



Brief Communication

Standardized Mortality Ratio of Inpatient Suicide in a General Hospital

Mei-Chih Meg Tseng,^{1,2*} I-Chih Cheng,³ Fu-Chang Hu⁴

Inpatient suicide rates are seldom reported using age-standardized methods. This study aimed to estimate the standardized suicide rate in a general hospital. A total of 27 suicidal patients were identified by the adverse event reports during hospitalization from 1995 to 2004. Standardized suicide mortality ratios (SMR) were examined using the Poisson regression model. The SMR of inpatient suicide was 8.25 (95% CI = 5.67–12.06). Hospital suicide rates were considerably higher than the corresponding general population rates for all age groups and were particularly high in age categories of 25–29, 30–34, 40–44, and 55–59 years after controlling for sex and calendar year. Hospitalized patients had an eight times higher risk of suicide mortality than that of the general population. While the elderly are at increased risk for suicide in the general population, young- and middle-aged patients are the age group at risk for suicide mortality during hospitalization.

Key Words: general hospital, hospitalization, Poisson regression model, standardized mortality ratio, suicide

Inpatient suicide has previously been the second most common sentinel event reported to the Joint Commission on Accreditation of Healthcare Organizations (JCAHO)¹. Inpatient suicide rates vary substantially, depending on the type of hospital and methods of estimation, and ranges from 5 to 15 and from 100 to 400 per 100 000 admissions in general and psychiatric hospitals, respectively.^{2,3} Suicide rates are seldom estimated by age-standardized methods in these studies. Little is known about the differences in suicide rates

between hospitalized patients and the general population. Only one previous study reported the standardized mortality ratio (SMR) of inpatient suicides in psychiatric hospitals in England and Wales from 1967 to 1973. The SMR was 4.6 and did not follow the same pattern as seen in the general population in terms of age.⁴ Specifically, no increase in suicide risk for elderly hospitalized patients was found which was similar to that of the general population. To our knowledge, no other study has reported SMR of inpatient suicide for

©2011 Elsevier & Formosan Medical Association

¹Department of Psychiatry, National Taiwan University Hospital Yun-Lin Branch, and Department of Psychiatry, National Taiwan University College of Medicine, ²Institute of Occupational Medicine and Industrial Hygiene, College of Public Health, National Taiwan University, ³Department of Psychiatry, Far Eastern Memorial Hospital, and ⁴Graduate Institute of Clinical Medicine and School of Nursing, College of Medicine, National Taiwan University, Taipei, Taiwan.

Received: June 13, 2009

Revised: October 27, 2009

Accepted: November 3, 2009

***Correspondence to:** Dr Mei-Chih Meg Tseng, Department of Psychiatry, 7 Chung-Shan South Road, National Taiwan University College of Medicine, Taipei, Taiwan.

E-mail: mct seng@ntu.edu.tw

general hospitals suicide in recent years. This study aimed to estimate the standardized suicide mortality ratio in a general hospital during a 10-year period and to examine the effects of age, sex and calendar year on these findings.

Methods

Participants and procedure

A total of 27 suicidal hospitalized patients (10 women and 17 men) were identified by adverse event reports during hospitalization from 1995 to 2004 in an 1800-bed teaching hospital that provides a complete spectrum of general hospital services.⁵ Annual statistics of admissions patient-days stratified by age and sex during the 10 years were obtained from the hospital administrative services. Annual national mortality rates of suicide stratified by 26 5-year age and sex categories during the same 10-year period were obtained from the website of the National Institute of Health of Taiwan.⁶

The original sample size (n) of this study was 26 age groups \times 10 years = 260. However, as there were only two suicide deaths in the general population younger than 10 years of age, the final sample size was 242. The study was approved by the hospital Institutional Review Board.

Statistical analyses

Statistical analyses were performed with SAS software (Version 9.1, SAS Institute Inc., Cary, NC, USA). SMR was estimated using the Poisson regression model, assuming that the number of inpatient suicides followed a Poisson distribution conditioning on the relevant covariates. We first examined whether the effects of age and calendar year on SMR were different between male and female inpatients. Then, the effects of age, sex and calendar year on SMR were jointly examined by fitting Poisson regression model. In variable selection, the stepwise procedure was used with the significant levels for entry (SLE) and stay (SLS) set to 0.15 or larger. Two-sided $p \leq 0.05$ was considered statistically significant.

Results

The observed annual numbers of inpatient suicides ranged from 0 to 5 over the 10-year study period. The sum of the expected age- and sex-specific numbers of suicide deaths in this period was 3.26, and thus the crude SMR for all was 8.25 (95% CI, 5.67–12.06) with 9.84 (95% CI, 5.29–18.29) for female patients and 7.57 (95% CI, 4.70–12.17) for male patients.

The results of Poisson regression analyses stratified by sex showed that the year 2000 ($\hat{\beta} = 1.05$), age categories of 25–29 ($\hat{\beta} = 2.41$), 40–44 ($\hat{\beta} = 2.03$), and 55–59 ($\hat{\beta} = 1.69$) years were statistically significant variables for suicide mortality in male patients. The year 1996 ($\hat{\beta} = 1.61$), age categories of 25–29 ($\hat{\beta} = 2.47$), 55–59 ($\hat{\beta} = 1.84$), and 60–64 ($\hat{\beta} = 1.60$) years were statistically significant variables for suicide mortality in female patients. When sex, age, calendar year and their interaction terms were included in the Poisson regression analysis, sex and calendar year were not significantly associated with SMR conditioning on the effect of age. As listed in the Table, the covariate-adjusted SMRs in the 25–29, 40–44, and 55–59 age categories were significantly higher and the 30–34 age category was borderline significantly higher than those of the other age categories.

In summary, the hospital suicide mortality rates were considerably higher than those of the corresponding general population in all age groups. Specifically, inpatients in the 25–29 age category had the highest SMR [$\exp(1.41 + 2.55) = 52.35$] among all of the age groups. An $\exp(2.55) = 12.81$ times higher risk of suicidal death than those in the reference age groups (i.e. the age groups other than the 25–29, 30–34, 40–44, and 55–59 age categories).

Discussion

On the basis of age and sex standardization, this study found that inpatients had an 8.25 times higher mortality risk of suicide than the general

Table. Comparison of age-specific standardized mortality ratio of inpatient suicides from the fitted final Poisson regression model^a

Covariate	Parameter estimate (95% CI)	Standard error	Wald χ^2	<i>p</i>	SMR (95% CI)
Intercept (Other age categories)	1.41 (0.82–2.00)	0.30	21.80	<0.0001	4.10 (2.27–7.39)
Age 25–29 yr	2.55 (1.41–3.69)	0.58	19.08	<0.0001	52.35 (9.23–296.87)
Age 30–34 yr	1.51 (0.00–3.01)	0.77	3.84	0.0501	18.43 (1.00–155.14)
Age 40–44 yr	1.90 (0.76–3.05)	0.58	10.60	0.0011	27.34 (4.82–155.07)
Age 55–59 yr	1.81 (0.81–2.80)	0.51	12.68	0.0004	26.26 (5.80–119.00)

^aThe value of deviance divided by the residual degrees of freedom was $104.5737/237=0.4412$ (which is <1) indicating a good fit of the Poisson regression model to the observed data ($n=242$). SMR=standardized mortality ratio; CI=confidence interval.

population. The SMR of inpatient suicide in this study is almost two times higher than that of the period 1963–1973 as reported by Copas.⁴ Comparisons of inpatient suicide rates between Taiwan and other countries may not be valid due to differences in the populations and facilities being studied. The suicide rates for the general population of Taiwan are age-dependent, with higher rates in the elderly of both sexes concurring with the trends in Western populations.⁷ General hospital suicide rates were considerably higher than the corresponding general population rates for all age groups and were particularly high in young- and middle-aged patients. No increase in suicide risk for elderly hospitalized patients was found, which is consistent with Copas' finding. Our findings confirm the clinical impression that hospitalized patients run greater risks of committing suicide than the general population. Health personnel should always be alert to hospitalized patients with risk of suicide.

Some precautions need to be addressed when we interpret the study results. Our study was conducted in a tertiary care center, which usually comprised patients with higher degree of physical illness. Our findings may not be generalized to all general hospitals. Future studies should attempt to replicate these findings in more and varied general hospitals.

Acknowledgments

The authors would like to thank Ms Chia-Chi Cheng for her assistance in statistical computing. She is currently affiliated with Department of Medical Research and the National Center of Excellence for General Clinical Trial and Research, National Taiwan University Hospital, Taipei, Taiwan.

References

1. Joint Commission on Accreditation of Healthcare Organization. Sentinel Event Statistics. 2008. retrieved 01/06/2009. Available at <http://www.jointcommission.org/SentinelEvents/Statistics/>.
2. Shapiro S, Waltzer H. Successful suicides and serious attempts in a general hospital over a 15-year period. *Gen Hosp Psychiatry* 1980;2:118–26.
3. Dong JYS, Ho TP, Kan CK. A case-control study of 92 cases of in-patient suicides. *J Affect Disord* 2005;87:91–9.
4. Copas JB, Robin A. Suicide in psychiatric in-patients. *Br J Psychiatry* 1982;141:503–11.
5. Cheng IC, Hu FC, Tseng MCM. Inpatient suicide in a general hospital. *Gen Hosp Psychiatry* 2009;31:110–5.
6. Health and National Health Insurance Annual Statistics Information Service. Causes of death for suicide and self-inflicted injury by age group 2006. retrieved 01/02/2006. Available at <http://www.doh.gov.tw/statistic/index.htm>.
7. Lin JJ, Lu TH. Suicide mortality trends by sex, age and method in Taiwan, 1971–2005. *BMC Public Health* 2008;8:6.