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Epidemiological and Clinical Patterns of Suicidal Burn Injuries: A Cross-Sectional Analysis with a Focus on Gender-Based Outcomes in Burns.

Abstract

Background: Suicide remains a critical public health issue globally, with Asia accounting for 60% of cases and India exhibiting particularly high rates, especially among women. Sociocultural factors such as gender-based inequality, economic hardship, and lack of mental health support are key contributors, with vulnerable groups including housewives and daily wage earners. In this context, a retrospective hospital-based study was conducted to analyse burn injuries in Northern Kerala from 2018 to 2021, focusing on epidemiology and sociodemographic risk factors.

Methods: The study reviewed 648 confirmed burn cases admitted to the Burns Unit and ICU, from the year 2018 (beginning) to 2021 (end).

Results: Females constituted 59.8% (n=387) of cases, and the suicide rate among them (22.5%) was significantly higher than in males (11.1%) ($p < 0.001$; OR = 2.32). Suicidal burns were most prevalent in Wayanad (29.3%). The 21–40 age group showed the highest burn (44.4%) and suicide rates (25%), with females in this group disproportionately affected (32.3%). Third-degree burns were most common among suicidal cases (64.65%). Overall mortality was 44%, with a significantly higher rate (72.4%) in suicidal burn victims. Mortality was notably significant in females aged 0–20 and 21–40 ($p = 0.026$), but gender differences in survival were not statistically significant.

Conclusion: The findings underscore the urgent need for region-specific, gender-sensitive mental health initiatives, especially for young women in high-risk areas like Wayanad. A multifaceted approach addressing sociocultural pressures, economic vulnerability, and access to psychological care is critical in reducing suicide-related burn injuries in Kerala.

Key Words

Burns, Females, Suicide.

Epidemiological and Clinical Patterns of Suicidal Burn Injuries: A Cross-Sectional Analysis with a Focus on Gender-Based Outcomes in Burns.

Background.

In India, female gender-based inequality and inequity, along with gender crimes and discrimination are among the highest. Female Suicide rates are almost double the global average suicide death rates (SDR). Economic dependency, Lack of mental health attention, family-related issues, and poverty are among the leading issues that push suicidal tendencies in our country [1]. National Crime Records and Bureau suggested that daily wage earners and housewives are among the highest susceptible groups to Committing suicides [1]. A recent report indicates that there may be over two million burn injuries per year in India [1]. The data published by the Government of India, Ministry of Home Affairs, indicates that death by fire contributes to 7–9% of all suicidal deaths [1]. The reasons for this are multi-fold, such as dowry problems, the rigidly defined role of women in the family, and interpersonal conflicts in a joint family, most often Burns is reported as an accidental injury without any mention of suicidal intent. The study aims to present a systematic understanding of sociodemographic risk factors and epidemiology of suicide among women in Northern Kerala by Burns. Kerala being a leading state in Suicide rates as per Government of India data, 2022.

Suicide is a global public health problem. Asia accounts for 60% of the world's suicides, so at least 60 million people are affected by suicide or attempted suicide in Asia each year. In That, India stands out, with South Indian Suicide Rates and attempts being the highest among the share [2]. The burden of female suicidal behavior, in terms of total burden of morbidity and mortality combined, is more in women than in men. Women's greater vulnerability to suicidal behavior is likely to be due to gender-related vulnerability to psychopathology and to psychosocial stressors [3].

Our aim is to identify the burden of Self-immolation among women and their death rate to understand the epidemiology and Socio-demography, as a representative data are not available at a National or State level to plan many suicide prevention policies.

Introduction.

Suicide attempts are influenced by several consistent risk factors, including intimate partner violence, non-partner physical violence, divorce, separation or widowhood, childhood sexual abuse, and having a mother who experienced intimate partner violence. [4] In Kerala, many suicide cases seen in tertiary centers can be linked to these factors; however, they remain poorly studied, and awareness of policy interventions among women is limited across various socio-economic strata.Similar studies suggest that many cases especially in self-inflicted burns cases go poorly investigated. [5]

Among different suicide modalities, self-inflicted burns stand out as particularly devastating due to their high lethality, extensive tissue damage, prolonged suffering, and poor clinical outcomes. Data suggests that there are an estimated 7 million burn injuries in India annually,

of which 700,000 require hospital admission and 140,000 are fatal. According to the National Burns Programme, 91,000 of these deaths are women; a figure higher than that for maternal mortality. Women of childbearing age are on average three times more likely than men to die of burn injuries. [6]

Although burns constitute a lower overall incidence compared to other suicide methods, they disproportionately contribute to highmortality cases, especially among women. Cross-sectional data from the past four years indicate a significant gender-based disparity, with female patients presenting with more severe burns and higher total body surface area (TBSA) involvement, suggesting greater lethality and intent.

This study aims to analyze the epidemiological and clinical characteristics of suicidal burns, with a focus on gender differences, TBSA involvement, and patient outcomes. Recognizing the strong link between violence and suicidality in women, particularly in low- and middle-income countries, is crucial for mental health policies and services. Training healthcare workers to identify and respond to the consequences of violence may significantly reduce the health burden associated with suicidal behavior. Therefore, our study seeks to evaluate the significant burden of self-immolation among burn cases in a tertiary care center in northern Kerala.

Methodology.

A complete list of Admitted patients coming to the burns Unit and ICU (Intensive care Unit), of a tertiary care Centre in Northern Kerala, was taken after Ethics Committee Approval and data of 4 years were collectedfrom 2018 January to 2021 December. The study is a hospital-based Observational Epidemiology: employed a Retrospective cross-sectional study, where retrospective data was collected. Admitted cases, whether discharged or Expired were considered for the Study. Patients with Inadequate data and insufficient History were excluded from the study.

Data was collected after getting Ethics Committee approval and Research Committee approval. Data was analysed using various Variables, such as age, sex, cause and mode of burns, whether accidental or suicidal, age category, place, burns characteristics, burns demographics, degree of burns, and outcome.

A systematic review of medical records and Data was analysed by Descriptive Analysis and chi-square Testing and fisher exact test Using SPSS software, and a p-value of <0.05 was considered significant. Limitations include the retrospective design, potential biases in data collection from medical records, and the single-centre nature of the study, which may limit generalizability to other settings.

Results:

The number of cases studied in the above Cross-Section is n=648, over 4 years with a comparable number of patients included in each year, viz: 2018 to 2021, except a dip seen in the year 2020.

Demographic Characteristics: Out of 648 patients, n=387, patients were females and n=261, patients were Males. With Age category (n=66) for 0-20 years of age, (n=288) among 21-40 years of age, (n=204) among 41-60 years of age, (n=75) for 61-80 years of age and (n=15) for 81-100 years of age.

(A) Factors associated with Burns and Suicide rates in the study:

1. Incidence of Burns Suicides and Gender-based Analysis: Of these cases, around n=528, cases were accidental burns among both Males and Females, n=116 Cases as Suicidal burns and n=4 cases due to Burns by assault. With more cases seen among Females compared to males, the Suicidal: Accidental ratio was higher in Females than in Males. (*Table 1*)i.e.22.5% (n=87 out of 387) in Females compared to 11.1% (n=29 out of 261) among males. The p-value of this observation was found to be significant with a p-value of less than 0.001. The odds ratio of the above finding was 2.32, suggesting a higher risk among females.

Table 1: The ratio of Accidental v/s Suicidal burns and the Comparison based on Gender

	Suicidal/Accidental				
	Accidental	Assault	Acid assault	Suicidal	Total
Females	300 (77.5%)	0	0	87 (22.5%)	387
Male	228 (87.4%)	2 (0.8%)	2 (0.8%)	29 (11.1%)	261
Total	528 (81.5%)	2 (0.3%)	2 (0.3%)	116 (17.9%)	648
Pearson's Chi-squared test value was 19.038 and a p-value of less than 0.001 for above significant rates in females.					

2. **Geographical Distribution**: Distribution across different districts or regions in Northern Kerala was seen as follows. n= 232 (35.8%) from Kozhikode, n=191 (29.5%) from Malappuram, n=134 (20.6%) from Wayanad and n=95 (14.6%) from all other adjacent districts (Kannur, Palakkad, Thrissur, Tamil Nadu etc.) and Suicidal Burns tallied among Individuals Geographically cites: n=34 (29.3%) from Wayanad, n=30 (25.8%) from Kozhikode, n=29 (25%) from Malappuram, and n=22 (18.9%) from Other nearby districts. Thisimplies a higher prevalence of Suicidal burns in Wayanad when compared to the rest of the districts.

3. **Age-group**: Above descriptive analysis, we find that Female Suicide rates are higher than Males in 3:2ratios. When going through the age group-wise analysis among Females Burns and Self Immolation by Suicide the Numbers showed: (*Table2*)

Table 2: Age-category comparison among females admitted with Burns-related events.

Age Category	*No. of females*	*Percentage*

0-20 years	43	11.1%
21-40 years	161	41.6%
41-60 years	111	28.6%
61-80 years	60	15.5%
81-100 years	12	3.1%
Total	**387**	

Burns rates were highest among the Age group of 21-40 Years, amounting to 41.6% of the total Burns incidence. In the same age criteria, the suicide rate was the greatest, at 25%. The female suicide ratio was 32.3% in this age group (21-40 years). Female suicide incidence was seen as high in 0-20 years of age at 30.2%. The above finding was found to be significant for 21-40 years of age at a p-value of 0.001 and for 0-20 years of age with a p-value of 0.014. The oddsratio calculated for Female to Male Risk was 9.533 for the age group 0- 20 years and 2.552 for the age group 21-40 years. Suggesting a high risk among Females in the age group of 0-20 and 21-40 years of age. (*Table 3*)

Table 3: Age-group comparison among patients admitted with Burns-related events and with the Causality (Suicidal v/s non-suicidal) by fisher-exact test.

Age-group/Sex category tabulation				
Age category	Gender	Suicidal	Non-Suicidal	Total
0-20 years	Female	13 (30.2%)	30 (69.8%)	43
	Male	1 (4.3%)	22 (95.7%)	23
	Total	14 (21.2%)	52 (78.8%)	66
Pearson'sChi-Squared continuity CorrectionLikelihood RatioFisher's Exact Test, p-value: 0.024 for **Age-Category 0-20 years.**				
21-40 years	Female	52 (32.3%)	109 (67.7%)	161
	Male	20 (15.7%)	107 (84.3%)	127
	Total	72 (25%)	216 75%)	288
Pearson'sChi-Squared continuity CorrectionLikelihood RatioFisher's Exact Test,p-value: 0.002 for **Age-Category 21-40 years.**				
41-60 years	Female	13 (11.7%)	98 (88.3%)	111
	Male	7 (7.5%)	86 92.5%)	93
	Total	20 (9.8%)	184 (90.2%)	204
Pearson'sChi-Squared **continuity CorrectionLikelihood RatioFisher's Exact Test,p-value: 0.354** for **Age-Category 41-60 years.**				
61-80 years	Female	7 (11.7%)	53 (88.3%)	60
	Male	1 (6.7%)	14 (93.3%)	15
	Total	8 (10.7%)	67 (89.3%)	75
Pearson'sChi-Squared **continuity CorrectionLikelihood RatioFisher's Exact Test,p-value: 1.00** for **Age-Category 61-80 years.**				
81-100 years	Female	2 (16.7%)	10 (83.3%)	12
	Male	0	3 (100%)	3
	Total	2	13	15

	(13.3%)	(86.7%)	

Pearson'sChi-Squared continuity CorrectionLikelihood RatioFisher's Exact Test,p-value: 1.00 for Age-Category 81-100 years.

(B) Burns-based Observations and Analysis:

1. Total Burnt surface area: The majority of our cases lay in the group of TBSA of less than 40% burnt surface area, a TBSA of 81-100% Burns surface area where seen in 14.4% cases i.e n=93 cases, of which n=38 cases were attempted suicidal (40.86%) which is significant.
2. Degree of Burns: While evaluating the degree of burns among the patients, it was found that most patients, both accidental and Suicidal burns getting admitted in a tertiary centre were due to Third-degree burns. The interesting factor to view in this analysis was, of n=116 patients who attempted suicide. n=75 (55 Females and 20 males) had Third-degree burns, around 64.65%, revealing the aggravated reality of the suicidal attempt.

Females were found to have a higher rate of category three burns: 65.9% of females (n=255 out of 387) with categorythree burns, compared to 58.6% among males (n=153 out of 261) (*Table 4*).However, this observation was not statistically significant, p-value of 0.60. However, the odds ratio was 1.364.

Table 4: Gender-wise analysis of 'Category 3 burns' in both Suicidal and Non-Suicidal category

	Category 3 Burns		
	Yes	No	Total
Female	255 (65.9%)	132 (34.1%)	387
Male	153 (58.6%)	108 (41.4%)	261
Total	408 (63%)	240 (37%)	648

Pearson's Chi-squared value is: 3.534, with a p-value of 0.060. The odds ratio was: 1.364(CI: 0.986-1.885)

The burns severity among Suicidal and Non-suicidal burns was found to be similar. With 63.20% of suicide-relatedCategory 3 burns and 66.7% Category 3 burns among non-suicidal burns in Females, this observation was found to be statistically insignificant with a p-value of 0.575. (*Table 5*)

Table 5: Category of Burns among patients and Gender-based analysis based on degree of burns

Suicidal/ Non-suicidal	Gender	Category 3 Burns		
		Yes	No	Total
Suicidal	Female	55 (63.2%)	32 (36.8%)	87
	Male	20 (69%)	9 (31%)	29
	Total	75 (64.7%)	41 (35.3%)	116

Pearson's chi-squared value: is 0.314 and a p-value of 0.575 for the above observation.				
Non-Suicidal	Female	200 (66.7%)	100 (33.3%)	300
	Male	133 (57.3%)	99 (42.7%)	232
	Total	333 (62.6%)	199 (37.4%)	532
Pearson's chi-squared value: is 4.873 and a p-value of 0.027 for the above observation.				

3. Outcome of Burns admission: Of the total admission, 44% mortality was seen, mainly among the Third degree burns patients. Among Suicidal attempts, 72.4% Females succumbed to the Burns, a similar percentage (72.4%) was seen among Male suicides, compared to 46.7% and 26.3% mortality among accidental Burns among Females and males, given a similar ratio of Category Burns in Suicidal and Non-Suicidal burns, which makes the below observation significant, (*Table 6*) as the psychological will to survive is lower in patients among Suicidal group. p-value of the above observation is less than 0.001 and the odds ratio of Mortality is similar among males and females.

Table 6: Outcomes (Death or Discharge) among patients, about Suicidal and Non-suicidal causes.

Suicidal/ non-suicidal	**Gender**	**Burns outcomes**		
		Death	Discharged	Total
Suicidal	Female	63 (72.4%)	24 (27.6%)	87
	Male	21 (72.4%)	8 (27.6%)	29
	Total	84 (72.4%)	41 (27.6%)	116
Non-Suicidal	Female	140 (46.7%)	160 (53.3%)	300
	Male	61 (26.3%)	171 (73.7%)	232
	Total	201 (37.8%)	331 (62.2%)	532
Pearson's chi-squared value: is 23.101 and a p-value of 0.001 for the above observation.				

Chi-squared test was done among females of different age groups to find the significance among mortality among females based on age group. It was found that the observation of mortality among females of the age group of 21-40 and 0-20 was found to be statistically significant. Thus, a younger age group is of significance in terms of suicidal risk as well as mortality. However, the same is not true for female mortality when compared to males. Statistically, there is no significance of a Female gender over males in predicting a higher risk in terms of mortality.

Discussion.

In the analysis of factors influencing burn cases, it was observed that 2020 showed a reduced incidence of burns in tertiary care Hospitals, which could be a confounder due to COVID-19 and transportation restrictions, potentially masking the true number of cases. Consequently, this observation may not be considered significant. The study found that burn injuries were most prevalent among individuals aged 21–40 years, with a notably higher incidence of suicidal burns among females. Despite a higher rate of suicide attempts among women, mortality rates were similar across genders, with no significant survival advantage. The severity of burns, including larger TBSA and a higher proportion of third-degree burns, was significantly greater in suicidal cases, contributing to increased mortality in this group. Socioeconomic and geographic factors, particularly in regions like Wayanad, were linked to higher rates of self-inflicted burns, reflecting the impact of poverty, limited education, and healthcare access, especially among tribal populations.

While the female gender was associated with a higher risk of suicide attempts, mortality rates were similar between males and females, with both genders exhibiting similar characteristics of burns, suggesting no advantage of gender in survival outcomes as suggested in literature in studies by Ercan, et al, there are literature which also suggests that mortality in similar conditions is higher in females than in males as in studies by McGwin et al [15] and Kerby, et al.[16]Another south Indian study directs an outcome where Venkoba, et al [10], conducted a study at Madurai Medical College and Government Rajaji Hospital and examined 100 consecutive female burn admissions aged 15-40. The findings revealed that 70% were suicidal, 25% accidental, and 3% homicidal. The predominant causes were marital and interpersonal problems (51%), psychiatric disorders (23%), and physical illness (15%).

Geographically, Wayanad stood out as the district with the highest number of suicidal burns compared to neighbouring districts, where studies like Srikumar, et al [17] and Nalinam M [18] state the socio-economic backwardness of the district and the condition of tribals in term of finance, education and health, seen consistent with studies like Golshan, et al [9], which goes over to review 27 studies, mostly from India, found burns were more common in young boys (0–12 years) and adolescent/adult females (>14 years). Flame burns and scalds made up over 80% of cases, mostly occurring at home, especially among women and children. Low socioeconomic status was found to be a key risk factor.

Age also played a significant role, with individuals aged 21-40 years being at higher risk for both suicide attempts and mortality, followed by the 0-20 age group. Female suicide attempts were more frequent in these age groups. In standard studies, similar outcomes were seen, in a study by Ali, et al [7], the mean age of burn patients was 28.13 years, with over half (58.2%) aged 16–30. Labourers, housewives, and students were most affected. Flame and electrical burns were common, with most cases being accidental. The average TBSA involved was 35.49%, and mean hospital stay was 16.45 days. Female patients made up 50.6% of fatalities. Expired patients had a higher mean age (30.07 years) compared to survivors (27.01 years). Outcomes were influenced by age, gender, TBSA, and injury intent.Again the study by Choudhary, et al [8], suggested that burn injuries were most common among females aged 20–39, with flame burns being the leading cause, often occurring in kitchens using kerosene. Most patients were from rural, low socio-economic backgrounds and presented late (>4 hours). Accidental burns were more frequent than suicidal or homicidal ones. Poor outcomes

were linked to female gender, higher age, suicidal intent, larger TBSA, and TBSA >60% had a 95% mortality.

Additionally, the total burnt surface area was significantly larger in the suicidal group, with category 3 burns being more prevalent among those who attempted suicide, suggesting more severe burns in intentional self-harm cases, correlating with a mortality rate of over 44%.Research indicates that suicidal burn patients tend to have larger TBSA involvement compared to those with accidental burns, as the study by Güldoğan, et at [11], found that suicidal cases had a significantly larger TBSA involved in surviving patients, suggesting a more severe extent of injury in self-inflicted cases, and TBSA to be a significant predictor of mortality and morbidity in the patients. Similar findings were also seen in studies by Obed, et al [13]. A study by Huang, et al, [14] also suggest that the depth of burns or, a higher degree of burns is also a significant risk factor, as seen in our study where, 64.65% of our patients had a third degree burns, with a high mortality rate.

The 21-40 age group remained highly susceptible to both suicide-related burns and mortality. Moreover, the burden of female suicidal behaviour, in terms of both morbidity and mortality, was greater in women than in men, likely due to gender-specific vulnerabilities to psychopathology and psychosocial stressors. This highlights the need for women-specific strategies in suicide prevention programs, with a call for more research on suicidal behaviour in women, especially in developing countries.

This study has several limitations that may affect the accuracy and generalizability of its findings. Cultural stigma and fear of legal or social consequences can lead to underreporting or misclassification of burn cases, particularly among women and marginalized communities. Additionally, cases that do not reach tertiary care facilities, such as those resulting in death at home or treated at primary health centres are excluded, introducing potential selection bias. The reliance on patient or family accounts to determine the intent behind burns may be unreliable, and missing data on key variables like socioeconomic status and psychiatric history can weaken the validity of observed associations. Furthermore, if mortality was assessed only during hospitalization, long-term outcomes such as disability, psychological sequelae, or social reintegration challenges may be overlooked. Lastly, the findings may have limited applicability to urban settings or higher-income regions due to differences in healthcare infrastructure, societal norms, and access to mental health services.

While this study primarily focuses on clinical aspects, it is important to acknowledge the broader implications of our findings. The disproportionately high number of female victims in suicidal burn cases may be influenced by underlying socioeconomic factors such as limited access to mental health resources, societal pressures, and cultural norms. Women in certain regions may experience higher stress levels due to social and economic vulnerabilities, which could contribute to a greater incidence of self-inflicted burn injuries and they need to be addressed at a policy level.

The study addresses a critical and often underreported public health issue by focusing on suicidal burns, particularly among young women, highlighting possibility of gender-specific vulnerabilities such as psychosocial stressors, psychiatric morbidity, and socioeconomic dependence. It identifies key high-risk groups, those from low socioeconomic backgrounds, and residents of geographic hotspots like Wayanad, providing valuable insights for targeted prevention strategies and community-based interventions. Beyond classifying burns by cause,

the study explores how injury intent correlates with TBSA, burn depth, and outcomes, offering a nuanced understanding essential for both trauma care and mental health screening. Additionally, it presents a balanced, evidence-based discussion on gender differences in burn mortality, acknowledging existing literature while grounding conclusions in observed data.

Conclusion

Gender analysis revealed that while females had a higher risk of suicide attempts, mortality rates were similar between genders. Wayanad district had a higher incidence of suicidal burns compared to neighbouring areas, highlighting the need for targeted interventions. Age was a key factor, with the 21-40 age group and those aged 0-20 being the most vulnerable, especially females. The severity of burns, particularly Category 3, was strongly linked to suicidal intent. This research emphasizes the importance of addressing mental health, prevention, and treatment in high-risk populations, considering gender, age, and geographic factors.

Future studies should aim to incorporate a more detailed assessment of psychosocial factors influencing suicidal burns. Longitudinal studies could provide deeper insights into the survivors' long-term outcomes and rehabilitation needs.

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