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BURN INTENSITY AMONG WOMEN WITH UNINTENTIONAL BURN INJURY: INFLUENCE ON COGNITIVE FUNCTIONING

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ABSTRACT

The present study was examine the burn intensity influences cognitive functioning among women with unintentional burn injury. Further, it compare cognitive functioning across different burn intensity levels. 200 women burn survivors age above 19 years were examined. The intensity of burn was asked in demographic and Montreal Cognitive Assessment Urdu version scale was used to measure cognitive functioning in the study. In SPSS version 24, descriptive statistics and one-way ANOVA were employed for data analysis. The findings showed that among women burn survivors, cognitive performance significantly declined as burn severity increased. Cognitive scores were best among those with modest burn intensity and lowest among those with high burn intensity. A substantial difference between burn intensity levels was confirmed by one-way ANOVA results, with a large effect size ($\eta^2 = 0.33$) and $F(2, 197) = 49.42$, $p < .001$. All group differences were statistically significant, according to post hoc, demonstrating that significantly worse cognitive ability is linked to more severe burns. These findings illustrate how cognitive impairment increases as burn injury severity increases. The data showed that burn survivors' cognitive performance is impacted by burn severity. Those with moderate burn severity (the second highest cognitive mean score) produced a higher mean score level than those with high burn severity. Those who sustain high burns have the lowest functioning. Cognitive functioning varies across groups indicating a clear negative relationship between cognitive functioning and burn severity with cognitive functioning decreasing as burn injury severity increases.

Keywords: *Cognitive functioning, Women burn survivors, Unintentional burn injury, Montreal Cognitive Assessment (MoCA); Burn severity.*

INTRODUCTION

Burn Injury

A burn is defined primarily as an acute injury to skin or other organic tissue resulting from an external source (Spronk et al., 2019; Zabihi et al., 2024). An assessment of the classification of burn injury severity is to look at the percentage burned of total body surface area along with the depth and extent of involvement (Zabihi et al., 2024).

Prevalence

Burn injury is an important public health issue around the globe (Siddiqui et al, 2015). WHO estimates about 180,000 deaths due to burns each year, and non-fatal burns are thought to be a major contributor to morbidity (Spronk et al., 2019). Globally, in 2021, it was estimated that there were about 12.99 million severe burns and 235.34 million mild burns (Zabihi et al., 2024). Additionally, which is important to note, there was a significant disproportion with the approximately 90% of all burn injuries occurred in low- and middle-income countries (LMICs) (Siddiqui et al., 2015).

Burden of Burn Injury

Burn injuries also impose a significant burden socially and economically on the affected individual, their families, and their communities. Burn injuries can consume a high amount of medical resources including surgical intervention, intensive care, and prolonged rehabilitation (Zabihi et al., 2024; Siddiqui et al., 2015). Negative ramifications may include physical and emotional complications such as pain, contractures, infections, hypertrophic scarring, and psychological issues that may last a lifetime (Spronk et al., 2019). Increasingly, a measure to assess the health impact of a disease at a societal level is the burden of disease, which includes all health implications of the injury in one composite measure (Spronk et al., 2019). The economic and physical impact is compounded by a low return to work rate and loss of productivity (Zabihi et al., 2024).

Women and Burn Injury Vulnerability

Although not all sources directly connect general gender roles and social expectations with incidence of burns, research has noted ways in which gender identities and social factors can heighten the mental burdens and vulnerabilities for women after suffering a burn injury.

Increased Vulnerability from Gender Roles, Stigma, and Social Expectations

Gendered social expectations and stigma can have a profound impact on the mental health and recovery of women after sustaining an injury that impacts their physical appearance.

Stigmas and Self-Esteem: Scarring and disfigurement allows for deteriorating personal value associated with burns and can challenge personal value perceptions and self-esteem when burned. The weight of social stigma and stereotypes that develop with physical difference increase disconnection from higher self-esteem and exacerbate psychological distress (Page et al., 2024; Koutsimani et al., 2021). Stigma negatively correlated to self-worth and quality of life in those burned (Page et al., 2024).

Gender Roles and Appearance: Gender role and appearance standards, particularly those related to physique and youth, can enhance feelings of worthlessness and further erode self-esteem when women's bodies already face negative effects of a burn (Pérez et al., 2025). Some would argue that the "good woman" stereotype extends to presentations, or appearances, and experiencing a contraction of facial injuries and feeling ugly is a confirmation of the internal experience of shame or failure to self-value (Page et al., 2024).

Mental Health Stigma: Gender and associated norms of oppression has been associated with status of women that, at best promotes mental health suffering. Research indicates that women who exhibit expected gender norms (dependent, emotional) are appropriate recipients to certain psychiatric diagnoses (Spronk et al., 2019).

Cognitive Functioning

Cognitive functioning refers to a rather complex set of mental processes that can include attention, perception, memory, organization, and executive function skills (Hendricks et al., 2017). In a clinical perspective, cognitive functioning is generally distilled to three main domains of cognitive functioning:

- Attention
- Memory
- Problem-solving skills (Hendricks et al., 2017)

Social Factors Related to Cognitive Functioning

Cognitive impairments can often have an impact on functional independence and social engagement irrespective of the activities of daily living involved (Hendricks et al., 2017). Factors related to cognitive function include:

Cognitive Reserve (CR) or the brains' ability to withstand age or disease related declines in brain functioning. Individuals with higher levels of CR have a better outcome and rehabilitation after a brain injury. Psychiatric conditions (cognitive impairment is a defining characteristic of certain conditions, such as schizophrenia, that can increase the chance of accidental injury, including burns, with decreased judgment and decision-making (Zabihi et al., 2024). Comorbid psychological outcomes (many psychological states, including anxiety and depression, are related to cognitive deficits. The extent to which these conditions might moderate the relationship between cognitive functioning and overall functioning, may vary by population (Koutsimani et al., 2021).

Cognitive Functioning as a Psychological Outcome of Burn Injuries

Cognitive impairment is one of the most common psychological and functional outcomes for survivors of burn injuries, which may remain present even after completion of inpatient rehabilitation (Hendricks et al., 2017).

Prevalence: A high proportion of patients with burn injuries exhibit cognitive-communication impairments upon admission to an inpatient rehabilitation program, with many still showing some level of impairment upon discharge (Hendricks et al., 2017).

Impact: Cognitive impairments may adversely impact a patient's ability to understand and retain the instructions and adaptive behaviors taught to them by the rehabilitation team, and their retention or understanding, may alter recovery outcomes (Hendricks et al., 2017).

Etiology: It's possible that cognitive impairments are a direct result of the primary injury and/or medical treatments received. The following are potential etiologies: direct effects of brain injury (i.e., anoxia, inhalation of toxic fumes), medical complications (dehydration, electrolyte abnormalities, hypoperfusion/shock), the use of centrally acting medications, and anesthesia (Hendricks et al., 2017).

Burn Intensity

Burn intensity, commonly referred to as burn severity, is categorized by the depth and extent of tissue affected (Zabihi et al., 2024). One common way to categorize the extent is the Total Body Surface Area (TBSA) involved.

Categorization (Low, Moderate, and High Intensity/Severity)

Burn categorizations aren't entirely standardized for studies of burden of disease, but they are frequently based on TBSA involvement:

Low/Mild Intensity: Burn injury less than 20% TBSA are commonly indicators of severity categorized as mild (Zabihi et al., 2024). Patients with minor burns typically report fewer long term problems than patients with serious burns (Spronk et al., 2019).

High Severity: Burns injury >20% TBSA are commonly defines classified as serious and higher risk of mortality and complications (Zabihi et al., 2024).

Impact on Cognitive Functioning

Burn severity serves as a primary factor for long-term outcomes such as cognitive functioning.

Correlation of Severity: The risk for poorer long-term health-related quality of life is higher with injury severity (Spronk et al., 2019). Although the correlation is complicated in regards to cognitive scores, research shows that the factors associated with severe burns, such as hospital stay, total body surface area involved, and number of procedures, are associated with poorer long-term outcomes overall (Spronk et al., 2019).

Impairment Mechanisms: More severe burns require a longer period of hospitalization and greater critical care, thereby increasing exposure time to inciting factors of cognitive impairment:

hypoperfusion (shock), anoxia, toxic fumes, and centrally acting medications (Hendricks et al., 2017). Medical complications are more likely or to be more pronounced with a greater burn severity.

Objectives

1. To examine burn intensity influences cognitive functioning among women with unintentional burn injury**.**
2. To compare cognitive functioning across different burn intensity levels.

METHOD

The current research was conducted to investigate the burn intensity and cognitive functioning among women with unintentional burn injury.

Design

The current study employed a cross-sectional research design to collect data from women with unintentional burn injury.

Participants

The study's sample of 200 female burn survivors was carefully selected to meet certain inclusion and exclusion criteria. Participants were adult females aged 19 years or older who had incidental burn injuries six months to two years before to the study's initiation.

A number of exclusion criteria were also finalized. To ensure that post-burn cognitive functioning could be more reliably attributed to the burn experience itself, rather than to unrelated medical or psychological conditions, participants with physical impairments, diagnosed mental health conditions, or pre-existing physical illnesses were excluded from the study. In order to preserve a distinct and focused focus on women who suffered accidental burn trauma, cases involving intentional burn injuries (such as self-harm or violence) and male burn survivors were also disregarded. In order to guarantee that the sample represented adult psychosocial experiences—which can differ significantly from those of adolescents—women under the age of 19 were also excluded.

Sampling technique

Purposive sampling, which is frequently used in psychological and medical research where particular participant traits are crucial to the study's goals, was used to choose the participants. Age, gender, and the existence of burn injuries of different severity were among the predetermined inclusion criteria that purposefully served as a guide for the selection procedure. Participants were only invited if they satisfied these requirements and could give their full consent. By carefully choosing people with relevant experiences, the researcher was able to guarantee that the sample accurately reflected the target population of women burn survivors. In order to guarantee the gathering of rich, pertinent, and significant data in line with the goals of the study and to enable a thorough analysis of the psychological effects of burn severity, purposeful sampling was selected.

Measures

The following instruments were used to collect data from respondents. A sociodemographic data collection form was developed. Age, education, marital status, family structure, employment status, type of residence, burn type, burn severity, affected body part, first aid, time since burn, length of hospital stay, health issues, satisfaction with treatment, and the person who brought the patient to the hospital are taken into consideration. The Montreal Cognitive Assessment (MoCA; Habib, Evans & Raiz, 2010) was used to assess the cognitive functioning of women who had survived burns in Urdu. A range of cognitive abilities, including executive processes, naming, attention, language, abstraction, memory, orientation, and visuoconstructional skills, are evaluated in this brief screening exam (around ten minutes). A score of 26 or higher indicates normal intellect, with a total score of 30. For mild cognitive impairment, MoCA has demonstrated outstanding sensitivity (87%) and reliability (α =.884; test–retest =.966) (Nasreddine et al., 2005). Additionally, it exhibits strong correlations with MMSE (r =.867) and intellect (r =.822) (Tu et al., 2013).

Procedure

The study's sample was selected through the use of purposive sampling. The sample consisted of

female responders who were unintentionally burned. The injury must also occur between the ages of six months and two years. The minimum age requirement for participation is nineteen. The sample was sourced from local communities and non-governmental organizations, as well as numerous burn centers in Lahore, Gujrat, Islamabad, and Rawalpindi. For the aim of gathering data, the hospital and non-governmental organizations were given the scale brochure, written consent, and permission letter. With official permission from the appropriate authorities, the respondents were contacted. The researcher secured the respondents' signed agreement and gave them guarantees of anonymity, such as that their identity would remain confidential, in order to guarantee that only willing participants were included in the survey. By introducing themselves, their affiliation with the organization, and the goal of the study, the researcher built rapport with the respondents before distributing the scales. In order to choose the answers that best suited their replies and mental states, the participants were enticed to carefully review the items. All of the scales used in this study were approved by the authors via email. The researcher thanked the responders for their assistance in finishing the study after data collecting was finished.

Data Analysis

Descriptive statistics and one-way ANOVA were used to evaluate the data.

RESULTS

The majority of female burn survivors had a bachelor's degree, were unemployed, and were between the ages of 15 and 35. The majority had one to three children and were married. The majority of them were from three to five-sibling, middle-class (15,000–35,000) metropolitan families. Hot or cold fluid was the most common cause of burns, with one to three body parts suffering third-degree burns. Most had two or three health problems, were happy with the care they received, had short hospital stays, were immediately provided first aid after the injury, and were taken to the hospital by their parents.

Table 1 Descriptive Statistics and One-Way Anova for Cognitive Functioning Across Burn Intensity Levels

Group	N	M	SD	Min	Max
Low Burn Intensity	16	23.50	4.37	13	28
Moderate Burn Intensity	79	15.65	4.03	5	24
High Burn Intensity	105	12.78	4.19	6	28
Total	200	14.77	5.05	5	28

The table compares the cognitive functioning of women with varying degrees of burn severity using descriptive data. Cognitive functioning was highest among participants with low burn intensity (N = 16) (M = 23.50, SD = 4.37). The mean score for cognitive functioning was lower for those with moderate burn severity (N = 79) (M = 15.65, SD = 4.03). Cognitive functioning was lowest among participants with high burn intensity (N = 105; M = 12.78, SD = 4.19). As burn severity rises, there is a visible downward trend in cognitive functioning scores. This indicates that less cognitive function is associated with more extensive burns. There is a range of performance across categories, as demonstrated by the minimum scores, which range between 5 and 13, and the maximum scores, which range between 24 and 28 across groups. The overall mean cognitive score for the combined group of 200 subjects was 14.77 (SD 5.05), indicating mild cognitive impairment. The findings suggest that cognitive performance is affected significantly by the degree of burn.

Table 2 One-Way Anova Summary Table for Cognitive Functioning

Source	SS	df	MS	F	p	η^2 (effect size)
Between Groups	1694.984	2	847.492	49.42	<.000	0.33
Within Groups	3378.092	197	17.148			
Total	5073.076	199				

With a large effect size (η^2 = 0.33), the one-way ANOVA shown in Table 2 shows a significant difference in cognitive functioning across levels of burn intensity ($F(2, 197) = 49.42$, $p < .001$). This indicates that about 33% of the variance in cognitive performance is explained by the differences in burn intensity. Participants with high burn intensity had a significantly worse performance on cognitive tasks than participants in both the moderate and low burn intensity groups.

Table 3 Post Hoc Comparisons of Cognitive Functioning By Burn Intensity

Group (I)	Group (J)	Mean Difference (I–J)	SE	Sig	95% CI Lower	95% CI Upper
Low	Moderate	7.85443	1.13525	.000	5.1735	10.5354
Low	High	10.71810	1.11132	.000	8.0936	13.3426
Moderate	Low	-7.85443	1.13525	.000	-10.5354	-5.1735
Moderate	High	2.86366	.61674	.000	1.4072	4.3201
High	Low	-10.71810	1.11132	.000	-13.3426	-8.0936
High	Moderate	-2.86366	.61674	.000	-4.3201	-1.4072

Note. All mean differences are significant at $p < .001$. SE = standard error; CI = confidence interval.

As shown in Table 3, pairwise comparisons for all burn intensity groups were statistically significant post hoc ($p < .001$). In terms of cognitive performance, participants in the low burn intensity group did better than both the moderate (Mdiff = 7.85) and high burn intensity groups (Mdiff = 10.72). Likewise, the moderate burn intensity group had better cognitive performance than the high burn intensity group (Mdiff = 2.86). These results suggest a downward gradient in cognitive function as burn severity increases. In other words, individuals with more serious burns perform significantly worse cognitively than individuals with less serious burns.

DISCUSSION

The analysis provided clear and strong evidence of a negative association between burn intensity and cognitive performance within a sample of women with unintentional burn injuries, as evidenced by systematically decreased cognitive functioning as burn severity increased, in accordance with existing literature on the negative neurological impacts of burn injury (Xie et al., 2022; Bajorek et al., 2017); descriptive statistics (Table 1) clearly portrayed the trends in typical dose response effects. The Low Burn Intensity groups had the highest mean cognitive performance (M=23.50) and indicated intact, or nearly intact, cognitive performance. The Moderate (M=15.65) and High Burn Intensity (M=12.78) groups demonstrated descending mean cognitive performance and thus descending cognitive ability. The overall mean cognitive score (M=14.77) observed across the 200 participants was indicative of mild cognitive impairment, demonstrating the large cognitive impacts of burn injury on an individual even after lower degrees of burn injury were sustained (Sanders et al., 2019). The One-Way ANOVA results demonstrated the statistically significant differences in cognitive performance between the three burn intensity groups ($F(2, 197)=49.42$, $p<.001$). In addition, the large effect size (0.33) indicated that burn intensity contributes to a large amount of the variance (33%) in cognitive performance, conveying that burn injury is a substantially meaningful predictor of cognitive performance (Spronk et al., 2019; Kim, 2014).

Post Hoc Comparisons depicted in (Table 3) delve deeper into these findings and can confirm that each of the pairwise comparisons were statistically significant ($p < .001$), reflecting a gradual, step-wise drop in cognitive performance relative to the level of burn injury, with each group performing markedly worse on cognitive assessments than the lower burn groups (High vs Moderate; Moderate vs Low). The cognitive decline demonstrated in this study is consistent with valiant clinical and animal model studies focusing on the neuropathophysiology of severe burn injury. Burn injury produces a significant systemic inflammatory response, culminating in the potential breakdown of the blood-brain barrier (BBB) and a neuroinflammatory response (Xie et al., in press; Chen et al., 2023). These events may be magnified in the presence of precipitants such as hypoxia, electrolyte imbalance, and sepsis emerging in negative outcomes in critical illness, all of which can lead to neuronal cell death (apoptosis) and a variety of neurological sequelae, cognitive deficits (i.e. memory) in the Central Nervous System (CNS). (Xie et al., in press; Chen et al., 2023; Hendricks et al., 2017.) The demographic composition of participants in this inquiry (female, young to middle age, married, with children, urban) speaks to the larger societal implications of this cognitive decline because, in the post injury period, impairments to capacity will be expressed in a woman's ability to return to professional, family, and everyday roles. The data strongly indicate that the severity of a burn has a substantial and negative impact on cognitive functioning in women who were survivors of a burn injury (Kim & Park, 2017). Given the statistically significant and clinically meaningful declines in cognitive scores were generally observed, especially in moderate and severe groups, the need for assessment and rehabilitation in neuropsychology in patients with severe burn is supported (Hendricks et al., 2017). Early detection and treatment for cognitive deficits may be important for advancing long term functional outcomes and quality of life for the survivors of burn injury.

Conclusion

All findings indicate there is a notable and adverse effect of burn severity on cognitive functioning among women sustaining unintentional injuries due to burn. High burn intensity had the lowest level of cognitive functioning. Cognitive performance obviously declined comparably and in a relative manner to increasing severity of the burn. It is worthwhile to understand there is potential for little delay to severe burn injury in terms of thorough critical evaluation from a neuropsychology standpoint.

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