•Systematic review•

Suicide in India: a systematic review

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Background: Suicide is an important cause of death in India but estimated suicide rates based on data from India's National Crime Records Bureau are unreliable.

Aim: Systematically review existing literature on suicide and the factors associated with suicide in India.

Methods: PubMed, PsycINFO, EMBASE, Global Health, Google Scholar and IndMED were searched using appropriate search terms. The abstracts of relevant papers were independently examined by both authors for possible inclusion. A standardized set of data items were abstracted from the full text of the selected papers.

Results: Thirty-six papers met inclusion criteria for the analysis. The heterogeneity of sampling procedures and methods of the studies made meta-analysis of the results infeasible. Verbal autopsy studies in several rural locations in India report high suicide rates, from 82 to 95 per 100,000 population – up to 8-fold higher than the official national suicide rates. Suicide rates are highest in persons 20 to 29 years of age. Female suicide rates are higher than male rates in persons under 30 years of age but the opposite is true in those 30 years of age or older. Hanging and ingestion of organophosphate pesticides are the most common methods of suicide. Among women, self-immolation is also a relatively common method of suicide. Low socioeconomic status, mental illness (especially alcohol misuse) and inter-personal difficulties are the factors that are most closely associated with suicide.

Conclusion: The quality of the information about suicide in India is quite limited, but it is clearly an important and growing public health problem. Compared to suicides in high-income countries, suicide in India is more prevalent in women (particularly young women), is much more likely to involve ingestion of pesticides, is more closely associated with poverty, and is less closely associated with mental illness.

Key words: suicide, India, systematic review, organophosphate pesticide, mental illness

1. Introduction

Suicide is the final outcome of complex interactions of biological, genetic, psychological, sociological and environmental factors. It is an increasingly important public health issue: from 1990 to 2010 the number of global suicides increased by 32%. It is particularly important among young adults 15 to 49 years of age among whom it accounts for 4.8% of all female deaths and 5.7% of all male deaths.[1] Eighty-four percent of global suicides occur in low and middle-income countries (LMICs); India and China alone account for 49% of global suicides.[2] There is substantial variability both in the prevalence of suicide and in the factors that influence the occurrence of suicide between geographic regions, cultures, and over time, so country-specific analyses are needed to develop targeted suicide prevention efforts.

The World Health Organization (WHO) estimates that of the nearly 900,000 people who die from suicide globally every year, 170,000 are from India.[3] However, India's National Crime Records Bureau (NCRB) – which report official suicide rates based on police reports – estimated only 135,000 suicides in 2011.[4,5] One possible reason for under-reporting of suicide by the NCRB is that suicide remains a crime in India.[6] Detailed independent verbal autopsy investigations of all unnatural deaths in several rural areas of the country report suicide rates that are up to five-fold higher than the official national average.[7] Despite the importance of suicide both as a health problem and as a social problem, the issue

receives little attention from Indian policy makers. This neglect of the issue is reinforced by cultural influences, religious sanctions, stigmatization of the mentally ill, competing political imperatives, and socio-economic factors.[8]

This systematic review aims to provide a more balanced assessment of the prevalence and correlates of suicide in India by identifying and integrating all available reports on the subject.

2. Methods

We searched the following electronic databases: PubMed, PsycINFO, EMBASE, Global Health, Google Scholar and IndMED (database of articles published in Indian biomedical journals). The combination of search terms (in the title or abstract fields) used included 'suicide' OR 'suicidal' OR 'suicidality' OR 'hanging' OR 'drowning' OR 'self-poisoning' OR 'overdose' OR 'self-injury' AND 'India' OR 'Indian'. The titles of the papers identified through the database search were screened and the abstracts of papers that reported on suicide or self-harm in India were retrieved. These abstracts were examined and the full text of papers that reported on the prevalence or correlates of suicide or self-harm were retrieved. These full texts were then examined to determine their compliance with the following eligibility criteria: papers published prior to June 2012 that reported the prevalence or correlates of suicide in any part of India for either gender in any age group. The reference lists of selected papers were hand-searched for additional eligible papers, but no additional papers

Figure 1. Flowchart of identification of articles

3277 articles published before June 2012 were identified from PubMed, PsycINFO, EMBASE, Global Health, Google Scholar and IndMED using the following search terms (in the title or abstract): 'suicide' OR 'suicidal' OR 'suicidality' OR 'hanging' OR 'drowning' OR 'self-poisoning' OR 'overdose' OR 'self-injury' AND 'India' OR 'Indian'

→ 1028 duplicate reports excluded

The titles of the 2249 articles were screened

→ 2148 reports excluded

The full text of 101 articles were examined to determine whether or not they reported on the prevalence or correlates of suicide in India

→ 65 reports excluded

36 articles included in qualitative synthesis

were identified. The screening and selection of papers was independently conducted by both authors; in the cases where different papers were selected the paper was re-assessed and discussed by both authors to arrive at a consensus decision.

We extracted the following data from included papers: date of publication, study design, setting, center (state, city), methods, sampling technique, sample size, definition of suicide, prevalence, and correlates of suicide. Data extraction was conducted by one reviewer (AR). We present the results as prevalence rates and, where available, corresponding 95% confidence intervals (CI).

3. Results

The selection of included articles is shown in Figure 1. Thirty-six papers were selected for the review, of which 6 were published between 1971 and 1980, 3 between 1981 and 1990, 3 between 1991 and 2000, and 24 between 2001 and 2010. Thirty papers were about cross sectional surveys, 3 were case control studies and 3 were ecological studies. Details of the studies are shown in Table 1. The studies were conducted in different parts of the country and used different sampling strategies and settings. Most studies either used verbal autopsy (i.e., interviewing family informants and other associates of the deceased) or the integration of multiple sources of information about a death to determine whether or not a death should be classified as a suicide – methods that are generally considered to be reliable. Some studies were part of ongoing community-based surveillance efforts that provided population based rates; but other studies did not specify their sampling strategies or had non-random sampling designs, making it difficult to assess the validity of the reported results.
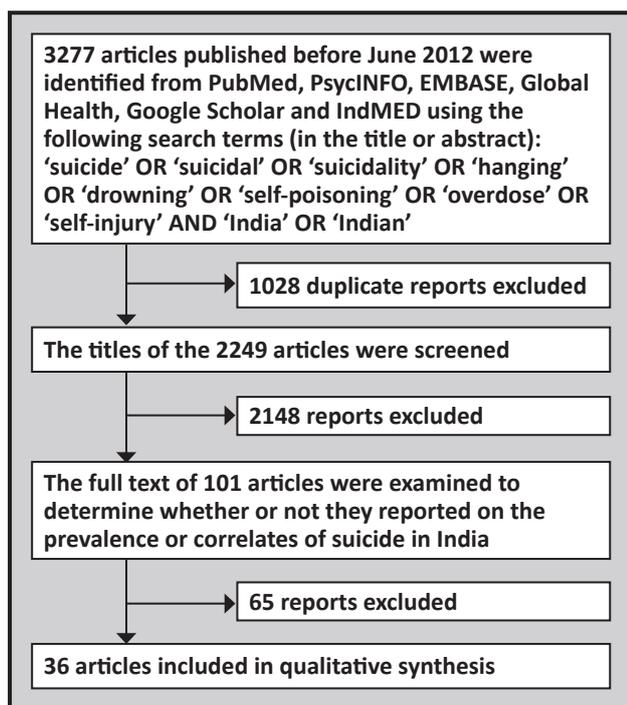
3.1 Prevalence of suicide

A community-based surveillance system using verbal autopsy covering a population of 108,000 in a rural development block of Tamil Nadu (one of the more highly developed states in southern India) has been operating for several decades.[22,26,33,35,36] Several reports have appeared using these data. The prevalence of suicide for the period from 1994 to 1999 was 95 per 100,000 population (annual rates ranged from 84 to 106 per 100,000) accounting for 8 to 12% of all deaths.[23] From 2000 to 2002 the average suicide rate was 92 per 100,000 (112 in men and 72 in women) accounting for 9.8 to 11.4% of all deaths.[36] For the period from 1998 to 2004 the average suicide rate was 82 per 100,000.[35] In young people 10 to 19 years of age, over the 10-year period from 1992 to 2001 the average male suicide rate was 58 per 100,000 (accounting for 25% of all deaths) and the average suicide rate for women was 148 per 100,000 (accounting for 50 to 75% of all deaths).[26] Over the same 10-year period, the mean suicide rate in persons 55 years of age or older was 189 per 100,000.[33]

Table 1. Description of reviewed studies

Author (Year)	Design	Sample	Prevalence	Correlates of suicide	Method of suicide
Sathyawati[9] (1975)	CSS legal records	45 suicides in children (<14 years) in a large city from 1967-1973		Increase in suicide rate with age; 76% girls; 38% working as laborers, domestic servants or errand boys; 80% live with parents; 75% had clear social stressors.	Burning and drowning each accounted for 38%; poisoning 3%; and hanging 9%.
Nandi[10] (1978)	National mortality records, WHO reports	Comparison of registered suicides in 1872 and 1972 in Bengal.	Suicide rate was 2.4 per 100,000 in 1872 and 16.0 per 100,000 in 1972.	In 1872 most suicides occurred between ages 25 and 30, and in 1972 most suicides occurred in the 18 to 30 age group. Men had higher rates at both times.	Poisoning (44%) and hanging (41%) in 1872; poisoning (50%) and hanging (22%) in 1972.
Sharma[11] (1978)	CSS legal records	130 suicides reported in a single community from 1968 to 1970		Majority 25 to 44 years of age; 63% males; 88% living in joint families; 70% of males and 63% of females married; 15% had mental illness; 22% had prior domestic conflict.	
Nandi[12] (1979)	CSS legal records	All suicide cases reported in two village police stations from January 1976 to September 1977.	Prevalence of suicide was 28.6 per 100,000 in one village and 5.1 per 100,000 in the other.	Most suicides were in the 15 to 24 age group. In one village male suicide was rare (none in 1976 and only 1 in 1977); in the other the male-to-female suicide ratio was 1 in 1976 and 0.4 in 1977. Chronic or incurable illnesses and domestic conflict were common precipitants of suicide.	In 1976 67% of suicides ingested Endrine and 22% died by hanging. In 1977 (after a ban on Endrine) 50% used Endrine and 32% die by hanging
Hedge[13] (1980)	CSS legal records	51 suicides recorded over 9 years in a cluster of villages with a population of 61,561.	9.3 suicides per 100,000 per year.	Most suicides were in the 10 to 29 age group. Males 67%. Marital and domestic problems 37.3%, incurable disease 29%, and financial problems 10%.	Drowning 39%, poisoning 33%, hanging 25%, other methods 2%.
Ponnudurai[14] (1980)	CSS legal records	87 suicides recorded at an urban police station in 1978.		Males 44.8%. Married women below 30 years of age at high risk; marriage in males not associated with suicide; mental illnesses in 7.6% males and 12.5% females.	Most common method was hanging followed by organophosphate pesticides in males and drowning in females.
Gupta[15] (1988)	CSS autopsy records	180 fatal burns cases reported to a district mortuary in a one-year period.	23.9% of fatal burns were suicides.	94% self-immolation suicides were female; 85% of females were married; among married females 73% of were married in last 5 years, 51% tortured by husband/in-laws for dowry, and 32.5% occurred following a quarrel or marital disharmony.	
Banerjee[16] (1990)	CSS semi structured interview	58 suicides in one year based on police records in a cluster of villages with a population of 133,510	43.4 per 100,000 per year.	Quarrel with a spouse was a common cause for suicide in females (32%) and quarrel with parents in males (33%).	Insecticide poisoning was most common method (93%)
Shukla[17] (1990)	CSS legal records	187 urban suicides identified in police records from 1986 to 1987 in a city	Annual rate of suicide was 29 per 100,000.		Poisoning (22.6%), burning (21.4%), drowning (20.3%), hanging (18.7%) and getting run over by car/train (13.3%) were reported.
Ponnudurai[18] (1997)	CSS[a], autopsy and legal records	144 consecutive suicide autopsies over one year in a tertiary care hospital.		34% of males preferred places outside their houses for suicide: hotel rooms (7.9%), rivers (6.7%) and work place (4.5%). Other sites were railway station, park and water tank.	

Table 1. Description of reviewed studies (continued)

Author (Year)	Design	Sample	Prevalence	Correlates of suicide	Method of suicide
Vijaykumar[19] (1999)	VA CCS legal records	100 urban suicides, 100 neighborhood age and sex matched controls		Factors with increased odds of suicide: presence of DSM-III-R Axis I disorder, family history of psychopathology and life events in the month before suicide.	
Bhatia[20] (2000)	CSS	55 suicide cases referred for post mortem evaluation at a tertiary care center.		Majority married, high school educated; 18.2% had made prior attempt.	Hanging (43.6%), burning (38.3%), poisoning (12.7%)
Mayer[21] (2002)	Ecological study, analysis of data from NCRB	Suicide data released by the NCRB for the years 1991 to 1997	Suicide rates increased between 1991 and 1997 from 9.2 to 10.0 per 100,000	In India the classic suicide sex ratio is inverted for the '≤14'- and '15 to 29' year age groups. Peak for male suicides is in the 30 to 59 age group, for women is in the 15 to 29 age group.	
Batra[22] (2003)	CSS autopsy and legal records	942 autopsies due to burns in a rural health district over 5 years	15.1 per 100,000 deaths by burns per year	48% of fatal burns are suicidal; 75% of cases from rural districts; 21 to 30 age group most affected; females accounted for 81%; torment by in-laws was common cause (32%).	
Joseph[23] (2003)	CSS VA	Suicide registry in rural development block with a population of 108,000 from 1994 to 1999	Suicides accounted 8 to 12% of total deaths; mean suicide rate 95/100,000.	M:F ratio was 1.2:1; rates higher in older men than older women; but in 15-24 age range rate higher in women (102/278) than in men (58/331).	Poisoning (45%) and hanging (41%) were the most common methods.
Sharma[24] (2003)	CSS autopsy records	857 suicides in 2272 autopsy records from January 1994 to December 2001.	38% of autopsies were suicide deaths	Most common in the 15 to 30 age group; majority male; most from rural communities; 40% had social difficulties, 28% had guilt or shame, and 15% had a recent loss.	Poisoning (18%), self-immolation (16%) and hanging (3%) were most common methods.
Steen[25] (2003)	Ecological study	Data on suicide from NCRB		Human development factors did predict suicide rates in both genders but no significant relationship between suicide rates and economic factors.	
Aaron[26] (2004)	CSS VA	154 male and 152 female suicide (10 to 19 year olds) in a rural development area with total population of 108,000.	Average suicide rate in young women 148 per 100,000 and in young men 58 per 100,000.	Family conflicts, domestic violence, academic failures, unfulfilled romantic ideals, and mental illness were main causes.	Hanging (44%), poisoning with insecticide (40%), self-immolation (9%), and drowning (7%).
Girdhar[27] (2004)	CSS suicide note study	Post-mortems of 50 suicidal deaths with suicide notes compared to 50 without notes from total of 320 suicide post-mortems done over 1.5 years at a tertiary center.		38 of 50 notes written by males; note writers had higher education but otherwise did not differ greatly from non-note writers; most frequent reported reasons were physical and psychiatric illness; 13 note-writers did not mention any difficulty.	
Gururaj[28] (2004)	VA CCS	269 suicide cases identified from police records (over a 3-month period) and 269 age- and gender-matched controls from a city of 6 million		M:F ratio was 2:1; 75% in 16 to 49 age group; emotional abuse (OR=2.6), physical violence (OR=1.8), longstanding alcohol abuse (OR=4.8), absence of social support networks (OR=3.1), limited resources (OR=11.5) and presence of mental illness (OR=1.6) were significant factors.	Hanging (59%), poisoning (25%) and self-immolation (11.5%) were common methods; burns (self-immolation) twice more frequent among women than men.

Table 1. Description of reviewed studies (continued)

Author (Year)	Design	Sample	Prevalence	Correlates of suicide	Method of suicide
Kumar[29] (2004)	CCS case records	689 autopsies of suicide victims during January to December 2001		61.8% males, older and likely to be employed.	Hanging (48.2%), poisoning (28.9%), and immolation (12.8%, 6 times more common in females than males).
Lalwani[30] (2004)	CSS autopsy records	222 autopsies of suicidal deaths in 10 to 18 year olds at a tertiary care center over 10 years	1.9% of all autopsies in 10 to 18 year olds were suicides.	Girls 55.4%; the most common age was 15 to 18 years.	Hanging (girls 57%, boys 50%); poisoning (girls 37%, boys 50%).
Sharma[31] (2004)	CSS autopsy records	2835 autopsies of unnatural deaths over 10 years from 1994 to 2003 at a tertiary care center.	39% of unnatural deaths were suicidal	Suicide was most common in the 21 to 30 age group; male-to-female ratio was 2:1; majority from rural background.	Poisoning (48%), burns (40%) and hanging (10%).
Steen[32] (2004)	Time series analysis, NCRB reports	Available data on completed suicides in all Indian states from 1967 to 1997.	The differences between male and female suicide rates were relatively stable over the 30 year period.	As modernization increases, there is little change in the male-to-female suicide ratio.	
Abraham[33] (2005)	CSS VA	152 male and 100 female suicides in persons 55 years or older over 8 years in a rural development area with total population of 108,000.	Annual suicide rate for people over 55 years was 189 per 100,000.	Male-to-female ratio was 1.5:1; suicide rate increased with age.	Hanging (51.6%) and poisoning (38.9%) were most common methods; women more likely to use burning or drowning.
Khan[34] (2005)	CSS VA	50 suicide cases referred for autopsy at a tertiary center.		Urban 72%; low income 54%; 24% had consulted physician or psychiatrist, 94% had stressful life events; precipitating factors present in 84%.	Hanging common in males, self-immolation in females.
Bose[35] (2006)	CSS VA	638 suicides over 7 years in a rural development area of 108,000	82.2 per 100,000 population, 11.3% of all deaths.		Hanging (47.8%), use of poison (40.4%), burning (7.2%), drowning (4%).
Prasad[36] (2006)	CSS VA	Suicides in a rural development block with population of 108,000 from 2000 to 2002	92 per 100,000; accounts for 9.8 to 11.4 % of all deaths; rates in men and women were 112 and 72 per 100,000, respectively.	Male-to-female ratio was 1.5:1; suicide rate for men increased with age; women peaks in young and old; more suicides in younger women than men; 77% had chronic stress; 23% had acute precipitating events; men and those 44 or older had more chronic stress whereas women and those under 44 had more acute precipitating events.	Organophosphate pesticides (40.5%) and hanging (49%) were the most common methods.
Mohanty[37] (2007)	CSS Interview, case records and autopsy findings	588 deaths diagnosed as suicidal among 2096 autopsies over 4 years at a tertiary center.	11.8 suicides per 100,000 population; 28% of autopsies were suicides.	Male-to-female ratio almost equal; 21-30 years was the most common age group; rural areas (50%); married (71%); unsound mind (6%); past suicidal tendency (14%); intake of alcohol (22%); financial burden (37%); and marital disharmony (35%).	Hanging (32.6%), poisoning (30.6%).

Table 1. Description of reviewed studies (continued)

Author (Year)	Design	Sample	Prevalence	Correlates of suicide	Method of suicide
Chavan[38] (2008)	CSS VA	101 deaths by suicide in a city in 2003.		60% were between 20 to 29 years old; males (57.4%), unemployed (55.4%), unmarried (57.4%), urban residence (70.2%), and low income (50.4%); psychosocial stressors (60.3%), interpersonal stressors (47.5%), and financial stressors (8.9%); psychiatric illness (34%); alcohol or substance abuse in (24%).	Hanging (72%); poisoning (16%).
Gupta[39] (2008)	CSS legal records	8 cases of murder-suicide from 2000 to 2004.		All assailants were mothers and all victims were their children aged 6 months to 7 years; five incidents in rural areas, three in urban areas; all cases in low socio-economic families; main cause is family-related problems.	Methods either for killing or suicide were either burning or drowning.
Kanchan[40] (2008)	CSS legal and autopsy records	Retrospective 5 years post mortem studies of 137 suicidal poisonings at a tertiary center.	18% of all autopsies were deaths due to suicidal poisoning.	Male 74%; most in the 20 to 29 age group; highest female rates during 2nd, 3rd and 6th decade; highest male rates in 4th, 5th, and 7th decade; 28% of female and 11% of male suicides had depression.	Agrochemicals were the preferred agents, especially organophosphates.
Bastia[41] (2009)	CSS VA	104 consecutive autopsies of death by hanging over a 2-year period reported at a Medical College.		Marriage protective for men (OR=0.14, CI=0.06–0.36); risk factors included dowry dispute, unemployment, illicit relationship of spouse and prolonged illness.	Hanging (15.7%), insecticide-ingestion (37.2%), other substance use (13.4%); medication overdose (6.5%), jumping under train (9.2%) and, self-immolation 8.5%.
Parkar[42] (2009)	CSS EMIC Interview with family of suicide victim	76 families of suicide decedents identified from police record in an urban slum from 1997 to 2003.		Most common age group was 21 to 28 years old; more women in young age groups and more men in older age groups; women had less education; 36% had prior attempts; common stressors included substance use by self or others, failed expectations, financial loss, interpersonal conflict and verbal abuse.	Common methods were burning (56.6%), poisoning (18.4%) and hanging (15.8%).
Soman[43] (2009)	CSS VA	Deaths over 5 years in seven contiguous districts constituting a development block in a southern state (798,695 person years of observation).	6.6% of all deaths were suicidal; male rate was 45 per 100,000, accounting for 7.3% of all deaths; female rate 27 per 100,000, accounting for 5.8% of all deaths		Hanging (64%), poisoning (10%), drowning (9.3%), self-immolation/burning (6.4%), and jumping in front of train (6.4%).
Manoranjit-ham[44] (2010)	CCS VA	122 family members of suicide cases and 100 age and gender matched controls in a rural and suburban population.		Male-to-female ratio was 1.5:1; 37% of the suicides and 16% of controls had at least one Axis I diagnosis; among suicides a higher proportion lived alone, experienced termination of a steady relationship, felt on-going stress, had few confidants, were widowed or separated, or experienced chronic pain.	

CSS, Cross-sectional study; VA, Verbal autopsy; CCA, Case-control study; NCRB, National crime-records bureau

A prospective community-based cohort study of cause of death in the south Indian state of Kerala from July 2002 to June 2007 reported a male suicide rate of 45 per 100,000 and a female suicide rate of 27 per 100,000, which collectively accounted for 6.6% of all deaths.[43] A retrospective, 4-year autopsy-based study by Mohanty and colleagues reported a suicide prevalence of 12 per 100,000 population.[37] Other autopsy studies[24,27,31,37] with sample sizes ranging from 2096 to 2835 report that the proportion of suicidal deaths among all autopsies ranged from 28 to 39%. A large (n=11,583), 10-year retrospective autopsy study published in 2004 by Lalwani and colleagues reported that 1.9% of all autopsies were suicides in individuals 10 to 18 years of age.[30] An earlier 7-year autopsy study reported in 1975 by Sathyawati and colleagues reported that among 1834 autopsies of suicide decedents, 45 (2.4%) were children 14 years of age or younger.[9]

3.2 Methods of suicide

Hanging was the most frequently reported method of suicide in most of the studies, accounting for 10 to 72% of all suicides.[13,14,17,19,20,26, 28,29,31,33-35,37,38,42,43] The second most frequently reported method was self-poisoning (often ingestions of organophosphate pesticides), which accounted for 16 to 49% of all suicides.[13,16,17, 19,26, 28,29,31,33-35,37,38, 42,43] The proportion of all suicides attributed to drowning ranged from 3 to 39%[13,17,19,26,35,43] and the proportion attributed to burning or self-immolation ranged from 6 to 57%.[17,19,26,28,29,31,34,35,38,42,43] Other reported methods of suicide include jumping off heights (0.5 to 2% of all suicides),[17,19,38] being run over by a train (6 to 13% of all suicides)[17,43] and using a firearm (3% of all suicides).[17]

Some studies report gender-based differences in method preference. A community-based surveillance study by Prasad and colleagues reported in 2006 found that significantly more women chose drowning and burning as modes of suicide than men, while significantly more men chose hanging.[36] A similar pattern of gender-based method preference was reported by Abraham and colleagues among persons 55 years of age and older.[33] Other studies report higher rates of suicides by hanging in males than females,[17,34,42] a predominance of males in suicide decedents who use other violent methods[17,34] (e.g., jumping in front of a train), and a predominance of females among suicides by self-immolation.[17,33]

3.3 Correlates of suicide

3.3.1 Age

Suicides in the third decade of life (i.e., in persons 20 to 29 years of age) account for 41 to 62% of all suicides.[13,16,17,28,31,34,37,38,42] Among older adults, the age-specific suicide rate increases with age: it is 137 per 100,000 for persons 55 to 64 years of age, 204 for persons 65 to 74 years of age, and 331 for persons 75 years of age or older.[33] Studies among children under 18 years of age

also found that suicide rates increase with age,[9,30] with the highest rate in the oldest children (i.e., those 15 to 18 years of age).

Age related trends differ by gender. The mean (sd) age of suicides as reported by Bastia and colleagues in 2009 was 32.5 (13.6) in males and 25.9 (8.7) in females.[41] Other studies have also reported higher mean age among male versus female suicide decedents (28.9 [12.6] v. 24.6 [10.5]; p<0.02).[17] In the community-based surveillance study in rural Tamil Nadu, the suicide rate for men increased with age while the suicide rate for women had two peaks, one between 15 and 24 years of age and the other over 65 years old.[36] Several studies have reported higher suicide rates among younger women than younger men and higher suicide rates among older men than among older women.[14,21-23,25,40-42] A prospective 5-year cohort study reported that the age-specific male to female ratio of suicide rates ranged from 0.4 in the youngest age group (i.e. 0 to 14 years) to 4.5 in the 45 to 54 age group.[43]

3.3.2 Gender

The evidence for differences in the rate of suicide by gender is inconsistent. Some studies report that a higher proportion of suicides are male (57 to 74%)[11,13,20,31,36,38,40] while others report that a higher proportion of suicides are female (56 to 79%).[14,16,41] Still other studies report that there is no significant difference in the proportion of suicides by gender.[37] Reports based on the community surveillance data in Tamil Nadu indicate that the male-to-female gender ratio (combining all age groups) has been stable over the last 30 years, ranging from 1.3:1 to 1.5:1 (i.e., an excess of males).[21,32,36] As discussed above, the male-to-female gender ratio of suicide rates is lower than 1 (i.e., a predominance of females) in the young age groups and greater than 1 (i.e., a predominance of males) in the middle and older age groups.

3.3.3 Marital status

Most studies report that the majority of suicide decedents were married at the time of death (57 to 73%),[11,17, 20,24,37,41,44] but two studies reported that a higher proportion of suicide decedents were unmarried (52 to 58%).[34,38] In one prospective study of suicide autopsies, male suicide decedents were more likely to be single (60.5%) while female suicide decedents were more likely to be married (73.8%); marriage was protective in males (OR=0.1, 95% CI=0.1–0.4), but not in females.[41] In a case series of suicidal deaths, being married put women – particularly women under 30 years of age – at a higher risk of suicide, but this was not the case for men.[14] One case control study found a much higher risk of suicide in persons who are widowed, separated or divorced compared to persons who are currently married (13% v. 1%; p=0.003)[19]; this finding was supported by another study that found that being separated or widowed was significantly associated with suicide (OR=2.9, 95% CI=1.1-7.7).[44]

3.3.4 Education

Evidence for the association of education and suicide is inconsistent. In one study, individuals who were illiterate or less educated were at significantly higher risk of suicide (χ^2=44.33, p<0.001),[37] a finding that was also reported in two studies that had female-only samples.[17,42] However, a psychological autopsy study reported that a larger proportion of subjects had completed high school (33%) or college (25%).[38]

3.3.5 Occupation

The association of occupation to suicide is also inconsistent. In a psychological autopsy of suicides, 55% were unemployed and a further 40% were semiskilled workers.[38] In a community based study, most of the women who completed suicide (54%) were housewives.[42] In a study of suicides among children (i.e., under 14 years of age), 38% were working as daily wage laborers, domestic servants or errand boys.[9]

3.3.6 Socioeconomic status (SES)

There are fairly consistent reports of higher suicide rates in persons of low SES. Low SES was reported in 50 to 66% of suicide victims.[34,38,42,44] A case control study[28] reported that 35% of suicides occurred in households with monthly incomes of less than 3000 rupees (about 50 $US) and another 35% occurred in households with incomes of 3001 to 6000 rupees (50 to 100 $US). Another control study reported that low socio-economic status was an independent risk factor for suicide.[37]

3.3.7 Residence

In a psychological autopsy study in the city of Chandīgarh, 70% of the identified suicide decedents were from an urban background, 10% were from rural areas, and 20% from suburban areas.[38] In this study, 57% of the identified suicide decedents had migrated from other parts of India and abroad. One study reported that 50% of suicide decedents were from rural areas,[37] and another reported a rural-to-urban ratio of suicide decedents of 1.4:1.[24]

3.3.8 Psychological stressors

The common stressors associated with suicides included interpersonal difficulties (especially conflicts with spouse or other family members),[11,13,16,22,26,27,37,38,42] psychosocial stress,[11,24,26,27,38,42] financial problems,[11,13,22,27,37,38,42] chronic illnesses,[11,13,22,27,41] domestic violence,[22,26,41,42] work-related problems,[11,27,38,41,42] extramarital relationships,[11,22,41] legal problems,[38] academic difficulties,[26,27] living alone,[44] and other types of stressful life events.[19,28,34,44]

One multivariate analysis of the independent role of various psychosocial stressors as risk factors for suicide[28] reported that longstanding alcohol abuse (odds ratio=4.8, 95% CI 1.9-12.8), absence of social support

networks (3.1, 95% CI 1.1-8.5) and limited resources (11.5, 95% CI 4.6-28.8) were independent risk factors for suicide. Factors considered in the study that were not significantly associated with suicide included presence of a mental illness (1.6, 95% CI 0.4-2.5), emotional abuse (2.6, 95% CI 0.1-56.2) and prior experience of physical violence (1.8, 95% CI 0.4-8.1).[28] Another multivariate analysis[44] identified on-going stress (odds ratio=97.7, 95% CI 27.8-3343.2) and chronic pain (66.1; 95% CI 5.0-873.5) as important risk factors for suicide.

3.3.9 Mental illness

The prevalence of any psychiatric illness among suicide decedents varied based on the source of the data: psychological autopsy studies reported a 34% prevalence of mental disorders in suicide decedents, case series studies reported a prevalence of 24% and studies based on police records reported a prevalence ranging from 5 to 25%.[11,14,22,37,38,40]

Several studies found that the presence of a current mental disorder increased the risk of suicide (odds ratios range from 3.1 to 19.5).[19,28,44] Several specific conditions were associated with elevated risk for suicide: alcohol consumption (odds ratio=4.5, 95% CI=3.0-6.8), a history of chronic alcohol abuse in self (23.4, 95% CI=12.9-43.7), a history of chronic alcohol abuse in one's spouse (6.1, 95% CI=2.5-15.4),[28] alcohol dependence (2.8, 95% CI=1.0-6.8), adjustment disorders (3.4, 95% CI=1.2-9.6)[44] and personality disorder (9.5, 95% CI=2.3-84.1).[19]

4. Discussion

Understanding a complex phenomenon like suicide in a country as diverse as India through studies of varying strengths and limitations is quite a challenge. As of June 2012 we could not find a single pan-India study investigating the prevalence or correlates of suicide. The sampling strategies and methodologies of the 36 studies we identified were quite heterogeneous so it was not possible to conduct a meta-analysis that would integrate the findings.

There are, however, some trends that emerge from this qualitative review of the available literature. Suicides in India are largely under-reported; the rates reported in the papers identified for this review are likely to be underestimates. Hanging and self-poisoning, especially with organophosphate pesticides, are the most common methods of suicide. The young, particularly young women are at a high risk of suicide. Low socioeconomic status, interpersonal stressors and the presence of mental illness are important risk factors for suicide. There is insufficient evidence to draw conclusions about the importance of education, marital status, residence or employment status as potential risk factors for suicide.

Based on results of a nationally representative mortality survey implemented by the Registrar General

of India between 2001 and 2003, the estimated rate of suicide in persons 15 years of age or older in 2010 was 22 per 100,000 population, accounting for 3% of all deaths in persons 15 or older.[6] Large scale verbal autopsy studies of all deaths find that the suicide rates in rural areas are three- to four-fold higher than those reported by the government.[45] The reported annual rates of suicide per 100,000 population by the NCRB from 2008 through 2012 were 10.8, 10.9, 11.4, 11.2 and 11.2, respectively.[46] These official government figures – which are about half those identified in the Registrar General mortality study – clearly underestimate the magnitude of the problem. The stigma associated with suicide and the criminalization of suicides under Indian law both deter reporting, and, thus, lead to serious under-estimation of the suicide rate.

The availability of specific means for suicide affects national patterns of suicide methods. In the United States, firearms are used in most suicides[47] while in countries with large rural populations such as China and the Republic of Korea pesticides are the most common method.[35,48] In Australia, Japan, New Zealand, Pakistan, and Thailand, hanging dominates while in Hong Kong and Singapore, jumping (typically from tall apartment buildings) is the most frequent method used.[49,50] Our review found that hanging was the most common method of suicide in India closely followed by self-poisoning, especially with organophosphate pesticides. In the Registrar General mortality study about half of suicide deaths were due to poisoning (mainly ingestions of pesticides) and hanging was the second most common method.[6] The Registrar General study also reported that burning (self-immolation) was a relatively common method of suicide in women, accounting for one-sixth of all female suicides.[6] India has the dubious distinction of having the highest absolute number of self-immolation cases, the highest fatality rate from self-immolation, and the highest proportion of hospital admissions for burns that are due to self-immolation.[51]

Our review clearly indicates that the young in India are at a high risk of suicide, a finding that is consistent with the Registrar General mortality study and the NCRB data.[4,6] In the Registrar General mortality survey, 40% of suicide deaths in men and 56% in women occurred between the ages of 15 and 29. A 15-year-old individual in India had a cumulative risk of 1.3% of dying by suicide before the age of 80.[6]

Although our review could not demonstrate a clear gender difference in risk for suicide, many of the reviewed studies reported an overall male excess when combining suicides across all age groups. However, several of the studies also reported a higher prevalence of suicide in females than males in the younger age groups. This gender difference is in keeping with that seen in other Asian countries. Unlike in most European countries and the United States, where male suicides far outnumber female suicides (3:1 to 4:1),[52] in most Asian countries the ratio is much lower, and in China the ratio actually falls below 1:1 (i.e., there are more female suicides than males suicides).[53] The higher rates of female suicide in Asian countries may be linked to the position of women in the traditionally patriarchal societies of Asia. Niaz and Hassan[54] argue that "women's lack of empowerment and both financial and emotional dependence have restricted their self-expression and choices in life. This, along with family, social and work pressures, has a definite impact on women's mental health."

Though not unequivocal, our review found that female suicide decedents were more likely to be married and male suicide decedents were more likely to be single. The peak in the suicide rates for females was in the 15 to 29 age group, which coincides with the traditional age for marriage for Indian females. Cultural attitudes toward the woman's role in marriage may partially explain the comparatively higher ratio of female to male suicides found in Asian countries compared to those in Europe and the United States. In countries like India, Pakistan and Sri Lanka where arranged marriages are common, the social and familial pressure on a woman to stay married even in abusive relationships may be one of the factors that increases the risk of suicide in women.[28] Dowry-related suicides are not uncommon in India; when dowry expectations are not met young brides can be harassed to the point where they are driven to suicide.[55]

The data related to the potential role of educational status as a risk factor for suicide identified in the review was ambiguous so no clear correlation could be established. However, the evidence about a relationship between low socioeconomic status and suicide was more robust. India is experiencing rapid socio-economic changes and a related widening of the gulf between the rich and the poor. In both high-income and low- and middle-income countries suicide rates tend to be higher in the subgroups of the population that are unable to realize the aspirations engendered by economic prosperity, those who remain in chronic poverty, unemployment and debt.[28,45,56,57,58]

The available studies do not provide a definitive answer about the relationship of location of residence and suicide, but there do appear to be higher suicide rates in rural versus urban areas both in India and in other countries with large agricultural populations.[4,6,45] If true, the likely explanations for the higher suicide rates in rural areas would include rapid migration, economic hardship, lack of social support, isolation, relatively easy access to lethal means (e.g., pesticides) and the lack of high-quality resuscitation services.[45,59]

Interpersonal conflicts, particularly those with family members, were the most common type of stressors associated with suicide identified in the studies considered in this review. Asian countries have traditionally been characterized by the centrality of extended family systems, dependence on the family, and the subjugation of individual concerns to the needs of the family. However, rapid economic development, social transformation and globalization are changing

the role of the family and the relationships between the individual and the family in many of these countries. These changes are engendering new types of interpersonal conflicts as traditional expectations of families encounter modern aspirations of individuals. As just one of several markers of cross-cultural differences in the psychological valence of interpersonal risk and protective factors for suicide, the suicide-protective effect of being married reported in high-income countries does not appear to be confirmed in studies from India and China, where single individuals are no more vulnerable to suicide than their married counterparts.[53,60]

Psychological autopsy studies conducted in developed countries report that psychiatric disorders are present in about 90% of people who die by suicide and that these conditions contribute 47 to 74% of the population attributable risk of suicide.[61,62] In our review mental illness – particularly alcohol use disorders – were also important risk factors for suicide, but not to the extent reported in high-income counties. Almost all studies from high-income countries indicate that affective disorder (i.e., depression and mania) is the mental disorder most closely associated with suicide (followed by substance abuse and schizophrenia)[61,63] and that more than half of all people who die of suicide meet current diagnostic criteria for an affective disorder.[64] This review suggests that depression plays a less dominant role in suicide in India. Other studies find that in Asian cultures impulse control disorders are stronger predictors of suicidal behavior than affective disorders.[65]

5. Conclusion

The quality of the information about suicide in India is quite limited, but the picture drawn from the eclectic mix of studies identified in this review indicate that it is an important and growing public health problem that is not being given sufficient attention by the government or the society at large. Compared to the pattern of suicides in high-income countries, suicide in India is more prevalent in women (particularly young women), is much more likely to involve ingestion of pesticides, and is more closely associated with poverty and less closely associated with mental illness. Initial targets for suicide prevention in India should include: (a) decriminalization of suicide; (b) restricting access to pesticides; and (c) improving the monitoring of fatal and non-fatal suicidal behavior.

Conflict of Interest

The author reports no conflict of interest related to this manuscript.

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有关印度自杀的系统综述

Anil RANE, Abhijit NADKARNI

背景：自杀是印度重要的死亡原因之一，但基于印度国家犯罪统计局数据估算的自杀率并不可靠。

目标：系统回顾现有的有关印度自杀及自杀相关因素的文献。

方法： 选择适当的检索词在 PubMed，PsycINFO，EMBASE，全球健康，谷歌学术和 IndMED 数据库中查找文献。查找到的论文摘要由两位作者分别独立筛选是否符合纳入标准，再从筛选出的论文全文中摘录标准化数据。

结果：本研究筛选出符合纳入标准的 36 篇论文进行分析。由于抽样过程和研究方法的异质性，荟萃分析的方法不可行。在印度部分农村地区的死因推断研究中报道的自杀率较高，每 10 万人口中有 82 至 95 人自杀，比官方报道的全国自杀率高出 8 倍。其中 20 至 29 岁人群的自杀率最高；30 岁以下人群中女性自杀率高于男性，而 30 岁及以上的人群则正好相反。自缢和服用有机磷农药是最常见的自杀方式，自焚在女性较为常见。社会经济地位低、精神疾病（尤其是酒精滥用）和人际交往障碍是与自杀关系最为密切的因素。

结论： 有关印度自杀的数据质量非常有限。但显而易见，自杀是一个重要且日益严重的公共卫生问题。相对于高收入国家而言，印度自杀特点为：女性（尤其是年轻妇女）自杀率高于男性、较多选择服用农药的自杀方式、与贫穷因素关系更为紧密而与精神疾病因素相关性较低。

关键词：自杀，印度，系统综述，有机磷农药，精神病

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