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Head and neck burns are associated with long-term patient-reported dissatisfaction with appearance: A Burn Model System National Database study

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ABSTRACT

Introduction: Burns affecting the head and neck (H&N) can lead to significant changes in appearance. It is postulated that such injuries have a negative impact on patients' social functioning, quality of life, physical health, and satisfaction with appearance, but there has been little investigation of these effects using patient reported outcome measures. This study evaluates the effect of H&N burns on long-term patient reported outcomes compared to patients who sustained burns to other areas.

Methods: Data from the National Institute on Disability, Independent Living, and Rehabilitation Research Burn Model System National Database collected between 1996 and 2015 were used to investigate differences in outcomes between those with and without H&N burns. Demographic and clinical characteristics for adult burn survivors with and without H&N burns were compared. The following patient-reported outcome measures, collected at 6, 12, and 24 months after injury, were examined: satisfaction with life (SWL), community integration questionnaire (CIQ), satisfaction with appearance (SWAP), short form-12 physical component score (SF-12 PCS), and short form-12 mental component score (SF-12 MCS). Mixed regression model analyses were used to examine the associations between H&N burns and each outcome measure, controlling for medical and demographic characteristics.

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Results: A total of 697 adults (373 with H&N burns; 324 without H&N burns) were included in the analyses. Over 75% of H&N injuries resulted from a fire/flame burn and those with H&N burns had significantly larger burn size ($p < 0.001$). In the mixed model regression analyses, SWAP and SF-12 MCS were significantly worse for adults with H&N burns compared to those with non-H&N burns ($p < 0.01$). There were no significant differences between SWL, CIQ, and SF-12 PCS.

Conclusions: Survivors with H&N burns demonstrated community integration, physical health, and satisfaction with life outcomes similar to those of survivors with non-H&N burns. Scores in these domains improved over time. However, survivors with H&N burns demonstrated worse satisfaction with their appearance. These results suggest that strategies to address satisfaction with appearance, such as reconstructive surgery, cognitive behavior therapy, and social skills training, are an area of need for survivors with H&N burns.

1. Introduction

Despite advances in acute burn care and treatment of burn-related sequelae, many burn survivors experience disabling scarring deformities [1,2]. Extensive scarring not only causes functional impairment, limiting patients' abilities to perform daily tasks and activities, but can also cause significant psychological and social distress [3–5]. In general, the head and neck (H&N) region is a highly specialized body area that holds key psychological and social functions [6]. Post-burn scarring can significantly impact each of these functions, as well as impairing patients' respiratory function [7], vision, oral continence [8], and the ability to express emotions [5].

H&N burns are common and affect many individuals every year [9]. Heilbronn et al. reported that over 200,000 patients were assessed in emergency departments in the United States due to H&N burns from 2009 to 2013 [10]. The high number of affected patients and the potential lifelong impact of H&N injuries highlight the need for the development and refinement of dedicated therapeutic strategies that can improve patient outcomes.

Secondary reconstructive surgery can help attenuate negative results such as scarring [11]. Although current techniques have demonstrated effectiveness in correcting functional disabilities, they have demonstrated suboptimal capacity to address psychological and social outcomes [12]. In a recent qualitative study on burn survivors with visible burns in Australia, the authors reported persistence of social and emotional challenges [14]. In a young adult burn population in the United States, burn survivors with facial burns experienced increased anger and sadness compared to those without facial injuries [14].

To our knowledge, limited research exists investigating long-term psychological, social, and physical outcomes for H&N burn survivors. Therefore, the purpose of this study is to evaluate psychosocial outcomes for H&N burn survivors using a longitudinal, multi-center burn outcomes database to explore the psychosocial and physical complications of those with H&N burns in comparison to those with non-H&N burns at long-term follow-up. Our hypothesis is that those with H&N burns will demonstrate worse psychosocial and physical outcomes than those with non-H&N burns.

2. Methods

2.1. Database

Data was obtained from the Burn Model System (BMS) National Database, funded by the National Institute on Disability, Independent Living, and Rehabilitation Research. The BMS Database was established in 1993 to examine the functional and psychosocial outcomes of burn survivors and it includes both adults and children [15]. Data are collected from subjects at the time of hospital discharge and at 6, 12, and 24 months after injury. Informed consent is obtained from all included subjects, and each center's Institutional Review Board oversees the data collection. Adult participants with burns between 1996 and 2015 were included in the study; the "head/neck burn" variable was used to stratify subjects into two groups: those with and without H&N burns. The enrollment criteria for the BMS National Database include those with more severe injuries. The current BMS Database enrollment criteria includes those who require autografting surgery for wound closure and are

- 0-64 years of age with a burn ≥20% total body surface area (TBSA) OR
- ≥65 years of age with a burn ≥10% TBSA OR
- any age with a burn injury to their face/neck, hands, or feet OR
- any age with a high-voltage electrical burn injury.

Modifications have been made to the BMS Database inclusion criteria over time. Details of the inclusion criteria, data collection process, and data collection sites can be found at http://burndata.washington.edu/. The BMS Database is an electronic, centralized database, that utilizes REDCap electronic data capture tools hosted at the BMS National Data and Statistical Center at the University of Washington [16]. REDCap (Research Electronic Data Capture) is a secure, web-based application designed to support data capture for research studies.

2.2. Demographic and clinical variables

Demographic data included age, gender, race/ethnicity, and employment status pre-injury. Medical data included the

presence of H&N burn, burn size (TBSA burned), burn etiology, and length of hospital stay.

2.3. Outcome measures

The following patient-reported outcome measures were used to assess long-term functional and psychosocial outcomes.

2.3.1. Satisfaction with life (SWL)

The SWL score measures life satisfaction and has previously demonstrated reliability and validity [17]. Psychometric evaluation in spinal cord injury, traumatic brain injury, and burn populations has shown the instrument to be useful in evaluating trauma outcomes [18]. There are different factors that define life satisfaction: social relationships, work or school, personal satisfaction with religious or spiritual life, learning in addition to growth, and leisure [17]. Items are scored on a 1–7 Likert scale with a total of 5 items and a maximum score of 35; higher scores indicate greater life satisfaction.

2.3.2. Satisfaction with appearance (SWAP)

The SWAP scale is a validated and reliable tool used to determine satisfaction with appearance in the burn population [19]. Participants are asked to rate each item on the basis of their thoughts and feelings in regards to their appearance post-burn. Each of the 14 items is rated on a 7-point scale, 1 (strongly disagree) to 7 (strongly agree) (Table 4). Subscales include social distress, facial features, non-facial features, and perceived social impact. Scores for facial and non-facial features can range from 0 to 24 and scores for social distress and perceived social impact range from 0 to 18. Higher scores suggest greater dissatisfaction with appearance and body image following injury. Total scores range from 0 to 84.

2.3.3. Community integration questionnaire (CIQ)

The CIQ score is intended to provide a measure on an individual's level of social integration (home and community integration). Gerrard et al. have validated this questionnaire in the adult burn injury population [20]. The overall score can range from 0 to 29, with a higher score indicating greater social integration. For the purposes of this study, the social integration sub-score was used (items 6 through 11 were summed, with possible scores ranging from 0 to 12). Most items are scored on a 3-point scale from 0 to 2. Sub-scores include home integration, social integration, and productivity. Most questions touch on individual performance on a specific activity within the household or community and whether it's performed alone or by someone else.

2.3.4. The short form-12 (SF-12) version 2

The validated SF-12 Health Survey was created as a shorter version of the SF-36 to measure health status and well-being [21]. The SF-12 includes 2 sub-scores: the physical component summary (PCS) and the mental component summary (MCS). Scores are standardized with a t-score transformation with a mean of 50 and standard deviation of 10 with a maximum of 100 based on a U.S. population [22]. Scores greater than 50 represent above average health status.

BMS Database subjects completed follow-up outcome questionnaires at 6±2 months, 12±3 months, and 24 ±6 months post-injury. Subjects were divided into four groups: adult males with and without H&N burn and adult females with and without H&N burn. For each group and outcome measure, mean scores at each follow-up time point were determined and portrayed graphically (Figs. 1 and 2). The preliminary examination of raw data did not use tests of statistical significance given that the primary analyses utilized mixed models, controlling for confounding variables, to examine significance.

3. Procedures

3.1. Regression analyses

Mixed models were employed for statistical analyses due to the study's repeated measures design and uneven follow-up intervals. This statistical methodology also handles missing data and does not require imputation [23]. A model was created for each outcome measure (SWAP, SWL, CIQ, SF-12 PCS, and SF-12 MCS). If the interaction term (H&N burn by time) was not significant ($p > 0.05$), it was removed and the model was re-calculated. analyses was completed using STATA/SE version 13.1. Models included the following demographic and medical variables: age in 10-year increments, gender, race/ethnicity, employment status pre-injury, time since burn, presence of H&N burn, TBSA burned in 10% increments, burn etiology, and length of hospital stay.

3.2. Item and subscale level analyses

For outcome measures that were statistically different between the H&N and non-H&N populations in the mixed models, an item or subscale level analyses was used to explore the significant differences between the two groups. If the SWAP, SWL or CIQ were different between groups, the percentage of subjects reporting poor functioning for each item in the scale was examined for the H&N and non-H&N groups at all three follow-up time points. If the MCS or PCS was statistically different between groups, the eight component scales (physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional, and mental health) were examined because all items contribute to both the MCS and PCS scores. The Wilcoxon–Mann Whitney test was used to test differences between the two samples. A p-value less than 0.05 was considered significant.

4. Results

4.1. Patients with H&N burns and non-H&N burns show dissimilar demographics

A total of 697 adults were included in the study; 373 subjects had H&N burns while 324 had burns elsewhere. The two groups were similar in age (H&N burns, 44.6±15.0 years; non-H&N burns, 44.8±15.9 years) and gender (H&N burns, 73.7% male; non-H&N burns, 71.6% male). However, the subjects with H&N burns had larger burn sizes (26.0±17.4 vs. 13.3±13.9; $p < 0.001$), were more likely to have a fire/flame injury (76.7% vs.

Table 1 – Clinical and demographic characteristics of the study population.

	H&N burn (n=373)	Non-H&N burn[a] (n=324)	p-Value
Age, mean years (SD)	44.6 (15.0)	44.8 (15.9)	0.80
Burn size, mean percent (SD)	26.0 (17.4)	13.3 (13.9)	<0.01
Length of stay, mean days (SD)	37.5 (30.9)	24.0 (19.4)	<0.01
Male Gender, percent (n)	73.7 (275)	71.6 (232)	0.53
Etiology, percent (n)			<0.01
Fire/flame	76.7 (286)	42.6 (138)	
Scald	1.6 (6)	18.2 (59)	
Contact with hot object	3.0 (11)	10.5 (34)	
Grease	5.6 (21)	16.4 (53)	
Other	13.2 (49)	12.3 (40)	
Ethnicity/race, percent (n)			0.52
White, non-Hispanic	66.0 (246)	63.9 (207)	
Black, non-Hispanic	12.3 (46)	15.1 (49)	
Hispanic	15.6 (58)	14.8 (48)	
Other	6.1 (23)	6.0 (20)	
Working pre-injury, percent (n)	69.2 (258)	61.7 (200)	0.09

H&N=Head and Neck.

[a] Non-H&N burn includes burns to the torso (31.8%, n=103), arms (48.5% n=157), hands (63.3%, n=205), legs (59.3%, n=192), or feet (53.7%, n=174). Individuals may have burns to more than one area.

Table 2 – Comparison of outcomes between head & neck and non-head & neck burn populations at 6, 12, and 24 months.

Outcome	H&N burn						Non-H&N burn					
	6 months		12 months		24 months		6 months		12 months		24 months	
	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n
MCS	47.7 (11.8)	394	47.5 (11.6)	371	48.1 (11.9)	287	49.0 (11.6)	334	48.8 (12.3)	273	48.4 (11.2)	226
PCS	41.9 (10.7)	394	43.2 (10.7)	371	45.4 (11.2)	287	44.0 (11.4)	334	45.2 (11.6)	273	47.2 (10.8)	226
SWAP	33.3 (18.5)	399	33.6 (19.6)	374	32.3 (19.8)	295	24.6 (16.7)	334	23.5 (16.7)	284	23.6 (16.5)	229
CIQ	7.8 (2.6)	397	7.7 (2.5)	375	8.0 (2.5)	298	7.8 (2.5)	340	7.8 (2.4)	285	7.8 (2.4)	231
SWL	20.6 (8.4)	402	20.3 (8.5)	381	21.8 (8.5)	296	21.2 (8.5)	346	21.7 (8.7)	286	21.5 (8.6)	236

H&N=head and neck, MCS=mental component summary of the SF-12, PCS=physical component summary of the SF-12, SWAP=satisfaction with appearance scale, CIQ=community integration questionnaire, SWL=satisfaction with life scale.

42.6%; $p<0.001$), and had longer lengths of stay in the hospital (37.5±30.9 vs. 24.0±19.4; $p<0.001$). Full demographic and medical characteristics of the study populations are presented in Table 1.

4.2. *Mixed model regression analyses*

In the mixed models regression analyses, SWAP and MCS outcome measures were significantly worse for adults with H&N burns compared to those with non-H&N burns, controlling for demographic and clinical factors ($p<0.01$) (Tables 2 and 3). SWL, CIQ, and SF-12 PCS demonstrated no significant differences between those with and without H&N burns. Additionally, time was associated with improved scores for all five measures ($p<0.05$).

4.3. *Item and subcale level analyses*

Item level data for SWAP was examined because scores were significantly different between H&N and non-H&N groups. SWAP items are scored on a 1–7 Likert scale with higher scores indicating greater dissatisfaction with appearance. The percentages of subjects with high scores (5,6, or 7) were compared between the H&N and non-H&N groups. For all statistically significant items, the H&N group exhibited worse scores than the non-H&N group and most SWAP items were significantly different between the two groups at each of the time points (6 months: 10 of 14 items; 12 months: 11 of 14 items; 24 months: 12 of 14 items) (Table 4). The eight SF-12 scales were examined because MCS scores were statistically different between those with and without H&N burns. SF-12 scale scores are standardized to a mean of 50 and standard deviation of 10; scores greater than 50 indicate an individual is doing better than the average of a national population-based sample. For all statistically significant scales between groups, the H&N group had worse scores than the non-H&N group, indicating a lower quality of life. The H&N group exhibited worse scores in 6 of 8 scales at 6 months, 3 of 8 scales at 12 months, and 2 of 8 scales at 24 months (Table 5).

4.4. *Post-hoc analyses*

Given that gender was often a predictor in many of the mixed models examining outcomes, a post-hoc analyses was

Table 3 – Mixed effects linear regression analyses examining association between head and neck burn and outcomes, controlled for demographic and clinical factors.

	MCS				PCS				SWAP			
	Coeff	Rob SE	95% CI	p-Value	Coeff	Rob SE	95% CI	p-Value	Coeff.	Rob SE	95% CI	p-Value
Head & neck burn	−3.01	1.09	−5.16, −0.87	<0.01	−0.15	0.75	−1.63, 1.33	0.85	6.91	1.25	4.46, 9.36	<0.01
Time since burn	−1.00	0.46	−1.91, −0.1	0.04	2.36	0.29	1.78, 2.93	<0.01	−1.06	0.42	−1.89, −0.23	0.01
Age (units of 10 years)	0.10	0.65	0.05, 2.60	0.68	−1.20	0.24	−1.66, −0.74	<0.01	−0.84	0.38	−1.58, −0.09	0.03
Female gender	−3.33	0.85	−5.0, −1.65	<0.01	−1.22	0.77	−2.72, 0.29	0.11	8.02	1.37	5.32, 10.71	<0.01
Length of hospital stay	−0.01	0.01	−0.03, 0.01	0.48	−0.05	0.01	−0.08, −0.02	<0.01	0.05	0.02	0.001, 0.08	0.04
TBSA burned (units of 10%)	0.33	0.27	−0.20, 0.85	0.23	−1.21	0.27	−1.74, −0.68	<0.01	1.20	0.45	0.33, 2.08	0.01
Fire/flame burn[a]	−0.79	0.86	−2.47, 0.90	0.36	1.06	0.76	−0.42, 2.54	0.16	0.14	1.30	2.85, 7.79	0.92
Race/Ethnicity[b]	−2.10	0.79	−3.64, −0.57	0.007	−1.42	0.69	−2.77, −0.072	0.04	5.32	1.26	2.85, 7.79	<0.01
Not employed at time of injury[c]	−1.63	0.86	−3.31, 0.05	0.06	−2.85	0.80	−4.42, −1.29	<0.01	−0.21	1.34	−2.84, 2.42	0.88
Constant	55.13	1.76	51.69, 58.58	<0.01	53.36	1.58	50.55, 56.76	<0.01	14.10	2.71	8.78, 19.41	<0.01

	CIQ				SWL			
	Coeff.	Robust SE	95% CI	p-Value	Coeff.	Robust SE	95% CI	p-Value
Head & neck burn	0.26	0.18	−0.09, 0.61	0.15	−0.30	0.62	−1.51, 0.92	0.63
Time since burn	0.15	0.07	0.01, 0.29	0.03	0.61	0.21	0.20, 1.01	<0.01
Age (units of 10 years)	−0.26	0.05	−0.36, −0.16	<0.01	−0.19	0.19	−0.55, 0.18	0.32
Female gender	−0.003	0.17	−0.35, 0.34	0.99	−0.23	0.65	−1.50, 1.04	0.72
Length of hospital stay	−0.01	0.003	−0.01, −0.002	0.007	−0.03	0.01	−0.04, −0.01	0.003
TBSA burned (units of 10%)	−0.10	0.06	−0.21, 0.02	0.10	−0.11	0.20	−0.50, 0.27	0.57
Fire/flame burn[a]	−0.03	0.17	−0.37, 0.31	0.85	−0.09	0.62	−1.30, 1.12	0.88
Race/Ethnicity[b]	−0.88	0.16	−1.19, −0.57	<0.01	−0.56	0.58	−1.71, 0.58	0.34
Not employed at time of injury[c]	−0.45	0.18	−0.81, −0.09	0.013	−1.89	0.63	−3.13, −0.65	0.003
Constant	10.10	0.36	8.87, 10.29	<0.01	23.69	1.33	21.1, 26.3	<0.01

MCS = mental component summary of the SF-12, PCS = physical component summary of the SF-12, SWAP = satisfaction with appearance scale, CIQ = community integration questionnaire, SWL = satisfaction with life scale, Coeff. = coefficient, TBSA = total body surface area.

[a] Other burn is reference category to which fire/flame is compared. Other burn includes: scald, contact with hot object, grease, and other (including: tar, chemical, hydrofluoric acid, electricity, radiation, UV light, frostbite, TENS/Stevens Johnson, abrasions, flash burn, necrotizing fasciitis, meningococcemia, other skin disease, and missing/unknown).

[b] Caucasian ethnicity is reference category to which non-white ethnicity is compared.

[c] Employed is reference category to which not employed is compared.

conducted examining gender differences in mean scores at each timepoint. For all five outcome measures, females with H&N burns had mean scores indicating worse outcomes than males. For four of the five outcomes, females with and without H&N burns had worse outcomes than males. Mean SWAP and MCS scores by gender and H&N group are illustrated in Figs. 1 and 2.

5. Discussion

It has long been postulated that patients with extensive facial burns confront a particular and more impairing set of challenges given the roles the face plays in social interactions, personal identity, and essential physiological functions [25,41]. Even so, objective data to corroborate these assumptions has been lacking, particularly in the U.S. population. This study employs a database containing self-reported patient outcome data to examine long-term psychosocial and functional outcomes of those with and without H&N burns.

The authors hypothesized that individuals with H&N burns would experience worse outcomes than individuals with non-H&N burns. The results, however, suggest that some elements of long-term physical and psychosocial well-being of patients with H&N burns are similar to those of patients with non-H&N burns indicating a degree of resiliency. Burn survivors with and without H&N burns reported similar satisfaction with life, community integration, and physical function outcomes when controlling for demographic and medical factors, including severity of injury. Importantly, however, adult H&N burn survivors demonstrated greater dissatisfaction with their appearance compared to patients with non-H&N burn injuries, and this dissatisfaction persisted over time. This dissatisfaction has also been shown to affect quality of life [24]. This finding is important in that scars often continue to change and improve with time and many reconstructive options are not available until a person's scars have matured for a year.

Our findings support the results of several other studies that have found that survivors with facial burns experience more challenges with appearance [25,26]. Additionally, findings specific to the differences seen by race/ethnicity and gender are consistent with the literature. Studies in the burn population have shown burn survivors identifying as

Table 4 – Comparison of high Satisfaction with Appearance Scale (SWAP) item scores between groups.

SWAP item, percent high score (>=5)	H&N burn 6 months, n=399 12 months, n=374 24 months, n=295	Non-H&N burn 6 months, n=334 12 months, n=284 24 months, n=229	p-Value*
1. Uncomfortable in the presence of family			
6-months	20.5	13.4	0.009
12-months	17.0	14.7	0.420
24-months	19.4	10.6	0.006
2. Uncomfortable in the presence of friends			
6-months	30.3	24.7	0.081
12-months	30.8	23.2	0.028
24-months	30.8	22.5	0.032
3. Uncomfortable in the presence of strangers			
6-months	42.1	36.9	0.150
12-months	43.9	34.9	0.019
24-months	41.6	30.9	0.011
4. Satisfied with overall appearance			
6-months	43.3	28.2	0.000
12-months	40.9	26.8	0.000
24-months	37.1	28.1	0.028
5. Satisfied with appearance of scalp			
6-months	13.8	7.6	0.006
12-months	16.9	6.2	0.000
24-months	14.7	6.0	0.001
6. Satisfied with appearance of face			
6-months	25.7	5.2	0.000
12-months	24.5	6.6	0.000
24-months	26.1	4.3	0.000
7. Satisfied with appearance of neck			
6-months	28.7	4.4	0.000
12-months	30.0	5.5	0.000
24-months	28.6	3.9	0.000
8. Satisfied with appearance of hands			
6-months	40.2	26.2	0.000
12-months	40.7	25.5	0.000
24-months	39.2	23.1	0.000
9. Satisfied with appearance of arms			
6-months	42.3	21.3	0.000
12-months	45.4	24.8	0.000
24-months	40.2	20.9	0.000
10. Satisfied with appearance of legs			
6-months	35.2	34.6	0.857
12-months	35.8	32.5	0.381
24-months	31.3	32.2	0.830
11. Satisfied with appearance of chest			
6-months	30.3	9.6	0.000
12-months	31.9	11.0	0.000
24-months	30.6	9.0	0.000
12. Appearance interferes with relationships			
6-months	30.9	23.6	0.027
12-months	29.1	21.2	0.020
24-months	32.0	23.9	0.041
13. Feel burn is unattractive to others			
6-months	57.4	55.0	0.512
12-months	53.8	51.0	0.477
24-months	59.3	50.4	0.042
14. Don't think people would want to touch me			
6-months	35.9	28.5	0.029
12-months	33.9	26.7	0.044
24-months	29.3	26.4	0.458

H&N=head and neck.

**Wilcoxon-Mann Whitney tests used to test differences between the two samples.

* The Satisfaction with Appearance Scale (SWAP) contains 14 items rated on a 7-point scale with 1 indicating strongly disagree and 7 indicating strongly agree. Total scores range from 0-84 with higher scores indicating greater dissatisfaction with appearance and body image following injury.

Table 5 – Comparison of SF-12 scores between groups.

SF-12 Scale Score, Mean (SD) SF	H&N burn 6-months, n=394 12-months, n=371 24 months, n=287	Non-H&N burn 6-months, n=334 12-months, n=273 24 months, n=226	p-Value*
Physical Functioning			
6-months	42.9 (12.1)	44.6 (12.5)	0.0237
12-months	44.4 (11.8)	45.6 (11.8)	0.1212
24-months	46.1 (11.4)	47.8 (11.4)	0.0252
Role Physical			
6-months	41.0 (12.0)	42.9 (12.2)	0.0247
12-months	42.4 (11.7)	44.8 (12.1)	0.0050
24-months	44.4 (11.4)	46.3 (11.8)	0.0226
Bodily Pain			
6-months	41.4 (12.7)	43.3 (12.8)	0.0259
12-months	42.1 (13.4)	44.6 (13.6)	0.0070
24-months	45.5 (12.7)	45.2 (13.1)	0.8790
General Health			
6-months	45.9 (11.5)	47.7 (11.0)	0.0383
12-months	45.9 (11.5)	46.9 (12.0)	0.1600
24-months	47.0 (12.0)	48.0 (11.3)	0.5353
Vitality			
6-months	48.5 (11.1)	50.4 (11.8)	0.0084
12-months	48.8 (11.4)	50.0 (11.9)	0.1377
24-months	49.0 (11.8)	51.1 (11.0)	0.0619
Social Functioning			
6-months	44.8 (13.1)	45.5 (13.3)	0.3442
12-months	44.0 (13.0)	46.3 (13.3)	0.0047
24-months	45.1 (13.1)	46.7 (12.3)	0.1533
Role Emotional			
6-months	43.7, 12.8	45.2 (12.1)	0.1191
12-months	44.4, 11.5	45.8 (12.4)	0.0315
24-months	45.5, 11.8	45.6 (12.6)	0.5650
Mental Health			
6-months	47.0 (11.5)	48.3 (11.8)	0.0660
12-months	47.1 (12.0)	48.9 (11.9)	0.0594
24-months	48.6 (12.4)	48.4 (11.7)	0.6594

H&N=head and neck.

**Wilcoxon–Mann Whitney tests used to test differences between the two samples.

* The Short Form 12 (SF-12) was created as a shorter version of the SF-36 to measure health and well-being. Scores are standardized with a t-score transformation with a mean of 50 (SD: 10) with a maximum score of 100. Higher scores indicate better quality of life with scores greater than 50 representing above average health status.

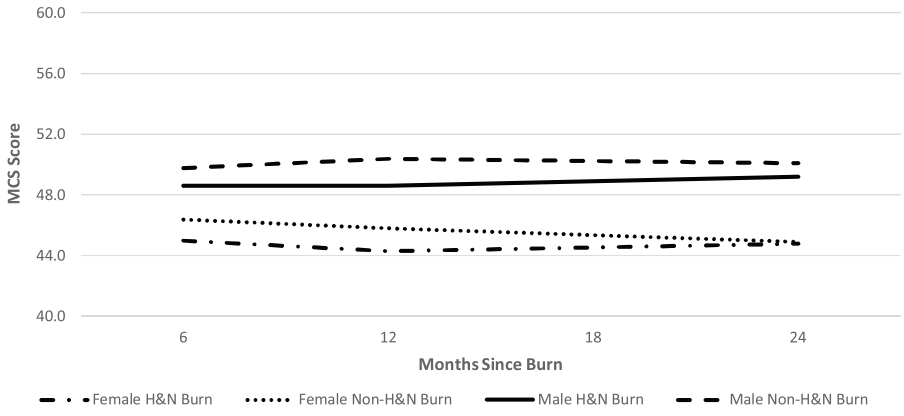

Fig. 1 – Mental composite summary (MCS) score of the SF-12 over time by gender and group.
H&N=head and neck.
***The mental component summary (MCS) score is one of 2 sub-scores of the short form 12 (SF-12). Scores are standardized with a t-score transformation with a mean of 50 (SD: 10) with a maximum score of 100. Higher scores indicate better quality of life with scores greater than 50 representing above average health status.**

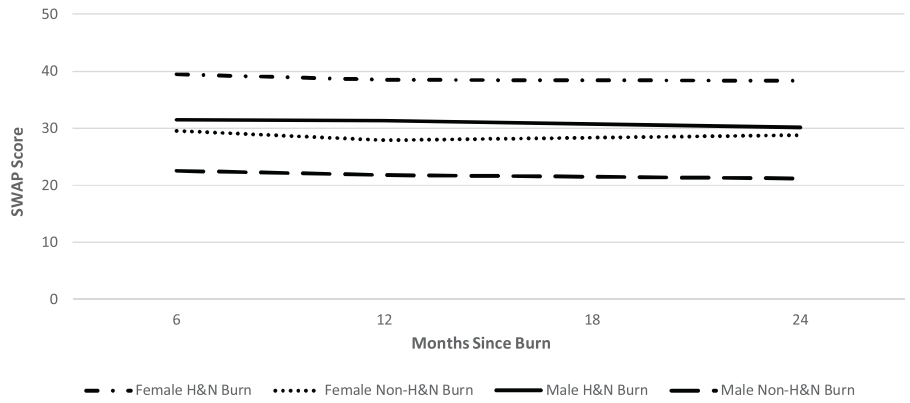

Fig. 2 – Satisfaction with appearance scale (SWAP) score over time by gender and group.
H&N=head and neck
***The satisfaction with appearance scale (SWAP) contains 14 items rated on a 7-point scale with 1 indicating strongly disagree and 7 indicating strongly agree. Total scores range from 0 to 84 with higher scores indicating greater dissatisfaction with appearance and body image following injury.**

non-white to be more dissatisfied with their appearance than their white counterparts [27,28]. Studies in other populations have shown similar results as well as identify the face/head as a common area of concern in regard to appearance. Female sex is also often a predictor of body image dissatisfaction [29]. When asked about satisfaction with appearance, women with burn injury often report higher levels of dissatisfaction than men [30]. Further, in a study of social recovery after burn injury, women scored worse than men in several areas of social recovery such as social interactions and romantic and sexual relationships [32].

In a factor analyses using a burn population, SWAP was shown to be made up of four factors: subjective satisfaction with appearance– facial features, subjective satisfaction with appearance – non-facial features, social discomfort due to appearance, and social impact of appearance [19]. The scale items that are related to facial features are likely large contributors to the large differences in scores between those with and without H&N burns (coefficient: 6.91). However, in the examination of item level data, there were significant differences in scores of all items probing social impact of appearance at 24 months post-burn.H&N burn survivors also exhibited lower scores on the SF-12 MCS. The MCS has been shown to be a useful screening tool for both depression and anxiety in adults, indicating that survivors with burns in the H&N region may require more psychological support and intervention [32]. Similarities in patterns between the SWAP and SF-12 MCS scores in the adult H&N burn population indicate a possibility of interplay between facial appearance, social interactions, and mental health. This is consistent with other research, which suggests facial differences are linked with social withdrawal and psychological distress [33–35].

The findings of this study suggest that the adult H&N burn population may require significantly more resources in managing appearance and psychosocial health after a burn injury. One consideration is to increase access to secondary interventions, such as reconstructive surgery and laser treatments, to improve facial appearance and reduce the disfiguring impact of scarring. Continuous re-assessment of patients' satisfaction with their appearance and post-acute reconstructive surgical interventions may benefit burn survivors and enhance their quality of life. There is a need to study the effects of surgical interventions on satisfaction with appearance.

In addition to surgical treatment options, there is a need for further research regarding non-surgical interventions for coping with a changed body image. The Phoenix Society for Burn Survivors is a national organization that provides resources for coping and peer support to burn survivors. The organization runs an online social skill training program, "Beyond Surviving: Tools for Thriving" that contains techniques to help burn survivors gain confidence in social situations [36]. Also, changing faces is an organization that provides various services for individuals with facial disfigurement, such as self-help guides for adults and children to assist with social interactions [37]. For example, one guide describes five techniques for social situations: explain, reassure, distract, assert, and humor. These methods attempt to empower those that have been affected by disfigurement and to help them feel comfortable with their appearance. Preliminary research on peer support after burn injury has demonstrated benefits in the realms of emotional and social recovery [38–41]. It is important to note that these interventions are targeted to social integration and do not attempt to change one's internal appraisal of their appearance. To our knowledge, there are no interventions that focus on improving body appreciation after an acquired change in appearance, such as that from trauma or cancer. Body appreciation is defined as holding favorable opinions toward the body regardless of its appearance, accepting the body along with its deviations from societal body ideals, respecting the body by attending to its needs and engaging in healthy behaviors, and protecting the body by rejecting unrealistic media appearance ideals [42]. In non-trauma populations, interventions that promote self-compassion and mindfulness have been shown to improve body

appreciation [43]. Similarly, interventions to reduce anxiety and appearance-related distress such as FaceIT, a computer-based cognitive behavioral therapy based intervention that offers psychosocial support for individuals with disfigurement, have been shown to be effective [44]. These interventions need to be explored in the burn population; researchers have advocated for establishing body image assessment and rehabilitation as a standard of care for patients with various medical disorders [45].

There are several limitations of this study. The inclusion criteria that the BMS Database uses selects those with more severe injuries. Therefore, results should be interpreted within the context of the population studied. The variable "head/neck burn" was used to define the study population since there is no variable for burns solely affecting the face. A longer follow-up could possibly detect additional significant differences. Additionally, it is likely that most survivors have not completed their reconstructive procedures by two years after burn, which may impact satisfaction with appearance at longer follow-up. Further, the BMS Database does not contain detailed information about burn-related surgeries, so it is not possible to determine if satisfaction with appearance was impacted by reconstructive procedures.

6. Conclusions

Our study demonstrates that adult burn survivors with H&N burns show similar community integration, satisfaction with life and physical outcomes to those with non-H&N burns. However, survivors with H&N burns exhibit worse satisfaction with their appearance compared to those without H&N burns. Based on these results, it may be beneficial to incorporate cognitive behavioral therapy and social skills training into the long-term care plan of those with head and neck injuries. Future studies are needed to assess the efficacy of such interventions on satisfaction with appearance. This study adds to the growing literature in helping better define the long-term needs of burn survivors.

Conflict of interest

No authors have any conflicts of interest to disclose.

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