhabitants per day) as suggested by the World Health Organization (37). In Austria, antidepressants are available only on prescription. Only 20% of psychotherapists are physicians and therefore entitled to prescribe antidepressants. All other psychotherapists are mostly psychologists (45%), teachers (13%), social workers (8%) and pedagogues (8%) as well as other professionals (36). Suicide rates were defined as the number of suicides per 100 000 inhabitants per year. The density of psychotherapists per year was calculated as the number of psychotherapists per 100 000 of the Austrian annual population.

Statistics

We applied a variable selection method, as described by Neter et al. (38). In the first step, we

Table 1. Suicide rates, psychotherapist density, antidepressant sales and socioeconomic factors in Austria (1991–2005)

Year	Total suicide rate (per 100 000 population)	Unemployment rate (% of total labor force)	Psychotherapist density (per 10 000 population)	Antidepressant sales (DDD/1000 inhabitants per day)	Per capita pure alcohol consumption (in liters)
1991	22.6	3.5	4.0	9.1	12.3
1992	22.2	3.6	4.3	10.2	12.0
1993	21.3	4.2	4.3	10.9	11.9
1994	22.1	3.6	4.5	13.1	11.0
1995	22.2	3.7	4.6	14.9	11.7
1996	22.1	4.1	5.2	17.3	11.7
1997	19.7	4.2	5.7	20.8	11.2
1998	19.3	4.2	6.3	24.1	11.2
1999	19.2	3.8	6.5	28.9	11.1
2000	19.6	3.5	6.6	32.0	11.4
2001	18.5	3.6	6.6	35.8	10.7
2002	19.2	4.0	6.8	38.9	10.7
2003	18.0	4.3	7.0	40.4	10.6
2004	17.4	5.0	7.1	43.6	10.4
2005	17.0	5.2	7.4	46.9	10.4

tested all variables for their inter-relations. A strong correlation between antidepressant use and psychotherapist density was observed (Pearson's $r = 0.96$, $P < 0.001$). In the second step, we calculated first-order autoregressive (AR1) models of aggregate time-series data to adjust for serial correlation in time series for each predictor (antidepressant sales, psychotherapist density, unemployment, alcohol consumption per capita). Finally, the effect parameters were analyzed in three first-order autoregressive models adjusted for unemployment and alcohol consumption, with suicide rate as the outcome variable and (1) antidepressant use, (2) psychotherapist density and (3) both simultaneously as predictor variables.

Regression model diagnostics included examination of autocorrelation and partial autocorrelation plots as well as the inspection of heteroscedasticity plots. All statistics were calculated using SPSS (version 14.0; SPSS Inc., Chicago, IL, USA). Significance was set at $P < 0.05$ (two tailed).

Results

During the 15-year period (1991–2005), the overall suicide rate in Austria decreased from 22.6 (per 100 000 inhabitants per year) to 17.0. This decreasing trend can be observed since 1987. The suicide rates in terms of age categories (0–19, 20–64, and 65+ years) are shown in Fig. 1. Tests for trends in suicide rates during 1991–2005 were applied and analyzed.

During the time period, per capita alcohol consumption decreased by 15%, the overall unemployment rate ranged from 3.5% to 5.2% (mean 4.0%; SD 0.52%). Raw data are presented in Table 1. Besides a more than fivefold increase in

antidepressant use, there was a twofold increase in the density of psychotherapists.

Impact on total suicide rates

In the crude AR1 models, psychotherapist density and antidepressant use significantly negatively correlated with the total suicide rate, while per capita alcohol consumption and unemployment did not correlate with the total suicide rate.

The adjusted AR1 model estimates are shown in Table 2. The results indicate that model 1, with antidepressant use being the significant predictor variable, fits the data as well as model 2 with psychotherapist density as the significant variable (r^2). In model 3, with all explanatory variables in one common model, both the effect of antidepressant use and that of psychotherapist density are non-significant.

Discussion

This study found that both antidepressant use and psychotherapist density increased rapidly in Austria during 1991–2005, whereas the total suicide rate decreased. After controlling for alcohol consumption per capita and unemployment rates, antidepressant sales were found to be inversely associated with the overall suicide rate. The inverse relationship between antidepressant sales and suicide rates between 1991 and 2005, as shown in our study, conforms with previous studies with comparable timeframes: Japan, 1999–2003 (6); England, 1993–2002 (10); USA, 1985–1999 (11); Northern Ireland, 1989–1999 (14); Italy, 1983–2000 (16); Iceland, 1989–2000 (17); Sweden, 1995–2002 (21) and Finland, 1994–2001 (23). Reseland et al. (31)
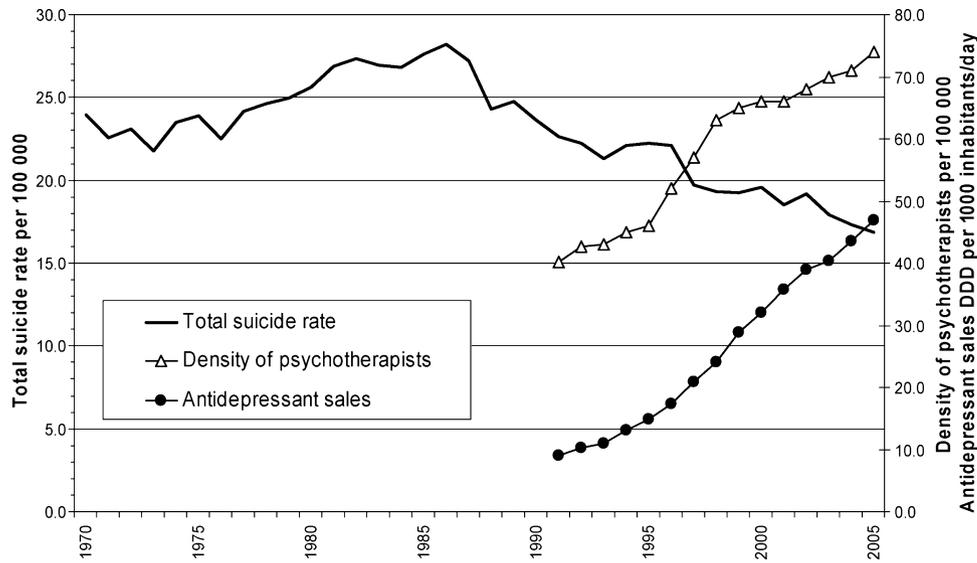
Fig. 1. The course of antidepressant sales, psychotherapist density and the suicide rate in Austria (1970–2005).

Table 2. Model estimates of first-order autoregressive analyses with total suicide rate as outcome

	Regression coefficient	SE	T	P-value	r²
Crude					
Alcohol consumption	0.692	0.661	1.047	0.318	0.09
Unemployment	−0.959	0.630	−1.522	0.156	0.17
Antidepressant sales	−0.135	0.017	−8.014	0.000*	0.85
Psychotherapist density	−1.534	0.165	−9.289	0.000*	0.89
Model 1					
Unemployment	−0.602	0.494	−1.219	0.254	0.86
Alcohol consumption	0.459	0.735	0.625	0.548	
Antidepressant sales	−0.103	0.034	−2.994	0.015*	
Model 2					
Unemployment	−0.659	0.361	−1.828	0.101	0.94
Alcohol consumption	0.472	0.562	0.840	0.423	
Psychotherapist density	−1.189	0.253	−4.692	0.001*	
Model 3					
Unemployment	−0.648	0.390	−1.662	0.135	0.94
Alcohol consumption	0.423	0.692	0.611	0.558	
Psychotherapist density	−1.131	0.549	−2.061	0.073	
Antidepressant sales	−0.007	0.059	−0.125	0.903	

*Significant predictors ($P < 0.05$).

examined even longer periods including all types of antidepressants for the Nordic countries: Norway, 1974–2003; Sweden, 1977–2003; Denmark, 1985–2003 and Finland, 1985–2003. Rising antidepressant use has previously been discussed in Austria as a possible factor influencing the decline in the general suicide rate (39). Of 13 ecologic studies on antidepressant sales and suicide published between 1998 and 2005, only five were controlled for socioeconomic variables (40). Interestingly, it were the models that did not adjust for socioeconomic changes which produced controversial results in terms of the hypothesis of preventive effects of

antidepressant prescriptions on suicide, whereas this hypothesis has been supported by all multivariate studies. The problem of unstable results of unadjusted studies can also be derived from five more recent studies from Japan (6), Italy (16) and the Nordic countries (7, 13, 23). When Hill's (41) nine epidemiologic criteria for causality (strength of association, consistency, specificity, temporality, biological gradient, plausibility, coherence, experiment and analogy) are applied to the model of the preventive effects of antidepressants on suicide, it is obvious that many of them remain unmet. Ecologic studies can contribute to the criteria of plausibility, consistency, temporality and analogy. Other study designs are needed to meet the other criteria.

The second result of this study – the negative association between the density of psychotherapists and suicide rates – is an alternative hypothetical explanation of the decrease in suicide rates. This plausible correlation is partially supported by a recent report indicating an increase in psychotherapist density in urban areas during 1991–2005 in Austria (34), which coincides with decreasing suicide rates in urban areas of Austria (42). In the USA, visits to psychotherapists for mood disorders were found to have increased between 1987 and 1997 (28). This finding has been discussed as a possible influence on suicide rates (11).

However, as the increased density of psychotherapists in Austria does not necessarily reflect the utilization of psychotherapeutic care, this question requires further examination. Because data on psychotherapy use in Austria (e.g. numbers of visits) are not available, because of a lack of assessment by the authorities, another indirect

measure of psychotherapy use is the total cost incurred to the social insurance system for refunding psychotherapeutic visits. The official costs increased by 68% from €22m in 1997 to €37m in 2002 (43), which is well above the inflation rate (about 3% per year) (44). This rise in costs corresponds to a similar 85% increase in psychotherapist density during the same period. It has to be noted that psychotherapists in private practice are only partly reimbursed by health insurances and that there are no reliable estimates of privately financed psychotherapy visits in Austria.

Nevertheless, as for antidepressant sales, we found an association between psychotherapist density and suicide rates. This alternative explanation challenges the hypothesis that the decrease in suicide rates is solely because of increased antidepressant use. The complex phenomenon of decreasing suicide rates cannot be attributed to a single factor. As antidepressant sales and psychotherapist density strongly correlated in our study, it is unsurprising that both models revealed a similar result. This exemplifies the problem of multicollinearity in ecologic studies: a common underlying factor may be misleadingly masked by model selection. Model 3 with both antidepressant sales and psychotherapist density as explaining variables demonstrates the effect of multicollinearity. The effect size of both variables was not significant, without a major alteration in the model fit r^2. From a statistical point of view, one should decide which of the two variables to exclude. As described before, there is more evidence for the association of antidepressant sales and suicide rates, than for the association of psychotherapist density and suicide rates.

However, psychotherapy cannot be seen as independent of psychiatric care. Although only 20% of psychotherapists are also physicians (36) and therefore entitled to prescribe drugs, psychotherapy is not only seen as an alternative but often used as an adjunct to medical treatment, which partially explains the association between antidepressant sales and psychotherapist density. The enactment of the psychotherapy law in 1991 coincided with the introduction of SSRIs in Austria in late 1989. It is possible, that with a growing awareness of depressive disorders and the need for pharmacological treatment, the awareness and need for psychotherapy increased.

In the Gotland study, it has been shown that general practitioners were the personnel to influence suicide rates the most (20). In Austria, the density of general practitioners increased between 1990 and 2005 from 109 to 147 per 100 000 inhabitants (+35%) and the proportion of all other physicians increased from 302 to 442 per 100 000 inhabitants (+46%) (45). As shown in our study, the density of psychotherapists in Austria increased from 40 to 74 per 100 000 (+86%), therefore stronger than the density of general practitioners. These numbers suggest that the density of psychotherapists is high, with nearly a half psychotherapist per every general practitioner.

Finally, as it is beyond the scope of this study to explore if the increasing psychotherapist density and the increasing number of antidepressants sold may reflect improvements in mental health care and its utilization in Austria, further studies are needed. In this context, a cross-sectional study from the USA showed that suicide rates correlate with access to health care, including density of psychiatrists and other physicians (24). Recently, it has been suggested that the availability of healthcare services may help to increase the diagnosis of depression (23). Therefore, it seems reasonable to assume that improved societal awareness of mental disorders would consequently lead to better diagnosis and management of persons with mental disorders, and this has been previously discussed in the USA (46).

Limitations

Besides the limitations of the data on psychotherapy use described above, this study has several other limitations. Data on antidepressant use in terms of age groups were not available and the multivariate models were hence not stratified by age. Furthermore, only antidepressants were taken into account, other compounds such as antipsychotics or anxiolytics were not included in the study, and data on different categories of antidepressants were not available.

Psychotherapist density and the amount of antidepressant use are only proxies, i.e. antidepressant sales figures may not equal antidepressant intake (we do not know the fate of sold drugs, i.e. whether they are actually taken or not), and density figures of psychotherapists may not equal the number of clients treated and psychotherapy hours consumed. We also do not know whether proportionally more depressive patients are utilizing psychotherapy now, with increasing number of psychotherapists, than previously when there were fewer psychotherapists. Furthermore, statistics on psychotherapists and antidepressants have been recorded only since 1991, while the decline in suicide rates in Austria began after 1986.

To conclude, the decline in suicide rates in Austria during 1991–2005 was associated with an

increase in antidepressant sales and in psychotherapist density as well. Our results show that the increase in antidepressant prescriptions and the growing number of psychotherapists are highly correlated, indicating a possible common underlying factor of mental health care, which may help decrease suicide rates. Therefore, further efforts to assess the influence of the utilization of psychotherapy and other mental healthcare factors on suicides could improve our knowledge on factors contributing to the decrease in suicide rates.

Acknowledgement

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