

Original Articles

Completed suicide in adults of rural Kerala: Rates and determinants

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ABSTRACT

Background. India has witnessed a dramatic increase in suicide rates during the past few decades. The southern state of Kerala has been reporting the highest rates of suicide. Since suicide rates are estimated from death registries, they are likely to be under-reported because the civil registration system is incomplete and suicide deaths are poorly reported.

Methods. A cohort of 132 000 participants (age 35 years and above) in Thiruvananthapuram (erstwhile Trivandrum) district, Kerala was followed up for mortality from 1996 to 2005, after having filled-in a lifestyle questionnaire at baseline. The cause of death was based on verbal autopsy. Suicide methods were recorded and rates were estimated, and suicide risks were calculated according to several socioeconomic factors.

Results. During the follow up period, a total of 11 608 deaths, of which 385 were suicides (3.3% of total deaths), were registered. The overall suicide rate was 39.3/100 000 person-years among adults 35–90 years of age (men: 78/100 000; women: 16.5/100 000). The predominant methods of suicide were hanging, followed by poisoning and drowning. The suicide determinants were male gender, middle-age (40–60 years), Hindu, alcohol drinkers and secondary education level (≤ 7 years). Neither low socioeconomic level, living alone, nor being a married woman was associated with suicide risk.

Conclusion. Suicide rates were consistent with the official rates of Thiruvananthapuram district (37/100 000). However, our study population did not include the 14–34-year-old age-group which represents more than 37% of all suicides and hence it is more likely that the official rates are under-reported.

Determinants of suicide were in line with previous studies.

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INTRODUCTION

According to 2 recent WHO reports, suicide is a major public health problem. In this worldwide phenomenon, low-resource countries have witnessed dramatic increases in suicide rates during the past few decades.^{1,2}

In India, about 123 000 persons took their own lives in 2007, leading to a suicide rate of 10.8/100 000 persons (12.8 in men, 8.0 in women).³ Rates have doubled since the late 1960s (5/100 000).⁴ Discrepancies have been observed between urban and rural areas, the suicide rate being much higher in cities,⁵ and among states, southern states reporting a higher toll of suicides.⁴

Suicide in India often has legal, social and economic consequences; it is synonymous with scandals or religious implications. Each completed or attempted suicide necessitates a police report and is considered a criminal act that invites penal action.⁶ To avoid any police investigation and consequent social stigma to the attempter and the family of the completer, suicide is often reported as an accident or illness. Therefore, it is likely that the number of suicide cases are voluntarily under-reported in India where death in general is under-reported because of a poor civil registration system.^{7–10} Moreover, ecological studies on suicide are based on police records; very few are from hospital or population settings.¹¹ One of the few examples of a population-based study is that by Gajalakshmi and Peto.¹² The authors reported suicide rates in the rural areas of Tamil Nadu through active collection of death information based on verbal autopsy. When applying these regional rates to the entire Indian population, the national suicide rates were found to be 5-fold higher than those of official police reports.¹²

On the one hand, Kerala has excellent health indicators,¹³ and, on the other, it has one of the highest suicide rates in India. The official data showed a suicide rate in the state of 26.3/100 000 persons in 2007, which is almost 3-fold higher than the national suicide data.³

However, these state- or district-level suicide rates are likely to be under-estimates and not a reflection of reality. We estimated suicide mortality rates as well as determinants of suicide in a large cohort of adults living in a rural area of Thiruvananthapuram district by actively assessing their vital status and their cause of death through verbal autopsy.

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METHODS

Subjects

The mortality data used were collected from an on-going cluster-randomized community-based oral cancer screening trial implemented to evaluate the efficacy of oral visual inspection on oral cancer incidence and mortality. The study, described elsewhere,^{14,15} was carried out in a rural area of the Thiruvananthapuram district. A group of 191 873 subjects (age ≥ 35 years) were eligible, of which, 167 331 participated between 1 January 1996 and 31 December 2004 (87% participation rate) during three successive rounds of screening. This study includes the participants of the first two rounds, i.e. 131 881 subjects, for which information on potential determinants of suicide were available. They are currently being followed up for cancer incidence and mortality. The study protocol was reviewed and approved by the Scientific and Human Ethics Committees of the Regional Cancer Centre, Thiruvananthapuram and the International Agency for Research on Cancer, Lyon, France.

Lifestyle questionnaire

Trained health workers administered a lifestyle questionnaire to study participants during home visits. Information was collected on sex, age, level of education (illiterate, 1–7 years, 8–10 years, college), occupation (blue collar, white collar, business, housewife), standard of living based on the household assets (deprived, moderate, privileged), religion (Hindu, Muslim, Christian), number of permanent household residents, type of house (thatched hut, tiled hut, concrete), total monthly household income in rupees (<1500, 1500–3000, 3001–5000, >5000), drinking habits and

marital status for women. Subjects >90 years of age were excluded ($n=153$) because of possible unreliability, which brought the total study sample to 131 728 subjects (50 663 men and 81 065 women). Figure 1 shows the flowchart of the study.

Mortality assessment and follow up

Each subject was actively followed up for vital status by field workers through municipal death registers, death records from mosques, churches and social organizations, and during repeated home visits. If medical records were not available, the cause of death was established by interviewing a close family member of the deceased person using a verbal autopsy questionnaire.¹⁶ The questionnaire included identification information on the field worker who performed the interview, information on the responder (usually the primary caregiver), questions on known medical conditions, on signs and symptoms during the final illness of the deceased person, and on treatment and services used by this person. Field workers were trained and re-trained periodically. Questionnaires were then reviewed by a medical doctor to code the cause of death according to the International Classification of Diseases–10th Revision.¹⁷

The start of the follow up was the date of the interview. The end of follow up was either the date of death, or 31 December 2005, whichever came first. The outcome was suicide mortality.

Statistical analysis

Descriptive analyses of means of suicide and suicide rates were computed according to potential determinants.

Relative risks (RR) and 95% confidence intervals (CI) were

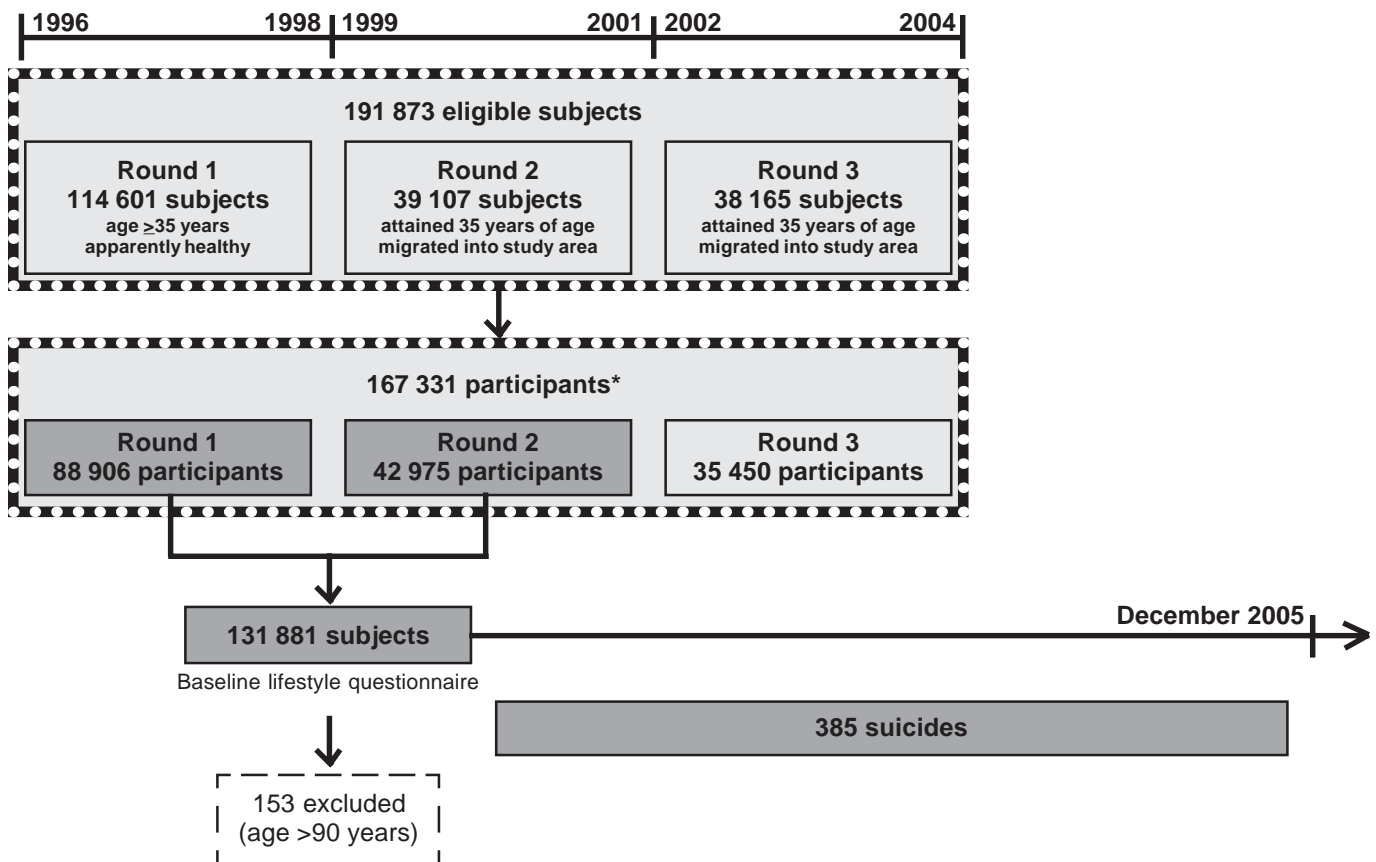


FIG 1. Flow chart of the study (* first time participants, whenever they were eligible)

estimated using the Cox regression method and CI were based on Wald statistics. Risks were adjusted for sex, age (continuous), randomization group (intervention, control), level of education, religion, occupation, house type, number of household residents, income level, household assets, habits of tobacco chewing, smoking and/or alcohol drinking, medical history of severe chronic disease (cardiovascular disease, cancer, tuberculosis, diabetes, bronchitis) using the stepwise backward elimination method. This method includes all potential confounding variables in the model and deletes automatically and one by one those which do not reach the significance level ($p < 0.05$).

The RR of suicide deaths as compared with staying alive were calculated using the Statistical Analysis System (SAS) PHREG procedure.¹⁸

The years of potential life lost (YPLL) due to suicide and accident were estimated in adults between 35 and 90 years of age, based on the number of deaths in the age-specific group multiplied by the difference between the mid-point of the age-group and the officially estimated life expectancy in rural Kerala, i.e. 75 years.¹⁹ YPLL to life expectancy were divided by the total number of deaths.^{20,21}

RESULTS

The analysis included 50 663 men and 81 065 women who were followed for a mean duration of 7.5 years. Seventy-eight per cent were literate (men 86%, women 74%). Hindus were 71%, Muslims 16%, and Christians 13%. During the follow up period, 11 608 deaths were registered and among them 385 were suicides (283 men and 102 women), i.e. suicide accounted for 3.3% of total deaths. The mean age of those who committed suicide was 50 years (men: 50, women: 51). Suicide deaths were equally distributed throughout the year, except for two peaks in April and December.

The commonest methods of suicide were hanging being used by half the subjects, poisoning by one-third, and drowning (Table I). When stratified by gender, age-group, level of education, religion, occupation, socioeconomic status (SES)—the house type, the income level or the house equipment—hanging was the commonest means of suicide, except for white collar workers in whom poisoning ranked first followed by either hanging or drowning. More men chose poisoning than women (34% of suicides in men, 18% in women), and more women chose drowning than men (6% in men, 19% in women). Self-immolation was used as the third means in the 40–49 years age-group, in the illiterate or with college-level education, Muslims and Christians, those living with 5–6 persons, and those with a high SES.

The overall suicide rate was 39.3/100 000 person-years (P-years). The suicide mortality rate was 78/100 000 P-years in men and 16.5/100 000 P-years in women with a 5:1 ratio (Table II). The highest suicide rates were observed in the 50–59 years age-group for all subjects and for men, while in the >70 years age-group in women. A higher suicide rate was also observed in those with education of ≤ 7 years, in Hindus, in blue collar workers, in those living alone, those with low income, poor housing and household equipment, and those who stopped alcohol use. Information on marital status was available for women who participated in the second round. Women who never married had the highest suicide rate (33.6/100 000 P-years) as compared with married (9.9/100 000 P-years) and widowed or separated women (11.7/100 000 P-years).

The risk of death from suicide was significantly lower (60%) in women than in men (Table II). Suicide risks increased significantly with age in all subjects and in women. Being a Hindu

was significantly associated with the risk of death by suicide; however, living alone, in extended families, occupation, income level, housing type and level of household assets were not. Those who were current or past alcohol users had a significant double risk of dying from suicide as compared with non-drinkers. Women who never married had a 3-fold higher risk of suicide (age-adjusted risk: 2.99 [0.72–12.45]) as compared with the reference group: married women, although the risks did not reach the significant level.

Figure 2 shows the proportion of years lost because of suicide and accident from the 75-year life-span. The impact of accidents is shown to suggest a possible misclassification of suicide in unintentional injuries. Suicide contributed to 8% of total life-years lost and accidents contributed to 7%, in all subjects at all ages. The proportion of years lost by both suicides and accidents were more important in men than in women and in the younger age-group; overall, 50% of years in men and 22% in women of 35–39 years of age were lost due to suicide or accident. The proportion of YPLL declined with age to represent only 5% in those ≥ 65 years of age.

DISCUSSION

The overall suicide rate, assessed through verbal autopsy, was 39.3/100 000 P-years in 35–90-year-old persons who lived in a rural area of Thiruvananthapuram district between 1996 and 2005 (men: 78/100 000; women: 16.5/100 000). Suicide accounted for 3% of total deaths. This suicide rate is in line with the Thiruvananthapuram district suicide rate of 37/100 000 persons of all ages in 2005, reported by the Kerala State Mental Health Authority.²² Although our results are consistent with these official rates, it is more likely that their rates are under-reported and do not reflect the actual burden of disease.

Our study population did not include the young group; however, both local and national studies reported high rates among persons under 30 years of age.^{23–25} In Vellore, south India, Aaron *et al.*⁷ reported an average suicide rate as high as 58/100 000 in boys (15–19 years of age) and 148/100 000 in girls of the same age-group, suicide having been assessed by verbal autopsy and being the first cause of death. The National Crime Records Bureau also reported that, in 2007, suicide among those <30 years of age represented 37% of all suicides (men: 31%; women: 48%).³ In applying adjustment to include the 0–30 years age-group to our study population (observed overall suicide rate/100%—official percentage of suicide among those <30 years old), the overall suicide rates would become 62/100 000 (39.3/100%—37%).

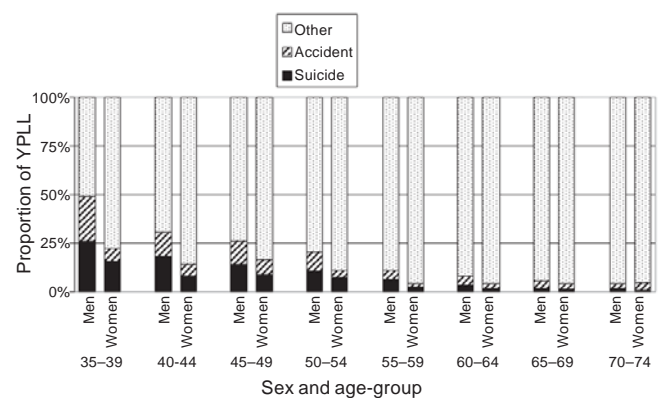


Fig 2. Proportion of years of potential life lost (YPLL) by causes of death

TABLE I. Suicide methods among the study participants

Variable	First rank method	<i>n</i>	%	Second rank method	<i>n</i>	%	Third rank method	<i>n</i>	%
All	Hanging	193	50	Poisoning	114	30	Drowning	36	9
<i>Sex</i>									
Men	Hanging	151	53	Poisoning	96	34	Drowning	17	6
Women	Hanging	42	41	Drowning	19	19	Poisoning	18	18
<i>Age-group (years)</i>									
34–39	Hanging	30	49	Poisoning	15	25	Drowning	7	11
40–49	Hanging	72	51	Poisoning	44	31	Fire	10	7
50–59	Hanging	50	50	Poisoning	37	37	Drowning	7	7
60–69	Hanging	23	45	Poisoning	14	27	Drowning	7	14
70+	Hanging	18	58	Drowning	6	19	Poisoning	4	13
<i>Education</i>									
Illiterate	Hanging	27	51	Poisoning	9	17	Fire	7	13
≤7 years	Hanging	97	51	Poisoning	55	29	Drowning	20	11
8–10 years	Hanging	55	48	Poisoning	41	36	Drowning	7	6
College	Hanging	13	54	Poisoning	7	29	Drowning/fire	2	8
<i>Religion</i>									
Hindu	Hanging	162	49	Poisoning	100	30	Drowning	33	10
Muslim	Hanging	10	56	Poisoning	5	28	Fire	2	11
Christian	Hanging	21	57	Poisoning	9	24	Fire	3	8
<i>Occupation</i>									
Blue collar	Hanging	122	55	Poisoning	72	33	Drowning	12	5
White collar	Poisoning	19	43	Hanging	15	34	Drowning	7	16
Business	Hanging	12	67	Poisoning	6	33	–	–	–
Other	Hanging	9	69	Fire	2	15	Poison/Train	1	8
Housewife	Hanging	35	39	Drowning	17	19	Poisoning	16	18
<i>Type of house</i>									
Thatched	Hanging	88	52	Poisoning	48	28	Drowning	17	10
Tiled	Hanging	66	52	Poisoning	39	30	Drowning	13	10
Concrete	Hanging	39	45	Poisoning	27	31	Drowning / Fire	6	7
<i>Number of residents</i>									
1	Hanging	3	30	Poisoning	2	20	Drowning	2	20
2	Hanging	10	42	Poisoning	7	29	Drowning	4	17
3–4	Hanging	88	55	Poisoning	49	31	Drowning	12	8
5–6	Hanging	66	48	Poisoning	39	28	Fire	13	9
7+	Hanging	26	49	Poisoning	17	32	Drowning	6	11
<i>Monthly income (Rs)</i>									
<1500	Hanging	112	52	Poisoning	55	26	Drowning	24	11
1500–3000	Hanging	54	49	Poisoning	40	36	Drowning	7	6
3001–5000	Hanging	18	46	Poisoning	13	33	Drowning/fire	3	8
>5000	Hanging	9	45	Poisoning	6	30	Fire	3	15
<i>Household equipment</i>									
Low	Hanging	96	51	Poisoning	53	28	Drowning	20	11
Moderate	Hanging	92	49	Poisoning	58	31	Drowning	16	8
High	Hanging	5	63	Poisoning	3	38	–	–	–

The determinants of suicide were male gender, middle-age (40–60 years), Hindu, alcohol drinkers and secondary education level (≤7 years). Neither low socioeconomic level (low income, living in a thatched house, low household assets), living alone, nor being a married woman were associated with suicide risk. However, the influence of religion was obvious, those of Muslim and Christian beliefs were less likely to take their lives, probably because suicide is seen as a negative act, less acceptable than for Hindus who do not consider death as a final step.^{26–28}

Alcohol abuse is often observed in those committing suicide.^{26,29,30} In a case–control study from Chennai, one-third of suicide cases suffered from alcoholism.²⁵ Alcoholism is known to be associated with mood disorders such as depression, difficulty

to cope with stressful life events, and self-directed or domestic violence. Mental illness is the most important determinant of suicide.³¹

In our study, the predominant method of suicide was hanging followed by poisoning and drowning, which is consistent with previous studies among populations of different age-groups from the Indian subcontinent.^{7,10,24,31,32} In farmers, where suicide rates are high, numerous studies reported pesticide poisoning as the first chosen method because of its easy access.^{4,11,33,34} We were not able to show this because farming as an occupation category was not specifically included in our study, and information on toxic products used was not available.

YPLL measure the relative impact of suicide on longevity in

TABLE II. Suicide rates and relative risks of mortality from suicide according to sociodemographic variables

Variable	n	P-years	Death rate	Crude RR	95% CI	Adjusted RR*	95% CI	p value for trend
<i>Sex</i>								
Men	283	3,62,725.7	78.0	1.00	Reference	1.00	Reference	
Women	102	6,16,653.4	16.5	0.21	0.16–0.26	0.40	0.20–0.78	0.072
<i>Age-group (years)</i>								
34–39	61	2,55,918.6	23.8	1.00	Reference	1.00	Reference	
40–49	141	3,05,242.7	46.2	2.00	1.48–2.70	1.60	1.18–2.16	
50–59	101	2,04,804.3	49.3	2.20	1.60–3.02	1.62	1.17–2.25	
60–69	51	1,39,684.6	36.5	1.73	1.19–2.50	1.36	0.92–2.00	
70+	31	73,728.9	42.0	2.23	1.45–3.44	1.93	1.22–3.04	0.0266
<i>Age-group (men only)</i>								
34–39	43	75,020.5	57.3	1.00	Reference	1.00	Reference	
40–49	101	1,16,951.2	86.4	1.54	1.08–2.20	1.43	1.00–2.04	
50–59	85	87,177.9	97.5	1.81	1.26–2.62	1.64	1.13–2.37	
60–69	33	55,688.0	59.3	1.20	0.76–1.89	1.09	0.68–1.73	
70+	21	27,888.1	75.3	1.79	1.06–3.01	1.74	1.01–2.99	0.1573
<i>Age-group (women only)</i>								
34–39	18	1,80,898.2	10.0	1.00	Reference	1.00	Reference	
40–49	40	1,88,291.5	21.2	2.21	1.26–3.85	2.19	1.25–3.83	
50–59	16	1,17,626.4	13.6	1.44	0.74–2.83	1.50	0.75–2.96	
60–69	18	83,996.6	21.4	2.37	1.23–4.56	2.66	1.34–5.28	
70+	10	45,840.8	21.8	2.65	1.22–5.73	3.15	1.40–7.09	0.0061
<i>Education</i>								
Illiterate	53	2,12,287.0	25.0	1.00	Reference	1.00	Reference	
≤7 years	190	3,77,456.9	50.3	1.97	1.45–2.67	1.56	1.14–2.13	
8–10 years	114	2,82,236.9	40.4	1.52	1.10–2.10	1.30	0.91–1.86	
College	24	1,02,647.4	23.4	0.87	0.54–1.41	0.84	0.49–1.43	0.8717
<i>Religion</i>								
Hindu	330	6,95,817.2	47.4	1.00	Reference	1.00	Reference	
Muslim	18	1,55,002.9	11.6	0.25	0.15–0.39	0.28	0.18–0.46	
Christian	37	1,28,559.0	28.8	0.61	0.43–0.85	0.44	0.31–0.63	—
<i>Occupation</i>								
Blue collar	221	2,68,269.4	82.4	1.00	Reference	1.00	Reference	
White collar	44	1,05,977.5	41.5	0.51	0.37–0.70	0.82	0.57–1.18	
Business	18	23,750.3	75.8	0.91	0.57–1.48	1.28	0.79–2.08	
Other	13	20,139.8	64.5	0.77	0.44–1.35	1.89	0.98–3.66	
Housewife	89	5,61,242.1	15.9	0.19	0.15–0.24	0.76	0.37–1.53	—
<i>Type of house</i>								
Thatched	170	3,82,376.3	44.5	1.00	Reference	1.00	Reference	
Tiled	128	3,11,918.9	41.0	0.91	0.73–1.15	0.97	0.77–1.22	
Concrete	87	2,85,083.9	30.5	0.67	0.52–0.87	0.86	0.65–1.15	0.3321
<i>Number of residents</i>								
1	10	20,215.0	49.5	1.00	Reference	1.00	Reference	
2	24	71,700.4	33.5	0.67	0.32–1.41	0.59	0.28–1.24	
3–4	160	4,01,191.2	39.9	0.78	0.41–1.47	0.67	0.35–1.28	
5–6	138	3,38,304.1	40.8	0.81	0.43–1.54	0.67	0.35–1.29	
7+	53	1,47,968.4	35.8	0.73	0.37–1.43	0.63	0.32–1.24	0.6465
<i>Monthly income (Rs)</i>								
<1500	215	5,13,559.1	41.9	1.00	Reference	1.00	Reference	
1500–3000	111	2,83,305.0	39.2	0.94	0.74–1.18	1.06	0.84–1.35	
3001–5000	39	1,08,880.4	35.8	0.85	0.61–1.20	1.15	0.80–1.65	
>5000	20	73,629.3	27.2	0.63	0.40–1.00	0.97	0.59–1.60	0.6786
<i>Household equipment</i>								
Low	188	4,48,993.8	41.9	1.00	Reference	1.00	Reference	
Moderate	189	4,91,324.8	38.5	0.90	0.74–1.11	1.01	0.81–1.26	
High	8	39,055.2	20.5	0.47	0.23–0.95	0.72	0.34–1.49	0.7709
<i>Drinking</i>								
Never	220	8,47,676.7	26.0	1.00	Reference	1.00	Reference	
Current	135	1,09,276.5	123.5	4.80	3.87–5.95	2.21	1.71–2.85	
Past	30	22,425.9	133.8	5.77	3.94–8.45	2.47	1.63–3.73	<0.0001
<i>Drinking (men only)</i>								
Never	118	2,31,866.5	50.9	1.00	Reference	1.00	Reference	
Current	135	1,08,767.1	124.1	2.41	1.88–3.08	2.13	1.65–2.75	
Past	30	22,092.1	135.8	2.93	1.96–4.37	2.42	1.60–3.67	<0.0001

* Risks adjusted for sex, age, randomization group, education level, religion, occupation, type of house, number of residents, income, level of equipment, chewing habits, smoking habits, drinking habits and medical history
P-years person years RR relative risk

showing the consequence of premature deaths. The highest burden due to suicide was observed in middle-aged men, during the most productive period of their lives. This result is consistent with a recent prospective study in a rural area in Vellore.⁸

Death information, among this large study population, was actively collected during repeated house visits. When medical information was not available, verbal autopsy was used; the cause of death neared completeness. However, the study was designed for another purpose; that is, the evaluation of efficacy of oral visual inspection on oral cancer incidence and mortality. Consequently, although the suicide rates are likely to be reliable, some important determinants are lacking. For instance, no information was collected on the current acute life stresses or the presence of mental illness.

To check the reliability of the cause of death and to avoid any hidden suicide being labelled an accident, we checked all causes of deaths from accidents in our cohort. There were no cases of intentional self-poisoning, hanging, strangulation or suffocation of undetermined intent. Therefore, it is likely that suicide was not under-reported.

There is an urgent need for a national strategy to decrease the burden of suicide.³⁵ It should not only include the development of prevention programmes focusing on diagnosis, treatment and follow up of patients suffering from mental disorders, and on improvement of problem-solving and coping skills,²⁶ but it should also restrict the access to lethal means of self-harm such as pesticides.^{33,36} National policies should address the problem of shortage of community health facilities and human resources which provide mental health programmes. According to a recent report, India has about 3000 psychiatrists, a large number of whom work in private practice, for a population of over 1 billion.³⁷ In rural areas, 80% of the population does not have access to psychiatric services,³⁸ and tend to use indigenous or traditional healers.²³ The states of Kerala and Tamil Nadu are exceptions, however, as they have implemented the National Mental Healthcare Programme with a psychiatrist in each district.²³ Public and voluntary organizations also play an important role by visiting rural communities, providing interventions and rehabilitation services, supporting families of mental patients, and promoting research on mental health.^{23,39}

In conclusion, there is a need for proper epidemiological studies on suicide in different settings to measure reliable information on burden of suicide and implement appropriate and specific prevention strategies. Efforts are being made in different parts of India, specifically in Vellore and rural areas of Tamil Nadu;³³ these efforts should be extended to the rest of the country.

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