PSYCHIATRIC EPIDEMIOLOGY

Suicide rates in rural Tamil Nadu, South India: Verbal autopsy of 39 000 deaths in 1997–98

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Background In India, death registration is not complete, especially in rural areas. Chiefly for other purposes special efforts were made to identify all deaths that occurred during 1997–98 in rural areas of one of the districts in Tamil Nadu, South India, and the verbal autopsy was done.

Methods Trained non-medical field interviewers interviewed surviving spouses, close associates or neighbours, and wrote the verbal autopsy reports in the local language (Tamil). The reports were reviewed independently by two physicians to arrive at the probable underlying cause of death. About 5% of the data were randomly selected for re-interview.

Results The verbal autopsy was done for 38 836 deaths. Injuries accounted for 18.5% of the total deaths. About half of these were suicides. The average annual suicide rate for men and women were 71 and 53/100 000, respectively. Three-fourths of all suicides were in the socially and economically productive age-group of 15–44 years. At ages 15–24 years the female suicide rate of 109/100 000 exceeded the male rate of 78/100 000; suicide was responsible for 49% of all deaths in women and 38% of all deaths in men at these ages.

Conclusions This is the second largest study to date that has used verbal autopsy to estimate mortality rates in India. Suicides accounted for 9% of total deaths, and the ratio of male to female suicide was 1: 0.72. The overall (male + female) annual suicide rate was 62/100 000 population. The female suicide rate at ages 15–24 years was higher than the male rate in that age-group and other female age-groups. About 50% of suicides were by self-poisoning, one-third by hanging and one-eighth by self-immolation.

Keywords Suicide rate, verbal autopsy, Tamil Nadu, India, injuries

Introduction

It has long been recognized that suicide rates are high in rural southern India, but routine death registration could not reliably assess how high they truly are. Many deaths are not registered at all,[1] especially in rural areas, because of an inefficient civil registration system and non-reporting of deaths; also because of legal and social consequences associated with suicide some of the registered deaths that were in fact due to suicide might be attributed to some other cause on the death certificate. A 'verbal autopsy' (VA) study conducted in Chennai,

Tamil Nadu[2] revealed that about 1100 deaths attributed to medical causes in the death certificate during 1995–97 were reclassified into non-medical causes based on the review of the verbal autopsy reports.

Chiefly for other purposes (to assess the hazards of tobacco),[3] we conducted a study in 1999 that sought to identify all deaths (except deaths at age ⩽1 day) irrespective of cause of death during 1997–98 in the largely rural district of Villupuram in the state of Tamil Nadu in South India and to assign causes to them by verbal autopsy interviews with surviving spouses, family members and/or neighbours. Irrespective of how accurately they could help us distinguish different diseases from each other, our informants would nearly always know reliably which deaths were due to disease, unintentional injury, violence and suicide, and would know the nature of unintentional injuries or methods of suicide. Hence, this survey has allowed us to assess age-specific death rates from unintentional injuries, violence,

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suicide and diseases much more reliably than would otherwise be possible. The data presented here from Villupuram, we believe, representative of the rural population of South India.

Methods

Rural survey of 41 000 families

This VA study was conducted in the rural Villupuram district (formerly part of South Arcot district) in Tamil Nadu, South India which has a population of ∼2.5 million living in ∼2000 villages. Special efforts were made to identify deaths at all ages (except deaths at age ⩽1 day) irrespective of cause of death during 1997–98 in the study area and to determine which really were due to suicide, unintentional injury, violence or disease. Data on name, age at death, sex, father/spouse name, place of death, address at the time of death, date of death and cause of death of the deceased were abstracted by the field interviewers from the records in the Village Administrative Offices in the study district, and by enquiring among village health nurses and village leaders in the study area. These data were computerized and checked for duplication. Computer printouts of the collected data from all sources excluding cause of death were given to the field interviewers to locate the houses of the deceased. Field interviewers were natives of the study area and sought the help of the village leaders and/or village health care workers in obtaining introductions to the relatives/neighbours of the deceased. The informants were given full information about the objectives of the study, and participation in this study was entirely voluntary. The participation rate was 100%.

The total number of deaths identified was 40 763. Of these, we successfully visited 38 836 residences of the deceased during 1999–2000, to try to assign cause of death by verbal autopsy; the remaining 1927 deaths could not be traced because the addresses were missing/incomplete in the Village Administrative Offices or the occupants had moved out after death. Of the 38 836 deaths traced, 7167(18.5%) were due to injuries and 31 669(81.5%) were due to medical causes.

Survey methods and quality control

The VA is a systematic retrospective inquiry of the family members about the circumstances, events, symptoms and signs of illness and treatment details prior to death, to help determine the underlying cause of death and to classify the broad patterns of mortality. In this study, the VA tool was used to arrive at the probable underlying cause of death.

The novel VA methodology used in Tamil Nadu studies[2,4] consists of training non-medical graduates with at least 15 years of formal education on VA tool to conduct the interviews. A list of symptoms/signs was used to prompt or probe to get more details. To enhance accuracy, the VA report written in the local language, described the chronological order of the appearance of signs and symptoms and their progress with details of treatment received, if any, and name of the hospital(s) admitted and any history of similar episodes. Interviewers were instructed to write the VA report as narrated by the respondent. If there were more than one respondent and the details given by them were entirely different, then the field worker wrote the VA report with details given by each respondent separately. These reports were sent for re-interview

by a special interviewer. All VA reports were reviewed independently by two physicians to arrive at the probable underlying cause of death. Each of the physicians gave only one underlying cause of death to the best of her judgement. Disagreement between the two physicians in arriving at an underlying cause of death was noted in 5% of the VA reports before the causes of death, were classified into broad groups. For example, 'Pneumonia' and 'Lower respiratory infection' were broadly grouped under 'Infection'. If according to one physician the underlying cause of death was pneumonia and to the other physician it was lower respiratory infection, these were discussed and resolved. There were no discrepancies in arriving at underlying cause of death for non-medical causes of death. The cause of death was coded according to the 9th International Classification of Diseases, Injuries and Causes of Death.[5]

A random sample of 5% of verbal autopsy reports were checked by re-interview 1 week after completion of the main interview by one of the two special interviewers who remained blind to its results. This re-interviewing was done partly because knowledge that a resurvey might well take place would ensure reliably motivated fieldwork at the initial survey, and partly to check whether there were any systematic defects in the technique of any of the field workers: none was found. The underlying cause of death determined by re-interview data was not different from the one arrived based on main interview data for all non-medical causes of death.

Validity of verbal autopsy tool

The validity of the VA tool depends to a great extent on the training given to the physicians to arrive at probable underlying cause of death by reviewing the VA reports, on how well the VA reports were written by the field interviewers (depends on the training given to the interviewers and interview skills), and on the immediate random checking of 5% of the interview data. The VA tool was not validated for suicidal deaths or for any other cause of death in rural study area because population based registries for morbidity or mortality are not existing in this study area and further, VA diagnosis could not be compared against the information in medical records since many do not attend the medical facility, prior to death, for their illness in rural area. Hence the validity of the VA tool could only be assessed for cancer deaths in urban area (Chennai, Tamil Nadu), where a population-based cancer registry with morbidity and mortality databases is available for comparison. The sensitivity of the VA tool to identify cancer was 95% (94% compared with Vital Statistics Department records and 96% compared with population-based Cancer Registry in Chennai) in the age-group 25–69.[4,6]

Results

The study was done in 1999–2000 and the VA reports were reviewed for both medical and non-medical causes of death. Table 1 presents the age- and sex-specific death rates from disease, injury and suicide along with the estimated number of suicides in India for the year 2005. Infant deaths at age ⩽1 day were excluded. Injuries (both intentional and unintentional combined) accounted for 18.5% of the total deaths at all ages

Table 1 Age- and sex-specific death rates from disease, injuries and suicide in rural Villupuram in Tamil Nadu, South India: 1997–98 and estimated suicide deaths for India in 2005

Number of deaths in 1997–98: annual mortality per 100 000

Age group	Sex	Person-years in thousands	Disease	Injuries	Total deaths (No)	Suicide	Suicide (%)	Population in thousands in India: 2005	Suicide deaths in India:2005
0–4[a]	M	254	1476:581	121:48	1597	0.0	0.0	61 561	0
	F	242	1624:671	103:43	1727	0.0	0.0	58 451	0
5–14	M	636	377:59	318:50	695	18:3	2.6	120 305	4000
	F	606	430:71	253:42	683	29:5	4.2	113 432	5672
15–24	M	573	408:71	759:132	1167	445:78	38.1	109 176	85 157
	F	527	452:86	727:138	1179	577:109	48.9	102 078	111 265
25–34	M	481	679:141	868:181	1547	551:115	35.6	88 561	101 845
	F	436	570:131	529:121	1099	419:96	38.1	82 225	78 936
35–44	M	368	1506:409	790:215	2296	411:112	17.9	72 716	81 442
	F	336	702:209	285:85	987	190:57	19.3	67 502	38 476
45–54	M	250	2720:1088	633:253	3353	276:110	8.2	53 314	58 645
	F	238	1331:559	204:86	1535	112:47	7.3	49 724	23 370
55–64	M	167	3331:1995	451:270	3782	166:99	4.4	32 844	32 516
	F	172	2295:1334	177:103	2472	49:28	2.0	33 313	9 328
65–74	M	96	3916:4079	298:310	4214	92:96	2.2	18 785	18 034
	F	103	3041:2952	203:197	3244	37:36	1.1	20 736	7 465
75+	M	38	3845:10 118	257:676	4102	36:95	0.9	8 516	8 090
	F	44	2990:6796	167:380	3157	21:48	0.7	10 131	4 863
Total	M	2817	18 258:648	4495:160	22 753	1995:71	8.8	565 778	401 702
	F	2704	13 435:497	2648:98	16 083	1434:53	8.9	537 593	284 924

[a] Age group 0–4 excludes deaths at age ⩽1 day.

Population estimates: The 2001 census for Villupuram Health District area indicates that the age structure was, but for some slight irregularities, very similar to the smooth age distribution of the UN estimates for India as a whole in the year 2000. The age-specific adult population of Villupuram 1997–98 was, therefore, taken to be a suitable multiple [allowing for the rate of growth of the adult population: 600 million in 1995, 671 million in 2000 (UN 2001)[17]] of the average of the 1995 and 2000 UN estimates.

(excluding deaths at age ⩽1 day). About half of the injury deaths were suicides. The average annual overall suicide rate was 62/100 000 population in the study area. The male to female ratio was 1: 0.72.

Suicide rates among men and women

The suicide rate is low in childhood; indeed, no suicides were recorded before age 10. Suicides accounted for 9% of total deaths (M: 1995/22,753 and F: 1434/16,083). The average annual suicide rates for men and women were 71 and 53/100 000 per year, respectively. Three-quarters of all suicides were in the socially and economically productive age-group of 15–44.

A high suicide rate was noted at ages 15–24 in women and the rate was about half high thereafter (Figure 1). In this age-group, the suicide rate of 109/100 000 among females actually exceeded the male rate of 78/100 000; suicide was responsible for 49% of all female deaths and 38% of all male deaths at these ages. At ages 25–34 years, the female rate was slightly lower (96/100 000) and the male rate slightly higher (115/100 000), but in both sexes suicide accounted for more than one-third of all deaths; at ages 35–44 years suicide accounted for more than one-sixth of all deaths. At progressively older ages, suicide accounted for a progressively smaller
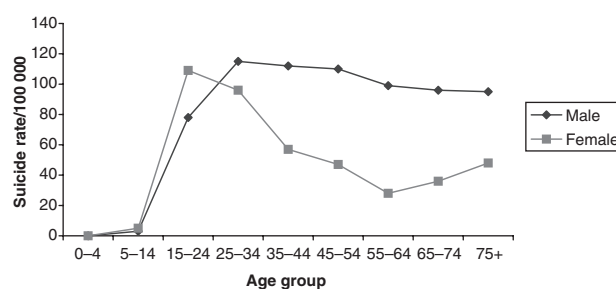
Figure 1 Suicide rates in rural Villupuram, Tamil Nadu, South India 1997–98

fraction of all deaths, chiefly because of the age-related increase in the death rates from disease. The probabilities of death by suicide at ages 15–44 years were 3.1% for men and 2.6% for women. The corresponding probabilities at ages 45–74 years were 3.1% for men and 1.1% for women.

Method of suicide

Table 2 shows that, at all ages and in both sexes, the predominant method of suicide was by self-poisoning

Table 2 Suicide methods in rural Villupuram in Tamil Nadu, South India: 1997–98

Age range (years)	Sex	Poison	Hanging	Fire	Other[a]	Total
0–14	M	6	8	4	0	18
	F	12	10	7	0	29
15–44	M	866	387	146	8	1407
	F	559	414	191	22	1186
45–74	M	257	223	52	2	534
	F	90	79	24	5	198
75+	M	15	17	4	0	36
	F	8	11	2	0	21
All ages	M: n	1144	635	206	10	1995
	M: %	57.34	31.83	10.33	0.50	100.00
	F: n	669	514	224	27	1434
	F: %	46.65	35.84	15.62	1.88	100.00

[a] Drowning.

followed by hanging and self-immolation (burning). In this largely rural district, self-poisoning generally involved ingestion of agricultural pesticides. A higher proportion of women chose hanging or self-immolation compared with men.

Discussion

Globally, the suicide rate is 13.5/100 000.[7] With the exception of rural China, men are three times more likely to commit suicide than women. In rural areas of China (Beijing), suicide rates are about three times higher than in urban areas increasing to almost 5-fold in women in the age-group 25–34.[8,9] Even though the highest suicide rates are reported in Eastern Europe and in island countries such as Cuba, Japan, Mauritius and Sri Lanka, the largest number of suicides are found in Asia.

This study was conducted in 1999–2000 for the deaths that occurred in 1997–98 in the rural area of one of the districts in Tamil Nadu, South India. Based on VA reports, suicide accounted for 9% of the total deaths; the average annual suicide rate was 62 deaths per 100 000 in 1997–98. The suicide rate computed based on police records ranges from 8.1 to 58.3/100 000 population in different parts of India.[10] These rates may not reflect the true suicide rates because of the possibility of non-reporting of deaths to police to avoid legal and social consequences. The estimated suicide mortality rates reported for India in the 2002 global burden of injuries[7] are much lower than the rates observed in the present study in rural Tamil Nadu, South India. The number of suicide deaths estimated based on present study results for the year 2005 in India is 687 000 (Table 1).

In women, the highest suicide rate was seen between the ages of 15 and 24 years and in men between the ages of 25 and 54 years. At ages 15–24, the female suicide rate of 109/100 000 or 40% of suicides in women (577/1434) was higher than the male rate of 78/100 000 or 22% of suicides in men (445/1995) at all ages. A study conducted by the Christian Medical College in 85 villages of the Kaniyambadi region of southern India also found a higher suicide rate (164/100 000) among women

aged 15–24 compared with men (96/100 000) at these ages[11] for the period 1994–99.

Self-poisoning, generally involved ingestion of agricultural pesticides and was the most common suicide method (53%) in this study area, similar to suicidal practice observed in rural areas in other parts of the world. Pesticides account for over 60% of suicides in rural China[12] and 71% in rural areas of Sri Lanka.[13] Most people living in rural areas in India are involved in agriculture. They keep pesticides in their homes or close to their homes, thus resulting in easy access to pesticides and a readily available suicide method. The second common method of suicide is by hanging, which accounts for one-third of suicides in both sexes. Sacrificing one-self on a fire (self-immolation) is the third most common method in both sexes. This method of suicide is not unique to India and has also been observed in Sri Lanka,[14] Central Asia,[15] and the Middle East.[15]

The strengths of the present study are: a large sample size that included all deaths (medical and non-medical causes) in a defined area to avoid selection bias; use of a VA tool with an open format and narrative text to capture all details irrespective of cause of death; independent review of VA reports by two physicians to arrive at the probable underlying cause of death; and validation of the VA reports by re-interview of randomly selected 5% data by special interviewers. The limitations of the study are the interview started 1 year after the event, did not record who the respondents were and could not assess the validity of the VA tool for suicidal deaths. However, our experience has shown that the respondents of VA interview could recall the circumstances prior to death even 2–3 years later.[2,4] One validation study showed no significant effect on sensitivity or specificity using differences in recall period length of 1–21 months for VA, and VA tool accuracy was not affected by age, sex, relationship and language of the respondents.[16]

Suicide is an important, largely preventable public health problem. Suicide in India is associated with a complex array of factors such as poverty, low literacy level, unemployment, family violence, breakdown of the joint family system, unfulfilled romantic ideals, inter-generational conflicts, loss of job or loved one, failure of crops, growing costs of cultivation, huge debt burden, unhappy marriages, harassment by in-laws and husbands, dowry disputes, depression, chronic physical illness, alcoholism/drug addiction and easy access to means of suicide.

Identifying the cause(s) of suicide and the factor(s) that triggered the suicidal act are essential for developing suicide prevention programmes. Community-based preventive programmes in India must be developed with an understanding of the economic and cultural practices of the region, and they should focus on primary and secondary prevention of the factors associated with suicide risk. Help agencies in the societies should be strengthened to support those in inter-personal crisis, and methods have to be evolved to restrict access to pesticides and other means of suicide. Village health nurses, each of whom generally takes care of a population of 5000 in a village could be involved to identify high-risk groups and to educate the public about improving their coping skills to face psychological and emotional problems.

Conclusions

This is the second-largest study to date that has estimated mortality rates based on VA in India. In the rural population covered by this study, injuries and suicides accounted for 18.5 and 9% of total deaths, respectively. This study found the suicide rate in 1997–98 was 62/100 000 which is about five times higher than the national average. Three-quarters of all suicides occurred among people aged 15–44 years. The female suicide rate at ages 15–24 years is higher than the male rate in this age-group and other female age-groups. There is an urgent need to bring various agencies together to develop a support system based on local problems and available resources.

Acknowledgements

KEY MESSAGES

- The average annual suicide rate in 1997–98 was 62/100 000 which is about five times higher than the national average.

- Three-quarters of all suicides occurred among people aged 15–44 years.

- The female suicide rate at ages 15–24 is higher than the male rate in this age-group and other female age-groups.

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