Suicide in rural Punjab, India: implications for ensuring farmer rights

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Background

Suicide is prevalent among farmers worldwide, and may be influenced by policies and agricultural initiatives that affect the socioeconomic insecurity. The objective of this study was to investigate the association between economic burden and suicides in rural areas of Punjab, India.

Methods

Suicide data were collected using household verbal autopsy surveys by the Baba Nanak Education Society, a local non-governmental organization, from 1980 to 2016. Data from five districts were analyzed: Mansa, Sangrur, Fatehabad, Jind, Patiala. Demographic data included the date at which death by suicide occurred, age, occupation, land holding, information on the debt, and the mode of suicide, for 2,473 suicides.

Results

Suicides were more prevalent among agricultural workers, which include agricultural laborers and agriculturalists (i.e. individuals involved in the business of owning agricultural land and cultivation). Agricultural workers were significantly more likely to commit suicide by poisoning, while those from other occupations preferred different means. The median age was lower in agricultural workers relative to other occupations. The frequency of suicides among agricultural workers significantly increased from 1980 to 2016. This increase was strongly correlated with the total annual debt and land holding.

Conclusions

Results from this study suggest that increasing debt and land holding may significantly predispose young and middle-aged farmers to death by suicide. Policies are needed to limit the availability of hazardous chemicals that can be used as poison and to protect the economic security of farmers in Punjab and other parts of the world.

Suicide, defined as a self-directed, fatal act with intent to die as a result of that same act, is a public health challenge worldwide.[1] It is a complex phenomenon influenced by many factors such as neurobiology, stressful events, socioeconomic and cultural environment.[2] Death by suicide is overrepresented in farmers worldwide,[3-6] especially in regions that are economically dependent on the agricultural output. The socioeconomic stress may play an even greater role than mental health disorders in driving high suicide rates among farmers in India.[7] Farmer suicides have been considered as 'political acts', used by the desperate agricultural workers to protest against the dire conditions that they experience.[8] This is evident from the recent countrywide 'winter of content' protests against government policies that left farmers feeling particularly vulnerable.[9]

Farming, as a profession, is subject to many uncertainties and risks, which are mostly arising from economic insecurity. The most important among them are unpredictable climate, the risk of crop failure, price volatility of agricultural goods due to increased access to foreign markets,

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and unintended consequences of the Green Revolution. The latter include higher costs of production, manipulation by middlemen, logistical barriers, insufficient support systems, expensive loans with high interest rates, corporate control, aggressive loan recovery programs, among others, all contribute to the escalation of debt traps, especially among marginal farmers.[7] These factors resulted in widening disparities in land distribution and higher rates of unemployment.[10]

In India, most agricultural suicides were reported in the states of Andhra Pradesh, Karnataka, Kerala, Maharashtra, and Punjab between 1998-2006.[8] Despite improvements in the number of suicides in industrial states like Tamil Nadu (population of 7 million) which recorded zero suicides from 2010-2018, agrarian states like Maharashtra (population of 11 million) and Punjab (population of 2 million) recorded 6833 and 649 suicides, respectively in the same period.[11] The prevalence of suicide from 2008-2018 in Punjab was 1190 out of 279,233 medically certified deaths in the population.[11] However, suicide events were under-reported since suicide was considered illegal until 2014.[12] In addition, most of these reports are not associated with information on the individual's economic status, which makes correlational analyses unreliable.

There is an increasing trend in the number of recorded suicide cases in Punjab during the past 30 years. Despite the rise of several initiatives, such as agricultural debt waiver and relief as well as Kisan credit card loan[13] and spiritual and rehabilitation programs,[8] to address farmers' suicide, there is a systemic failure to offset the root causes. Therefore, the aim of this study was to uncover the causes of suicide, by providing improved evidence on the importance of ensuring farmers' rights by implementing policies that protect their economic security and make them less vulnerable to debt spirals.

METHODS

STUDY DESIGN

Data were reviewed from the household verbal autopsy surveys from 102 villages between 1980 and 2016 by the Baba Nanak Education Society (BNES), a local non-governmental organization based in Punjab, India. Detailed surveys on factors related to the death of an individual were conducted by BNES staff at the homes of each family where a suicide had recently occurred. These data were confirmed by signed affidavits by the local village council. Seven districts (Mansa, Sangrur, Samana, Fatehabad, Jind, Sanrur, Patiala) were included in the data collection, spanning across the three districts in Punjab that have greater agricultural focus (Sangrur, Mansa, Patiala) and one district in the neighboring state of Haryana (Jind). Response rate to household surveys was nearly 100%, with confirmation by *Panchayat* (village council) affidavit in 93% of cases. This study does not constitute human subjects research as all subjects are deceased. Institutional Review Board (IRB) approval was obtained from Weill Cornell Medicine to use protected health

information (PHI) for descendants of this study for research purposes.

DATA SOURCES

Data were obtained from BNES in 2016. Data cleaning and analysis took place from August 2017 to November 2020. Demographic data, including the date of the suicide, age, occupation, landholding, available debt information, and the mode of suicide were recorded.

STATISTICAL ANALYSES

Suicides with at least one missing data point were excluded. The location of each individual's village was plotted onto a map based on village coordinates from official government census data, with suicides subsequently grouped according to *Tehsil* (sub-district) and district. This was done using the R packages: cowplot, googleway, ggplot2, ggrepel, ggspatial, libwgeom, sf, rnaturalearth, rnaturalearthdata. Bar plot was used to show the distribution of suicides across the different occupations. The dataset was then split by occupation. Agriculturalists (i.e. individuals involved in the business of owning agricultural land and cultivation) and agricultural laborers were grouped under 'agriculture' and were referred to as 'agricultural workers' in the text. All other occupations (tailor, shop keeper, government service, housewife, shop laborer, watchman, driver, barber, car mechanic, carpenter, tea seller, trader, truck driver, and service) were denoted as 'other' and were referred to as 'other workers' in the text. The frequencies of suicides and modes of suicide, sum of debts, and the sum of land holding for the total suicides per year were computed and were merged into one dataset. Boxplots were used to show the distribution of suicide age per year. The median age per year was computed and was used to analyze statistical significance between the two categories. Statistical significance was set at the alpha level of 0.05 for linear regression models. Adjusted odds ratio were computed to study the relationships between suicide frequency and total debt or land holding. Analyses were performed using R software, version 4.0.3 (Vienna, Austria).

RESULTS

OVERVIEW OF THE DEMOGRAPHICS

There were 2,489 recorded suicides during the study period, with complete data available for 2,473. 58.39% of the recorded suicides were among agriculturalists and 40.72% were among agricultural laborers. The remaining recorded suicides were recorded for other occupations (barber, car mechanic, carpenter, driver, government service, house wife, service, shop laborer, shopkeeper, tailor, tea seller, trader, truck driver, watchman) (Figure 1, panel A). Most of the cases were in Sangrur (2228/2473) and Mansa (223/2473) districts (Figure 1, panel A).

Agricultural workers (*i.e.* agriculturalists and agricultural laborers) most commonly committed suicide by poisoning
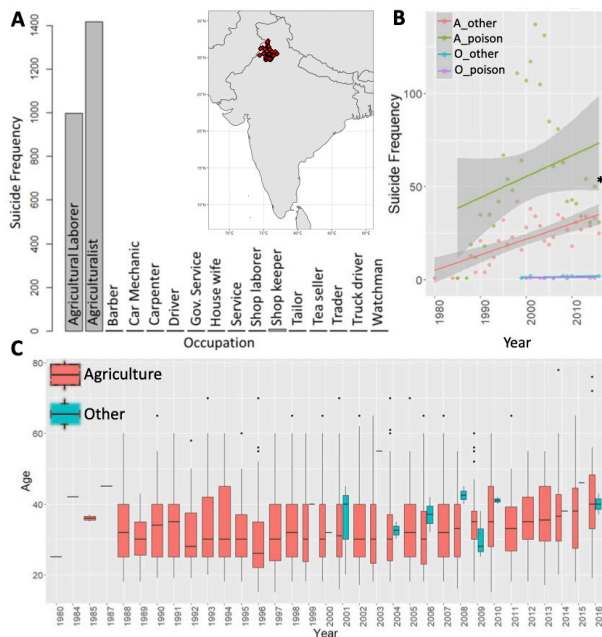
Figure 1. Demographics of death by suicide events in rural India.

(A) The distribution of suicide events by occupation and geography. Data was collected by Baba Nanak Education Society (BNES), from 1980-2016 in rural India. (B) The frequency of suicide by poison increased throughout the years and was higher than other modes among agricultural workers. This was not evident in suicide cases for other occupations. Linear regression model. (Agriculture): Year: t(60)=2.80, *P=0.007*. Mode of suicide: t(60)=5.21, *P=2.48e-6*. (Other occupations): Year: t(13)=1.19, *P=0.256*. Mode of suicide: t(13)=-1.66, *P=0.120*. Agriculture/other suicide mode (A_other), Agriculture/poison (A_poison), Other occupation/other suicide mode (O_other), Other occupation/poison (O_poison). (C) The median age was higher in other occupations relative to agriculture. Linear regression model. Occupation: t(42)=3.27, *P=0.002*.

(t(60)=5.21, *P=2.480e-6*), a trend that increased from 1980 to 2016 (t(60)=2.80, *P=0.007*) (Figure 1, panel B).

The average median age at the time of suicide was 33 and 39 years for agricultural and other workers, respectively. Agricultural workers who died by suicide were significantly younger than other workers (t(42)=3.27, *P=0.002*). The highest median age for agricultural workers was 45 years, while that of other workers was 55 years (Figure 1, panel C and Table 1).

THE ASSOCIATION BETWEEN SUICIDE FREQUENCY, DEBT, AND LAND HOLDING

The frequency of suicide cases and the sum of debt per year increased throughout the years among agricultural workers (t(31)=3.24, *P=0.003*, t(31)=4.58, *P=7.170e-5*, respectively) (Figure 2, panels A and B). Land holding did not change dramatically throughout the years (Figure 2, panel C).

Not surprisingly, debt increased the suicide risk throughout the years regardless of occupation (agriculture: t(31)=9.36, *P=1.56e-10*, Other occupations: t(31)=2.97, *P=0.014*). However, the relationship was stronger in agriculture (odds ratio, OR=2.94, 95% confidence interval, CI=2.33-3.72) relative to other occupations (OR=1.28, 95% CI=1.06-1.54) (Figure 3, panel A). Land holding was also correlated with suicide frequency. This relationship was only evident in agriculture (t(31)=7.08, *P=5.9e-8*; OR=2.77,

95% CI=2.07-3.72), but not in other occupations (t(10)=0.31, *P=0.760*; OR=1.08, 95% CI=0.63-1.84) (Figure 3, panel B).

DISCUSSION

This study confirmed that debt and land holding are precipitating factors for suicide among farmers in rural Punjab, India. Farmer suicide is a universal phenomenon.[14-16] In India, it has been estimated that one suicide among farmers occurs every 30 minutes.[17] While each suicide is a tragedy caused by a unique set of circumstances, there are likely occupational risks and hazards that predispose numbers of farmers in despair to take their own lives. It is therefore important to address the root causes, in order to potentially reverse the pattern of recorded suicides.

This study found that farming shortened the lifespan of workers (median$_{max}$ = 45 years) by up to 10 years relative to other occupations (median$_{max}$ = 55 years) (Figure 1, panel C and Table 1). This trend was different in other reports in India where the highest number of suicides was among 15-29 year olds[18] and in the US where the number of suicides remained high for >75 year olds from 1999-1994, while the highest increase was among the middle-aged group (45-64).[19] Farmers were significantly more likely to die by suicide as a result of poison. This is consistent with previous reports, suggesting that the majority of death by suicide among farmers in India was by ingestion of insecticides[20] and pesticides,[21] which were available in farms or the households. The number of farmer suicides increased in these rural regions despite national bans for pesticide use in India,[22] suggesting that pesticide regulation may not be efficient in rural areas and fails to address the root causes of farmer suicides. In comparison, 590 farmers in three southeastern states in the US were more likely to use firearms as a means for death by suicide during the period of 1990 to 1998.[15] Firearms were also the most prevalent method for death by suicide among 662 farmers in England during of the period of 1979 to 1994.[23] This difference may suggest region-specific conditions and cultures that influence the ability to access or use certain methods. The number of suicides, debt, and land holding did not decline over the years despite initiatives aimed at mitigating the economic burden for farmers. Both debt and land holding increased the risk for suicide among farmers. These results confirm previous descriptive reports and social analyses on farmer suicides driven by economic debt.[7,8,17,20]

Based on the official Indian census reports from 2008 to 2016, Punjab had 926 deaths by suicide in all 22 districts.[11] In comparison, this study reported 652 deaths by suicide in only 7 of the 22 districts in Punjab (Figure 2, panel A). Hence, more than two folds of suicide events were undocumented in government reports. In addition, Sidhu et al. reported 773,[20] while this study reported 1061 deaths by suicide in the Punjabi district, Sangrur, from 2000-2008. This comparison suggests that the data collection in our study is more inclusive and exhaustive than previous reports.

Limitations for this study include the lack of data related to the individuals' gender, literacy levels, as well as their
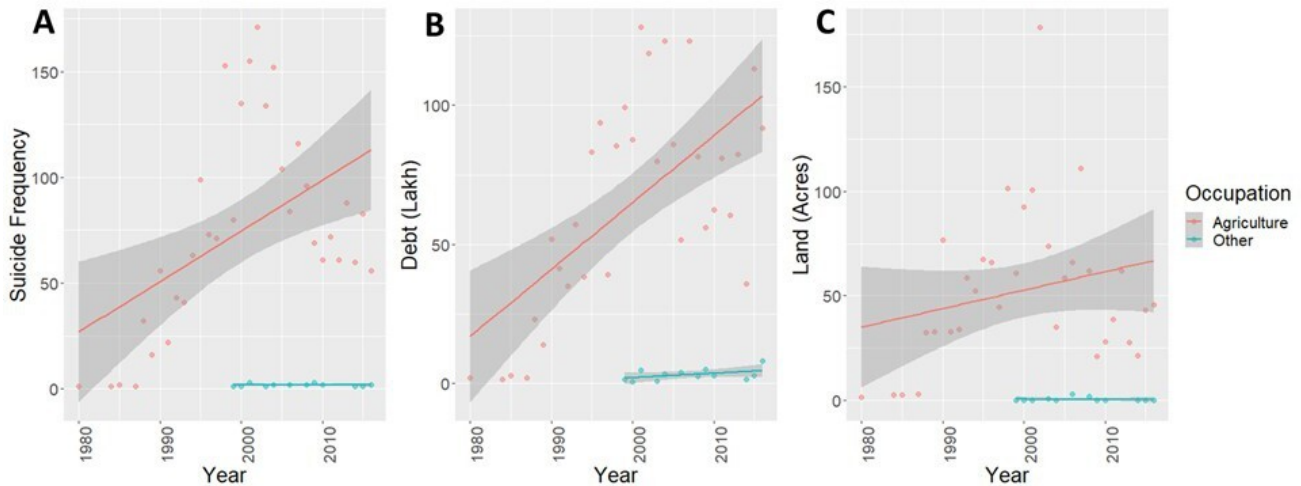
Figure 2. The variation of suicide frequency, debt, and land holding in all districts across the years.

(**A**) Suicide frequency increased among agricultural workers throughout the years. Linear regression model. (Agriculture). Year: t(31)=3.24, *P=0.003. (Other occupations). Year: t(10)=0.02, P=0.987. (**B**) Debt (Lakh) increased among agricultural workers throughout the years. Linear regression model. (Agriculture). Year: t(31)=4.58 *P=7.17e-5. (Other occupations). Year: t(10)=1.61, P=0.140. (**C**) The increase in land holding (Acres) across the years was not statistically significant. Linear regression model. (Agriculture). Year: t(31)=1.39, P=0.176. (Other occupations). Year: t(10)=-0.35, P=0.736.

mental health during the data collection process. Nevertheless, previous social and descriptive analyses have downplayed the role of potential pre-existing psychological disorders in driving suicide among farmers in India.[7] Further, measuring debt is complicated. In this study, the debt value was directly assessed using household surveys, which reflects the total size of the debt. However, other indicators like the assets sold, family size, and annual income could have provided more information about the relationship between debt and suicide. In addition, other social and familial factors could have contributed to suicide.[20]

CONCLUSIONS

The data presented here identifies economically-driven trends in suicide in Punjab, India, and can herald problems that are likely to arise in other regions of the world where farmers suffer from increased economic insecurity. Further studies into the role of exploitive informal moneylenders, trade liberalization and multinational corporations, and the necessity of public investment into secondary and tertiary sectors of the economy are warranted to identify mechanisms to safeguard the socioeconomic human rights of farmers.

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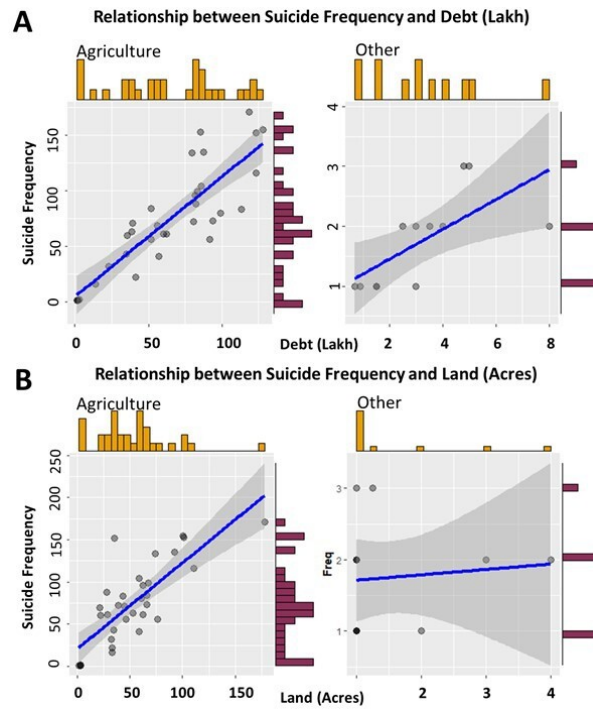New York, NY 10065
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Figure 3. The relationship between suicide frequency, debt (Lakh), and land holding (acres).

(**A**) Debt (Lakh) influenced suicide frequency regardless of the occupation. Linear regression model (Agriculture). Debt: t(31)=9.36, **P=1.56e-10*. (Other occupations). Debt: t(10)=2.97, **P=0.014*. There was a stronger correlation between suicide frequency and debt (Lakh) in agriculture (OR=2.94, 95% CI [2.33-3.72]) relative to the other occupations (OR=1.28, 95% CI [1.06-1.54]). (**B**) Land holding (Acres) influenced suicide frequency among agricultural workers. Linear regression model (Agriculture). Land holding: t(31)=7.08, **P=5.9e-8*. (Other occupations). Land holding: t(10)=0.31, *P=0.760*. This correlation was only evident in agriculture (OR=2.77, 95% CI [2.07-3.72]) and not in other occupations (OR=1.08, 95% CI [0.63-1.84]).

Table 1. Summary of the median age (years) for the recorded suicide cases per year in Punjab, India

Occupation	Year	Median age (years)	Average median age (years)
Agriculture	1980	25	32.8
	1984	42	
	1985	36	
	1987	45	
	1988	32	
	1989	30	
	1990	34	
	1991	35	
	1992	28	
	1993	30	
	1994	30	
	1995	30	
	1996	26	
	1997	30	
	1998	32	
	1999	30	
	2000	30	
	2001	31	
	2002	30	
	2003	30	
	2004	30	
	2005	32	
	2006	30	
	2007	32	
	2008	33	
	2009	35	
	2010	35	
	2011	33	
	2012	35	
	2013	35.5	
	2014	36.5	
	2015	38	
	2016	40	
Other occupations	1999	40	39.3
	2000	32	
	2001	40	
	2003	55	
	2004	32.5	
	2006	37	
	2008	42.5	
	2009	28	
	2010	41	
	2014	38	
	2015	46	
	2016	40	

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