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Factors associated with the farmer suicide crisis in India

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Abstract *Background:* In India, it is estimated that ~16,000 farmers die by suicide each year, and at rates far above those of the general population. This paper reviews much of the literature concerning the factors associated with this crisis.

Methods: A literature search was undertaken from multiple databases on Ovid, as well as more elementary searches of Google, Google Scholar, and PubMed. This paper presents a review of the key results.

Results: Socioeconomic factors, rather than mental health problems, are associated with farmer suicides, with increased indebtedness playing the predominant role. Available research suggests this has arisen to a greater extent recently, due to an agrarian crisis affecting the most vulnerable farmers. This has multiple manifestations, including a lack of agricultural investment and irrigation improvement, use of cash crops, the increased use of noninstitutional credit sources, and the reduction of trade barriers. Bt cotton is unlikely to be an important factor and no studies reported a significant burden of mental health problems.

Conclusion: Indebtedness and numerous factors relating to this are clearly identified as the most important risk factors. Further large-scale assessments are required to further understand the situation.

Contents

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1. Introduction

Between 1995 and 2006, official records indicate that 166,304 farmers died by suicide in India (~16,000 per year) and that at its peak, ~18,000 farmers were taking their own lives every year [1]. The issue received significant news coverage, mainly over claims surrounding the introduction of the Monsanto developed Bt cotton (a genetically modified cotton crop that provides resistance to bollworm and other pests) to the region.

Some have said that there is little evidence suggesting a particular suicide crisis amongst farmers in recent years [2,3]. However, numerous reports state that farmers have died by suicide at rates exceeding those of the general population [1,4,5]. The 2013 National Crime Records Bureau (NCRB) statistics (considered the official domestic figures) estimate the suicide rate for the general population at 11.2/100,000 people, increasing from 10.5/100,000 people in 2002 [6]. Breaking down the NCRB figures, Nagaraj [1] estimates that as of 2001, the overall suicide rate for farmers across India was 15.8/100,000 people, ~50% higher than the general population rate, and that this has been increasing at a rate above that of the general population.

Analysis of the regional disparities indicates that the large majority of farmer suicides occur in a geographically contiguous region that Nagaraj [1] terms the Group I states (Maharashtra, Karnataka, Andhra Pradesh, Chhattisgarh, and Madhya Pradesh). Combined, these have significantly higher suicide rates of 28.7/100,000 farmers, accounting for ~30% of India's farming population but over 60% of its farmer suicides [1]. Here, the problem is so acute that the official rate for farmers is between 59% and 83% higher than the general population's, depending on whether ''all cultivators'', or just ''main cultivators'' are included, respectively. Not only are the absolute figures high, they have been increasing at a rate of 5.4% per annum, suggesting a doubling every 14 years if they continue unchanged. Another estimate of farmer suicide rates in Maharashtra suggested a worse picture, with rates increasing from 15/100,000 people to 57/100,000 people between 1995 and 2004, with the general population rate having only increased slightly from 17.4 to 20.3 [7]. Farmers in this region have gone from having lower suicide rates than the population to rates significantly higher, with a quadrupling of suicides from 1083 per annum to 4147 per annum in this period [7].

There is evidence that, worldwide, farming is an occupation with a higher risk for suicide than other occupations [8,9], so Indian farmers' higher rates may simply fit this pattern and warrant little explanation. However, evidence suggests that a substantial investigation into the causes of this crisis is an imperative, as along with the increasing rates of farmer suicides, research suggests that these suicides are not occurring from more organic processes such as mental health problems, but from socioeconomic and psychosocial circumstances. These circumstances are making the life of the Indian farmer much more precarious, leading many of them to such a desperate situation that they take their own lives. This paper examines these risk factors that have been associated with suicides in farmers.

2. Material and methods

A literature search was undertaken on Ovid of the Embase (1980–2015 Week 18), Global Health (1973–2015 Week 17) and Ovid MEDLINE(R) in-process and other non-indexed citations and Ovid MEDLINE(R) (1946 to present) databases. The search term was ''[India and farm* and (suicide or death)]''. This returned 362 results (301 unique), and all titles and abstracts were read and assessed. A total of 67 were isolated as having potentially some relevance to farmer suicides and read in full. More elementary searches of Google, Google Scholar, and PubMed were done, which identified a few additional reports.

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The criteria for inclusion in this paper is the relevance of the studies or reports, and below is a selection of the key results that helps to answer the main questions concerning the risk factors for farmer suicides.

3. Results and discussion

Amongst the literature returned, numerous factors were identified and to varying degrees investigated. As outlined below, indebtedness is considered the overwhelming correlate of farmer suicides, but many explanations for why farmers have become so indebted are also provided.

3.1. Indebtedness

Most studies identified indebtedness as the predominant single factor associated with farmer suicides [1,3,5,7,10–15]. Dongre and Deshmukh [10] found that farmers in the Vidarbha region of Maharashtra ranked debt as the most important reason for farmer suicides, followed by addictions, environmental problems, and price issues, amongst others [10]. Two other studies concluded that unpaid loans are a correlate of those who die by suicide [3,7]. Kale [12] found that in a small sample from Vidarbha, 95% of farmer suicide victims were indebted, while of control households, this was only 25%. Another in the same region found that 197 of 200 victims (98.5%) were indebted [16]. Mishra [7] also found that debt was the most common factor in Maharashtra at 86.5%, followed by deterioration in the farmers' economic status (73.9%). A comparison of these farmers with those who had not died by suicide showed they had three times as much debt, and the difference was significant to the 95% confidence interval [7]. An investigation of the socioeconomic causes of farmer suicide in Karnataka also found that agricultural debt was given as the primary factor, leading to farmer suicides in 29/30 suicide cases [13] and Gedela [15] calculates that indebtedness is one of the statistically significant factors identifying suicide farmers from controls in Andhra Pradesh.

3.2. Cash crops

The increased use of cash crops (which are a higher cost and grown primarily to be exported) as opposed to food crops (low cost and designed to be sold more locally) has been identified as an issue in some studies [3,7,14]. The suggestion is that farmers using these are more prone to becoming indebted if one of their high cost crops fails, as they have invested significantly more in their production [7], and that potentially, their use makes them more vulnerable to global price fluctuations. Kennedy and King [14] found that ''cash crop cultivators, with marginal landholdings and debts" are most at risk, and that these three characteristics account for ~75% of the variation in overall male suicide rates seen across India. When charting cash crop percentage against the male suicide rate by State in 2003, there is a clear, statistically significant, positive correlation between the two ($r = 0.628$). Gujarat and Rajasthan are the only exceptions, and the authors suggest that this is because they had amongst the lowest proportions of marginal farmers, indicating that this crisis is focused on the most weak and vulnerable at the bottom of the socioeconomic scale [14].

3.3. Bt cotton

The impact of one particular cash crop, the genetically modified Bt cotton, is considered one of the most contentious issues surrounding farmer suicides following its introduction in 2002. Two small studies in Vidarbha that break down crop productivity in small groups of farmers were returned [12,16]. Kale [12] shows Bt cotton to have slightly lower yields than non Bt cotton crops between 2007 and 2008, while Kale et al. [16], using data for 2004–2005 and 2005–2006, show Bt cotton having greater productivity. Statistical significance is not assessed and it is likely that these figures are too small to draw conclusions from. However, Kale [12] presents a much larger drop in productivity in all crops when comparing suicidal farmers with nonsuicidal farmers, and it is likely to be this observation that is more important in explaining suicides amongst them.

Two broader studies were identified which attempted to estimate the economic impact of Bt cotton for Indian farmers. A review conducted by Gruere and Sengupta [3] estimates that while farmers using Bt cotton have annual costs 15% higher than controls, factors such as reduced pesticide use and costs, and increased yields (plus 36.2%) lead to a net return 58.2% higher. The benefits in net returns are observed in all states with some variability. Qaim [17] found similar results in a sample of farms in four Indian states between 2002 and 2006. However, both analyses report large amounts of variability in the early years of Bt cotton's introduction when not all were profiting, and suggest that the positive average values may obscure large levels of volatility in its effects on individual farmers [3,17]. Two main explanations are offered for this volatility. Firstly, not all farmers cultivated it under the correct conditions

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due to a lack of information [3,17], particularly by spraying too many pesticides [18]. Secondly, the development of a rapidly growing secondary market for so called ''stealth" or ''spurious" seeds meant the quality of the seeds could not be verified [19]. Assessing the strength of these explanations is beyond the scope of this report.

Perhaps most importantly, overriding much of the individual analysis concerning the consequences of Bt cotton, is the observation that as opposed to a sharp jump, the official number of farmer suicides has kept growing steadily since its introduction in 2002, even as the area of land sown with the seed has risen significantly [3]. While it may play a part in individual cases, its introduction seems unlikely to have played a large role in the suicide crisis and no study has found an empirical link between Bt cotton and farmer suicides [1,3,7,10,11].

3.4. Agrarian crisis and neoliberal reforms

More broadly an agrarian crisis, often blamed on the neoliberal reforms of the late 1980s, has been linked to farmer suicides [1]. Mishra [7] describes how the agricultural sector, responsible for 56% of gross domestic product in 1950–1951, was by 2001–2012 responsible for only 25%, while 58% of workers (specifically ''cultivators or agricultural labourers") remained reliant on it. Statistics from 2015 suggest that 48% of the population rely on agriculture, while it has a reduced 17.6% share of the total Gross Value Added [20]. Not only is the role of the farmer within Indian society reducing and increasingly the reserve of small and marginal farmers [7,20,21], estimated to represent up to 85% of all holdings [20], their role in a more global marketplace has led to extra pressures being placed on the viability of their livelihoods.

While shifting trade patterns are hard to directly analyse, as the whole country is affected by the liberalisation of trade barriers and the effect of US government subsidies for example, two studies suggest that the opening up of economic barriers somewhat protecting Indian farmers from international competition has reduced the price received for cotton production for example, and contributed to lower revenues [1,3]. Indian farmers have complained about the saturation of the market with highly subsidised United States (US) crops in this period [22], while they receive reduced government support. For example, Lake et al. [23] estimate that cotton, wheat, and rice are produced by US farmers for 47%, 28%, and 26% below costs due to significant government subsidies. The criticism of this policy was particularly strong in light of the Indian government's agreement to reduce tariffs on these imports from 35% to 5% in 2002–2003 [7].

Alongside this, the opening up of the financial sector and declining government investment are suggested to have had a direct impact on two other factors, credit availability and irrigation.

3.4.1. Credit

Sadanandan [5] shows that after 1989, the percentage of total bank loans going to agriculture began to reduce sharply, from approximately 20–12% by 1994. By the 2000s it had halved, with even less (~8%) being lent directly to farmers [5]. This drop does not appear to simply mirror the decline in agriculture's part of the country's gross domestic product, but is a decline in formal sources of finance that has led to higher rates of loans from noninstitutional sources, such as local moneylenders, who charge much higher interest rates [5,7,10,24]. According to one report, the vast majority of loans from formal sources charge 12–20% per annum, but from informal sources, two-fifths charge >30% per annum, and another one-third charge between 20% and 25% [24].

Across India, Sadanandan [5] found that where there was more foreign and private competition amongst banks, farmers had more debt and relied more on private moneylenders for credit, suggesting that these were significant factors explaining why farmers died by suicide more in certain states. The impact of foreign banks on Indian agriculture may partly be explained by the priority sector lending demands the Reserve Bank of India places on commercial banks. Domestic commercial banks must lend 40% of their deposits to priority sectors, with 18% of the total targeted to agriculture, while foreign banks currently have a lower target of 32%, with no specific agriculture target [21,25]. While foreign banks are a small part of the Indian banking system overall, holding 7% of banking deposits [21], it is plausible that in regions where they have made an impact, they may have pushed out banks more amenable to lending to farmers, and thus forced many to use noninstitutional sources.

The expanding number of marginal and small farmers [7,21], along with their difficulty providing collateral for loans, and offering a consistent profitable return on investment for banks, provide a further plausible reason why an increasingly commercialised banking sector, with less compulsion to lend to farmers, would reduce the availability of credit to these groups. Various studies identified the critical importance of noninstitutional sources to farmers' credit availability (Table 1) and three found that farmers who died by suicide were more

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Table 1 Studies identified which examined the importance of moneylenders and informal sources of credit to Indian farmers.

Author	Publication year	Description of study	Key results
Behere and Behere [38]	2008	Report on farmers' suicide in Vidarbha province	– Moneylenders are the predominant source of loans for farmers here at 28.4% – Only 3.94% access land development banks
Chhikara and Kodan [30]	2013	Analysis of secondary data on farmer indebtedness in Haryana	– Negative association between the size of the landholding and percentage of credit attained from informal sources – Some 29–53% of credit for marginal farmers, 38% for small farmers, and 25% for large farmers is from informal sources
Gedela [15]	2008	Small case-control study in Andhra Pradesh (37 cases, 37 controls)	– Suicide victims obtain up to 70% of their credit from private moneylenders – Some 53% in controls – Households with victims also had much higher debt
Kale [12]	2011	Small case-control study in Vidarbha province (40 cases, 40 controls)	– Formal sources made up 76% of victims' credit, but this was 96% in the nonsuicidal group – The nonsuicidal group was also much less likely to require credit
Kale et al. [16]	2014	Interview of family members of 200 victims in Vidarbha province	– Some 47% had outstanding debt to only institutional sources – Some 51.5% had outstanding debt to both institutional and noninstitutional sources
Mishra [7]	2006	Case-control study in Maharashtra (111 cases, 106 controls)	– For suicide cases, more of their debt was owed to informal sources (72% vs. 38% for non-suicide controls) – Suicide cases also have higher levels of debt

likely to have debt with noninstitutional sources than controls [7,12,15].

Across India, the 2010 Report of the Task Force on Credit Related Issues of Farmers, set up by the Ministry of Agriculture, found that the reliance on moneylenders had increased from 18% to 27% of credit between 1991 and 2002, with this share varying widely across the country [24]. Furthermore, there was an inverse correlation between size of the land holding and reliance on ''noninstitutional agencies'', who held 47–57% of marginal farmers' debt, and 42% for small farmers, but only 32% for large farmers (who were less likely to have debt) [24].

Considering the link between the suicide rate and indebtedness, and the increasing use of higher interest moneylenders, especially by small and marginal farmers, that potentially pushes them further into debt, it would be expected that the suicide crisis would be focused in these groups of farmers. Kennedy and King [14] found that the numbers of marginal farmers in different states is strongly linked to the suicide rate, along with indebtedness and cash crop production. Kale et al. [16] found that of 200 victims in Vidarbha, 43.5% were ''small farmers'' with 1.01–2.00 hectare landholdings, and 23.5% were ''marginal farmers'' with landholdings <1 hectare. However, one small study in Karnataka found that 97% of suicides were medium and large farmers, although there were only three marginal or small farmers of the 60 in the sample [13].

3.4.2. Irrigation

Declining agricultural investment is highlighted particularly in regard to irrigation, which has seen little improvement since the reforms [1], leading to a reliance on rainfall for crop growth. Sadanandan [5] states that only 35% of land used for agriculture in India is irrigated. In some areas of Vidarbha, one of the worst affected areas of the crisis, Kale [12] suggests that around 85% of

Table 2 Studies that identified subsidiary occupations in farmer suicide cases.

Author	Publication year	Description of study	Key results
Gedelal [15]	2008	Small case-control study in Andhra Pradesh (37 cases, 37 controls)	– Value of livestock for households in cases is Rs. 20,000 – Value of livestock for households in controls is Rs. 27,000
Kale [39]	2011	Interview of family members of 200 victims in Vidarbha province	– Some 99% had no ''allied occupations/businesses"
Kale et al. [16]	2014	Interview of family members of 200 victims in Vidarbha province	– Only 1% of victims were engaged in dairy farming
Nagthan et al. [13]	2011	Small case-control study in Karnataka (30 cases, 30 controls)	– Some 87% of victims had ''negligible supplementary enterprises" – This was even higher in controls at 93.3%

Table 3 Some of the identified social and personal factors associated with farmer suicides.

Related factor	Author	Publication year	Key results
Alcohol	Dongre and Deshmukh [10]	2012	– Identified as a factor by some farmers
	Mishra [7]	2006	– ''Addictions" identified as a factor in 27.9% of farmer suicide cases
	Nagthan et al. [13]	2011	– Alcohol identified retrospectively as a responsible factor in 30% of suicide cases
Family structure	Gedela [15]	2008	– Some 65% belong to a nuclear type household
	Kale et al. [16]	2014	– Some 61% and 25% of suicide victims live in medium (4–6 people) and large (7–9 people) households – Some 63% belong to a nuclear family – Some 91.5% of suicide victims were married
Family dynamics	Gedela [15]	2008	– Suicide cases communicate less regularly with their relatives (49% of cases communicate with their relatives occasionally as opposed to 73% of controls)
	Kale et al. [16]	2014	– Majority of suicide cases were the heads of the household
	Mishra [7]	2006	– Some 55% of suicide cases did not share their problems with other family members
	Nagthan et al. [13]	2011	– Some 73% of suicide cases had conflict with their wives – Marriage of the farmers' daughter/sister retrospectively identified as a responsible factor in 40% of suicide cases
Literacy/education	Gedela [15]	2008	– Some 92% of suicide cases illiterate, 84% of controls
	Kale et al. [16]	2014	– Some 16.5% of suicide victims were illiterate – Only 4% educated up to college level
	Nagthan et al. [13]	2011	– Some 30% of suicide cases illiterate compared to 6.7% of controls – Some 50% of suicide cases had a primary school education, compared to 70% of controls
Community status	Nagthan et al. [13]	2011	– Some 53.3% and 36.7% of suicide cases described as having medium or high levels of participation in various social functions in their communities

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Table 4 Studies identified that provided information as to the importance of pesticide poisoning in farmers.

Author	Publication year	Description of study	Key results
Kale et al. [16]	2014	Interview of family members of 200 victims in Vidarbha province	– Of 200 cases, 131 (65.5%) completed suicide with insecticide – Hanging was the next most common at 24.5%
Mishra [7]	2006	Case-control study in Maharashtra (111 cases, 106 controls)	– Of 111 cases, 88 (79.3%) completed suicide with insecticide – Hanging was the next most common at 12.6%
Nagthan et al. [13]	2011	Small case-control study in Karnataka (30 cases, 30 controls)	– Of the 30 farmers who completed suicide, 16 (53.3%) poisoned themselves with insecticides or pesticides – Hanging was the next most common at 40%
Raddi and Anikethana [40]	2014	A profile of 320 patients admitted to the Karnataka Institute of Medical Sciences with organophosphate poisoning	– Organophosphate poisoning was found to be most common amongst ''agricultural labourers and unskilled workers" – Some 30% of cases were in farmers, the largest single group – Overall, only 2.5% of exposures were accidental

Table 5 Estimated suicide rates in India from various studies.

Author	Figure derived from	Estimated suicide rate	Estimated male suicide rate
National Crime Records Bureau [6]	Police reports of suicide victims	– A total of 10.5/100,000 in 2002 – Increasing to 11.2/100,000 in 2013	– A 2:1 male–female ratio for number of victims – Does not provide an official value
World Health Organisation (WHO) [41]	WHO Global Health Estimates	– A total of 23.3/100,000 in 2000 – A total of 21.1/100,000 in 2012	– A total of 26.2/100,000 in 2000 – A total of 25.8/100,000 in 2012
Joseph et al. [42]	Verbal autopsies in Kaniyambadi region of southern India	– A total of 95.2/100,000 (average over the period 1994–1999)	– Women 0.84× as likely to commit suicide
Gajalakshmi and Peto [43]	Verbal autopsy of 38,836 deaths in Tamil Nadu in 1997–8	– A total of 62/100,000 in 1997–1998	– A total of 71/100,000 in 1997–1998
Gunnell et al. [44]	A review of studies estimating the suicide rates in different regions of India	– A total of 40/100,000 (considered a ''reasonable" national estimate as of 2007) – Finds that some studies report rates 3× higher than the official figures in those regions, and adjusts the overall estimate to more reflect estimates from rural populations	

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the area is rain-fed, making farmers particularly susceptible to extreme variations in yields and therefore returns. This appears to be one factor affecting suicide rates, and Kale et al. [16] found that 69% of victims in a sample from Vidarbha had no water source and relied entirely on monsoon rains for their fields. Gedela [15] found that non-suicide farmers had a higher proportion of their land area that was irrigated than suicide victims in Andhra Pradesh. Poor irrigation may not only be a direct cause of increased debt by lowering returns and potentially causing crop failures, but also be partly responsible for the move towards moneylenders, as banks may be reluctant to lend to farmers who lack irrigation facilities as the return they receive on their investment is less assured.

3.4.3. Subsidiary occupations

A lack of subsidiary occupations may further enhance this propensity for marginal and small farmers to be overwhelmed by high interest loans and crop yield volatility. Although no study satisfactorily assessed its impact, four studies suggested few farmers engaged in these extra activities (Table 2).

3.5. A broad picture

In the developed world, suicide is associated overwhelmingly with mental illness [26]. This has not been identified in the studies presented above and there is no suggestion it is an important factor. The research indicates that the characteristics associated with farmer suicide correspond to socioeconomic pressures or factors that worsen it, such as indebtedness and credit difficulties. This corresponds with studies of suicide in India's general population that found it to be associated much more with socioeconomic and psychosocial stress, with mental health disorders rare [27–29].

Nonetheless, beyond talking of risk factors for what the report has (for brevity) referred to invariably as ''suicide cases'', ''victims'', amongst others, this paper has not addressed what it means to be the individual farmer, or more specifically the individual person, who dies by suicide. While there are numerous strong associations, suicide is not solely completed by, for example, the marginal farmer who is indebted to moneylenders, but by a wide variety of farmers who may come to find the pressures coming down on their lives too much to bear, and who sadly come to take their own lives. Some of these personal factors were observed in some small-scale studies presented in Table 3. Farmers have struggles beyond indebtedness, with potentially stressful roles within their families as the head of the household, arguments with their wives and other family members, alcohol abuse, and difficulties adjusting to changing statuses in their local communities if and when they find themselves in difficulties.

Furthermore, not all debt is acquired to aid their occupation, with only 60% of outstanding loans being for ''productive purposes'' in 2002 [24]. Chhikara and Kodan [30] estimated that for marginal and small farmers in Haryana, respectively, 23.7% and 20.7% of loans were taken out to fulfil social obligations such as ceremonies and marriages.

A predominance of suicide by pesticide poisoning was also noted amongst farmers (Table 4), which could plausibly have an impact on the figures as farmers have easier access to this method of self-poisoning that has a particularly high case fatality rate [31].

Pesticide poisoning is the most common method in successful suicide attempts, at approximately 49% and 44% for men and women, respectively, in India [2], but considering historically the majority of the population was engaged in agriculture, this observation adds little to help determine whether farmers' easy access to pesticides might inflate their suicide rates. In Sri Lanka, death rates from pesticide self-poisoning halved after regulations were instituted on the sale of highly toxic pesticides in 1995, even though pesticide self-poisoning attempts increased [31]. It is hard to predict whether similar measures would significantly alter the numbers of farmers that attempt and eventually complete suicide compared to the general population, especially as suicide in these groups appears to arise from long-term socioeconomic stress as opposed to transient moments of hopelessness that might pass.

It should also be noted that studies in other countries have proposed links between long-term pesticide use and depression or suicide [32–34]. Considering the specific socioeconomic factors identified here, this is unlikely to be a significant factor, although it has not been assessed.

Another factor that could be altering farmer suicide rates is the substantial grants given to the families of farmers who die by suicide in various states [35,36]. It has been suggested this may provide an incentive for suicides [3,37]. Unfortunately, no study was found that satisfactorily assessed the impact of this on farmer suicide numbers.

Lastly, there is no accurate, authoritative estimate on just how many farmers and non-farmers are dying by suicide in India. As Table 5 shows,

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there are significant discrepancies in reported suicide rates in India. The NCRB figures, for which the studies in the introduction proposing an increasing farmer suicide rate come from [1,7] are considered significant underestimates as, for example, they only use police records to classify deaths, and due to the stigma associated with suicide in a country where it was illegal until a government decision in 2014. Of all the estimates in Table 5, they are by far the lowest.

While the official suicide numbers are likely significant underestimates across the whole population, for farmers, a further underestimation may result from only counting and designating individuals as farmers who have explicit title to land [1]. Farm workers who rent their land, or are reliant on work from someone who does, are not officially counted as farmers. Nagaraj [1] suggests this may also significantly understate suicides amongst female farmers and it is notable that amongst 200 farmer suicides reported by Kale et al. [16], only six were female, and in a sample of 30 reported by Nagthan et al. [13], 29 were male.

3.6. Limitations and further research

Trying to present a broad picture of the evidence available in such a small space led to limitations. More databases could be searched, studies presented, and background given to the specific details of each study. This report is also not an authoritative review of every study. Not all available reports were found and of those that were, not all could be included here. Considering the large amount of data, included and not included in this paper, a more authoritative and objective systematic or literature review is warranted. Further research could also compare the situation of farmers in India directly with those of other countries.

To better understand this issue, large case-control or cohort studies are particularly important. While numerous, interrelated results are presented here that seem to be plausible, it should be noted that of the studies assessed, there was a lack of these kinds of studies and many of the verbal autopsy studies only had a few hundred participants at best. Few studies were able to present statistically significant results. Another potential limitation was the assumption that each study has a similar meaning when referring to what a ''suicide'' is, and what a ''farmer'' is.

Importantly, while these studies can identify associations and risk factors, we cannot know precisely why these farmers kill themselves and thus our knowledge is severely compromised and has to be inferred from risk factors and verbal autopsies.

Considering the scale of this crisis, and the potential applicability of these features (indebtedness, credit problems) to other countries, it is surprising that there are not significantly more substantial assessments in the literature. However, the lack of large, authoritative studies does not overshadow the fact that the large number of studies presents a broad picture of the pressures on the Indian farmer and the risk factors most associated with suicide.

4. Conclusion

Determining a single defining cause for farmer suicides in India is impossible, especially considering the relative lack of detailed literature. What can be inferred is that an amalgamation of factors has led to a picture of large-scale farmer indebtedness, that combined with a volatile ecological climate and socioeconomic landscape has left hundreds of thousands, if not millions of farmers vulnerable to a situation of such crushing debt and desperation that many have come to take their own lives. The most discussed cause, Bt cotton, does not appear to be a significant factor, and notably there is little, if any suggestion that mental illness plays a role. Rather an agrarian crisis that manifests as a culmination of lack of agricultural investment and irrigation improvement, the increased use of noninstitutional credit sources (that appears to have increased since the neoliberal reforms of the 1990s), and likely to some extent the reduction of trade barriers appear to best explain the picture of farmer indebtedness and the acceleration of farmer suicides over the period.

Conflicts of interest

All contributing authors declare no conflicts of interest.

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