

# Activity Impairment, Work Status, and Work Productivity Loss in Adults 5–7 Years After Burn Injuries

Inge Spronk, PhD,\*†,‡ Nancy E.E. Van Loey, PhD,‡|| Cornelis H. van der Vlies, PhD,§¶  
 Juanita A. Haagsma, PhD,† Suzanne Polinder, PhD,† Margriet E. van Baar, PhD,\*† and The Burden of  
 Burn Injuries Study Group#

An important aspect of the rehabilitation of burn patients is social participation, including daily activities and work. Detailed information on long-term activity impairment and employment is scarce. Therefore, we investigated activity impairment, work status, and work productivity loss in adults 5–7 years following burn injuries, and investigated associations with burn-specific health-related quality of life (HRQL) domains. Adult participants completed the Work Productivity and Activity Impairment General Health questionnaire and the Burn Specific Health Scale-brief (BSHS-B) 5–7 years post-burn. Outcomes were compared between participants with mild/intermediate and severe burns (>20% total body surface area burned). Seventy-six (36%) of the 213 participants experienced some degree of activity impairment due to burn-related problems 5–7 years post-burn. Seventy percent of the population was employed; 12% of them experienced work productivity loss due to burn-related problems. Nineteen percent reported changes in their work situation (partly) because of the burn injury. A higher proportion of participants with severe burns had activity impairments (56% vs 29%;  $P = .001$ ) and work productivity loss (26% vs 8%;  $P < .001$ ) compared to participants with mild/intermediate burns. Activity impairment and work productivity loss were both associated with burn-related work problems and lower mood, measured with the BSHS-B. In conclusion, a substantial part of the study population experienced activity impairment and work productivity loss, was unemployed, and/or reported changes in their work situation due to their injury. Particularly patients with severe burns reported productivity loss and had lower employment rates. This subscribes the importance of addressing work-related functioning in the rehabilitation of burn patients.

Burn injuries can have significant consequences at individual and societal level.<sup>1, 2</sup> Improvements in burn treatment and care have resulted in higher survival rates leading to an increased number of people who have to live with the consequences of burns. A significant proportion of burn patients face physical and mental problems.<sup>3</sup> In addition, the ability to participate in daily activities, including work, leisure, and sport activities, can be diminished.<sup>1, 4</sup> As highlighted by the World Health Organization, an important part of the rehabilitation of patients is returning to social life, daily activities, and work.<sup>5, 6</sup>

Participation in everyday life and daily activities can improve patients' health, life satisfaction, well-being, and quality of life.<sup>7, 8</sup> Additionally, returning to work and being employed has personal, social, and economic benefits for patients.<sup>9</sup> According to the International Classification of Functioning Disability and Health (ICF) framework, both involvement in social life and daily activities, and employment are important domains within the participation construct.<sup>5, 10</sup> Participation in the ICF is defined as "involvement in a life situation."<sup>5</sup> Examples of participation restrictions are limited social relations and unemployment.

Involvement in daily activities and social life is important for burns patients. Existing studies showed that burn patients have significant difficulties in these domains. Their social participation was found to be lower compared to that of the general population<sup>11</sup>; it deteriorated during the first 6 months after burn injuries, and did not recover to the pre-injury level.<sup>6</sup> Daily activities were also shown to be impaired, especially during the first 3 months post-burn and recovered over time; however, a significant group of burns patients remained experiencing activity impairment 4–7 years post-burn.<sup>12, 13</sup> Studies investigating associated factors showed that severe burns, female sex, a higher level of social support, and a low body image are related to social participation and involvement in daily activities.<sup>6, 14–16</sup>

Employment is another important domain of participation. Two systematic reviews on return to work after burn injury highlighted the need for attention for this topic indicating that around 30% of all burn patients did not return to work.<sup>4, 17</sup> The time to return to work ranged between 5 weeks and 24 months.<sup>17</sup> Factors associated with not returning to work include a higher percentage of total body surface area (TBSA)

\*Association of Dutch Burn Centres, Maastricht Hospital, Rotterdam, The Netherlands; †Erasmus MC, University Medical Center Rotterdam, Department of Public Health, Rotterdam, The Netherlands; ‡Association of Dutch Burn Centres, Department Behavioural Research, Beverwijk, The Netherlands; ||Utrecht University, Department Clinical Psychology, Utrecht, The Netherlands; §Burn Centre, Maastricht Hospital, Rotterdam, The Netherlands; ¶Trauma Research Unit Department of Surgery, Erasmus MC, University Medical Center Rotterdam, Rotterdam, The Netherlands

#A complete list of study group members appears in Acknowledgments.

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Address correspondence to Inge Spronk, Association of Dutch Burn Centres, Maastricht Hospital, PO Box 9100, 3007 AC Rotterdam, The Netherlands. Email: spronki@maastadziekenhuis.nl

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burned,<sup>18, 19</sup> a longer length of hospital stay,<sup>19–22</sup> ICU admission,<sup>19</sup> inhalation injury,<sup>23</sup> diagnosed with either a pre-burn or post-burn psychological disorder or delirium,<sup>18, 20</sup> electric etiology,<sup>22, 24</sup> and work-related burns.<sup>22</sup> Only two studies, both Swedish, investigated the long-term employment status of burn patients. One study showed that in a small sample of pre-burn employed patients ( $n = 48$ ), 69% had returned to work on average 4-year post-burn.<sup>25</sup> The other study showed that 83% of the patients with work-related burn injuries were employed on average 9 years post-burn.<sup>26</sup> The unemployed patients reported more pain and a poorer health-related quality of life (HRQL), particularly in psychosocial domains.<sup>26</sup>

Not only is employment important in the recovery of burns patients, also work productivity and the ability to return to the pre-burn job are important. Work productivity may be hampered when the person is not able to perform on the pre-injury level or a person has to find another job because burn sequelae prevent return to the pre-burn job. To the best of our knowledge, these topics were not investigated in burn survivors. Insights in these topics might identify potential gaps in the aftercare of burn patients and might provide input to develop interventions or initiatives to support patients in work and social participation. Furthermore, work status and HRQL may be related.<sup>26</sup> This self-reported outcome measure reflects a patient's perception of how burns affect his/her physical, psychological, and social wellbeing.<sup>5</sup> This study investigated activity impairment, work status, changes in the work situation, and work productivity loss in adults 5–7 years following burn injuries, and assessed whether these outcomes were related to particular burn-specific HRQL domains.

## METHODS

The present study is part of a larger cross-sectional study on long-term outcomes of burns: the Burden of Burn Injuries study.<sup>27</sup> This study is registered in the Netherlands Trial Register (NTR6407), performed according to the principles of the Declaration of Helsinki, and approved by the Ethics Committee (registration number NL59981) as well as by the institutional board of the three participating hospitals. Participants were asked to complete two surveys. The first survey investigated generic health-related quality of life, scar quality, participation, and activity impairment; the second survey investigated burn-specific HRQL and other long-term outcomes.

## PARTICIPANTS

Adult burn patients ( $\geq 18$  years old) admitted to one of the three dedicated Dutch burn centers between August 2011 and September 2012 were selected from the Dutch Burn Repository R3.<sup>28</sup> To specifically increase the number of patients with severe burn injuries, patients admitted to burn centers between January 2010 and March 2013 with TBSA burned  $>20\%$  in adults  $\leq 50$  years old, or TBSA burned  $>10\%$  in adults  $>50$  years, or TBSA full thickness  $>5\%$ <sup>29</sup> were also invited to participate. Patients were not eligible when they were unable to understand or answer the Dutch questionnaires, or when contact details were missing. Between March 2017 and March 2018 eligible patients were invited to participate by

a postal invitation including an information letter explaining the nature of the study. This letter was accompanied by an informed consent form and the first survey. Patients received a telephone call or postal reminder to increase the participation rate. For the present study, we only included patients who were below the Dutch retirement age of 66 years old at time of study (2017/2018).

## OUTCOME MEASURES

### Activity Impairment, Current Employment, and Work Productivity Loss

The Work Productivity and Activity Impairment General Health (WPAI-GH) questionnaire<sup>30</sup> was used to assess participation. The WPAI-GH consists of six questions. This questionnaire was completed during the first wave of the study.

Activity impairment was assessed with one item that asked to rate to what degree burn-related health problems affected regular daily activities in the past 7 days on a scale ranging from 0 (health problems had no effect on my daily activities) to 10 (health problems completely prevented me from doing my daily activities).

Current employment was assessed with one item that asked if the participant had a job at time of study. Employed participants were asked to provide objective information regarding productivity loss. Work productivity loss comprised three items: 1) absenteeism, that is, the number of hours worked in the past 7 days, 2) presenteeism, that is, the number of hours missed from work due to burn-related problems, the number of hours missed from work due to other reasons, 3) work productivity loss (absenteeism plus presenteeism), that is, to what degree burn-related health problems affected their work productivity on a scale ranging from 0 (health problems had no effect on my work) to 10 (health problems completely prevented me from working). Based on validated algorithms, WPAI-GH consist of four subscores: activity impairment, absenteeism (work time missed), presenteeism (impairment at work/reduced on-the-job effectiveness), and work productivity loss (overall work impairment/absenteeism plus presenteeism).<sup>30</sup> These outcomes were expressed in percentages, with higher WPAI absenteeism scores indicating a greater amount of absenteeism and higher WPAI presenteeism scores indicating worse job performance.

### Changes in the Work Situation

For participants employed, we added one item to our survey: "Has something changed in your work situation as a consequence of the burn injury" to investigate whether the post-burn work situation differed from the pre-burn work situation. This item had four answer options: 1) something has changed and this is due to the burn injury, 2) something has changed and this is partly due to the burn injury, 3) something has changed but this was not due to the burn injury, 4) nothing has changed. This item was only answered by participants who were employed at time of survey.

### Burn-Specific Health-Related Quality of Life

The Dutch version of the Burn-specific Health Scale-brief (BSHS-B)<sup>31</sup> was used to assess burn-specific HRQL. The

BSHS-B consists of 40 items comprising nine subscales: simple abilities, heat sensitivity, hand function, treatment of regimens, work, body image, affect, interpersonal relationships, and sexuality.<sup>31</sup> Items are scored on a five-point scale ranging from 0 (extremely/great difficulty) to 4 (not at all/no difficulty). The BSHS-B total score (range 0–160), mean total score (total score/160), and mean scores per subscale were assessed, with high scores referring to a good HRQL. The BSHS-B has shown good internal consistency for both mild and severe burns.<sup>32</sup> This questionnaire was completed during the second wave of the study.

### Other Study Parameters

Patient and burn injury characteristics were extracted from the Dutch Burn Repository R3.<sup>12</sup> The characteristics included sex, age at injury, %TBSA burned, % full-thickness burns, anatomical site(s) affected, aetiology, number of surgeries, length of hospital stay (LOS), reconstructive surgery, mechanical ventilation, and date of injury.

## DATA ANALYSES

A non-response analysis was performed to study whether characteristics of responders differed from those of non-responders. Mann–Whitney *U*-tests were used for continuous variables and chi-square tests for categorical variables. Descriptive statistics were applied to assess characteristics of participants and activity impairment and work outcomes. Analyses were performed for both the total sample and subgroups based on burn severity. Characteristics and outcomes were compared between the two burn severity subgroups. Also, characteristics of participants with and without employment were compared.

BSHS-B outcomes were compared between participants with and without activity impairment; with and without work; and with and without work productivity loss due to burns. To determine which BSHS-B subscales were associated with participation, after adjusting for burn severity, univariate and multivariate analysis were performed with activity impairment and work productivity loss as dependent variables. Subscales with a *P*-value of *P* < .20 in univariate analyses were checked for collinearity (>0.8 or < -0.8) and entered into the multivariate model. The significance level was set at *P* < .05. Regression coefficients and standard errors were presented. IBM SPSS Statistics 25 was used for the analyses.

## RESULTS

### Participants

Within the study period, 666 adult participants were registered in the burn registry, of whom 517 met the inclusion criteria. A total of 257 participants provided informed consent (Appendix 1) which is a response rate of 49.7%; 213 completed the WPAI-GH and were <66 years old at the time of study and were included in the present study of which 155 participants completed the BSHS-B in survey 2. Fifty-eight participants (27.2%) were lost to follow-up. Participants (*n* = 213) were

on average statistically significant older than participants who were not included (*n* = 304) (Appendix 2).

The 213 participants were on average 42.8 years old (SD 13.5) at the time of the first survey and most of them were male (62.9%) (Table 1). Mean %TBSA burned was 9.8 (SD 12.7) (median: 5.5%; IQR: 1.5–13.0) and mean length of hospital admission was 16.2 days (SD 20.7). The majority of participants (59.2%) underwent at least one surgery and most burns were caused by flames (56.9%). The time since burn was on average 5.6 year (SD 0.5). The majority of the participants had mild/intermediate burns (*n* = 159; 74.6%). Except for sex, all characteristics were statistically significantly different between the participants with mild/intermediate and severe burns (Table 1).

### Activity Impairment

A total of 76 of the 213 participants (35.7%) reported at least minor impairment in their regular daily activities due to burn-related health problems (Table 2). This proportion was higher in participants with severe burns (30 of 54; 55.6%) compared to participants with mild/intermediate burns (46 of 159; 28.9%). Overall, the degree of impairment was 13.6% in the total sample, which indicates impairment was modest; on average 13.6% of the daily activities were impaired due to burn related problems in the past 7 days. Participants with mild/intermediate burns, reported a lower degree of impairment (11.1%) compared to participants with severe burns (20.7%) (*P* = .001) (Table 2). However, in the group of participants that experienced at least minor impairment, the average degree of impairment was comparable in participants with mild/intermediate burns (impairment: 38.5%) and participants with severe burns (impairment: 37.3%). This indicates that the impairment degree was comparable, but more participants with severe burn reported impairment.

### Employment

*Changes in the Work Situation Due to Burns:* A total of 148 participants (69.5%) were employed 5–7 years post-burn. Of them, 28 (18.9%) reported that something had changed in their work situation that was (partly) caused by their burn injury. Changes were more often reported by the participants with severe burns (43.7%) compared to those with mild/intermediate burns (12.1%) (*P* < .001) (Figure 1).

*Current Employment:* The current employment rate was 80.0% in participants with mild/intermediate burns, and 59.3% in those with severe burns (*P* = .057). Unemployed participants were more often female, were on average older, and had had more surgeries (Table 1).

### Work Productivity Loss

*Absenteeism:* Thirteen of the 148 employed participants (8.8%) missed work in the past seven days due to burn-related problems, accounting for 58.0% of their work time (Table 2). Three participants reported to have missed 100% of their work time due to burn-related problems. For the total sample, mean work time missed due to burn-related problems was 5.1% (SD 18.3) of the total work time, which

**Table 1.** Characteristics of the study sample

	Total sample (n = 213)	Mild/inter- mediate burns (n = 159)	Severe burns* (n = 54)	P	Employed (n = 148)	Not em- ployed (n = 65)	P
Sex: Male, n (%)	134 (62.9%)	101 (63.5%)	33 (61.1%)	.751	100 (67.6%)	34 (52.3%)	<b>.034</b>
Age at survey (M, SD)	42.8 (13.5)	41.1 (13.5)	47.9 (12.4)	<b>.002</b>	41.0 (13.3)	47.0 (13.2)	<b>.003</b>
Age at burn (M, SD)	37.2 (13.5)	35.7 (13.5)	41.7 (12.6)	<b>.004</b>	35.4 (13.3)	41.3 (13.2)	<b>.004</b>
Comorbidity, n				<b>.013</b>			<b>&lt;.001</b>
pre-existing chronic conditions (%)							
None	167 (78.4%)	132 (83.0%)	35 (64.8%)		130 (87.8%)	37 (56.9%)	
One	36 (16.9%)	20 (12.6%)	16 (29.6%)		14 (9.5%)	22 (33.8%)	
More than one	10 (4.7%)	7 (4.4%)	3 (5.6%)		4 (2.7%)	6 (9.2%)	
%TBSA burned (M, SD)	9.8 (12.7)	4.5 (4.2)	25.4 (16.1)	<b>&lt;.001</b>	10.0 (13.2)	9.3 (11.6)	.498
%TBSA full-thickness <sup>1</sup> (M, SD)	3.4 (8.3)	0.7 (1.2)	11.5 (13.7)	<b>&lt;.001</b>	3.1 (8.8)	3.9 (7.0)	.127
Length of hospital stay (M, SD)	16.2 (20.7)	8.3 (9.1)	39.5 (27.0)	<b>&lt;.001</b>	14.4 (19.6)	20.4 (22.7)	.153
Number of surgeries (M, SD)	1.2 (1.9)	0.6 (0.6)	3.0 (3.1)	<b>&lt;.001</b>	1.0 (1.7)	1.6 (2.3)	<b>.008</b>
Number of surgeries, n (%)							
0	87 (40.8%)	81 (40.9%)	6 (11.1%)		67 (45.3%)	19 (29.2%)	
1	90 (42.3%)	69 (43.4%)	21 (38.9%)		60 (40.5%)	30 (46.2%)	
>1	36 (16.9%)	9 (5.7%)	27 (50.0%)		21 (14.1%)	16 (24.6%)	
Reconstructive surgery, n (%)	25 (11.7%)	6 (3.8%)	19 (35.2%)	<b>&lt;.001</b>	15 (10.1%)	10 (15.4%)	.255
Artificial ventilation, n (%)	34 (16.0%)	12 (7.5%)	22 (40.7%)	<b>&lt;.001</b>	25 (16.9%)	9 (13.8%)	.730
Severe burn group*	54 (25.4%)				32 (21.6%)	22 (33.8%)	.059
Etiology <sup>2</sup> (%)				<b>.002</b>			.311
Flame	120 (56.9%)	79 (50.0%)	41 (77.4%)		89 (60.1%)	31 (49.2%)	
Scald	40 (19.0%)	35 (22.2%)	5 (9.4%)		25 (16.9%)	15 (23.8%)	
Other	51 (24.2%)	44 (27.8%)	7 (13.2%)		34 (23.0%)	17 (27.0%)	
Time since burn (years) (M, SD)	5.6 (0.5)	5.5 (0.2)	6.2 (0.7)	<b>&lt;.001</b>	5.6 (0.5)	5.7 (0.6)	.374

Note: \*Severe burns: >20% total body surface area (TBSA) in adults ≤50 years old; >10% TBSA in adults >50 years old; or TBSA full thickness>5% (criteria American Burn Association<sup>29</sup>). P-values in bold indicate statistically significant values. M, SD = mean, standard deviation.

<sup>1</sup>Three values missing.

<sup>2</sup>Two values missing.

corresponds to an average of 1 day per month missed per full time employed participant.

**Presenteeism:** A total of 38 participants (27.1%) reported presenteeism (impairment at work/reduced on-the-job effectiveness), with on average 30.3% of their work time reduced on-the-job effectiveness. For the total sample on average 8.2% (SD 17.2) of the total work time was impaired due to burn-related problems.

**Productivity Loss:** The average overall work productivity loss (absenteeism plus presenteeism) was 12.2% in the whole sample, and statistically significantly higher in the subgroup of participants with severe burns (25.5%) compared to those with mild/intermediate burns (8.4%) ( $P < .001$ ).

### Burn-Specific Health-Related Quality of Life

One hundred and fifty-five of the 213 participants completed at least one subscale of the BSHS-B, and 132 of them completed the total BSHS-B. The average BSHS-B total score

was 149.2 (SD 14.9), with an average BSHS-B mean total score of 3.7 (SD 0.4). No problems on any of the 40 items were reported by 20.6% of the participants.

BSHS-B outcomes for subgroups based on participation status are presented in [Table 3](#). Participants with any level of activity impairment (based on WPAI-GH) had a significantly lower average BSHS-B total score compared to participants without any activity impairment (139.5 vs 153.6;  $P < .001$ ). The largest differences in burn-specific problems were reported on the subscales heat sensitivity, work, and affect.

Participants who were unemployed 5–7-year post-burn reported significantly more burn-specific problems compared to their employed counterparts. The average BSHS-B total score was 145.2 (SD 145.2) in unemployed participants and 151.7 (SD 12.0) in employed participants ( $P = .014$ ). Especially more problems were reported in the subscales work and affect by unemployed participants.

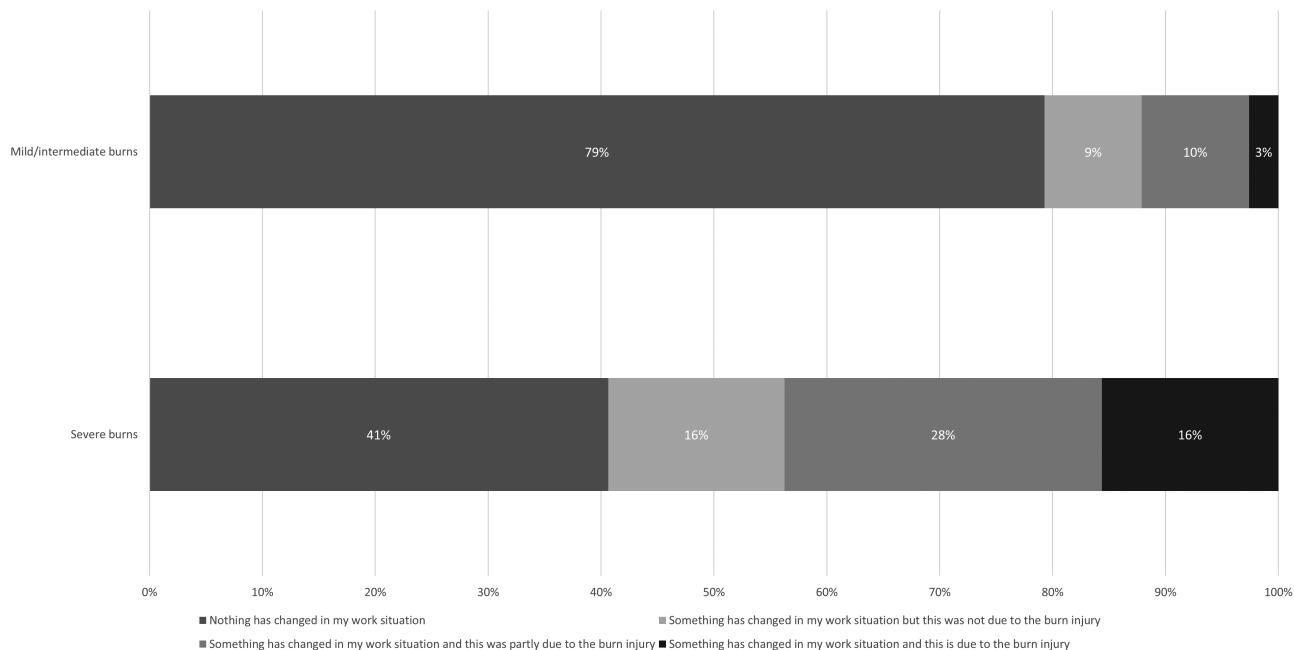
Within the group of employed participants, burn-specific problems were compared between those with and without work productivity loss. Those with productivity loss had

**Table 2.** Activity impairment and work productivity loss due to burn related problems for the total sample, and for subgroups based on burn severity

Variables	Total sample		Mild/intermediate burns		Severe burns	
Mean percent activity impairment	<i>n</i> = 213	13.6% (SD 23.6)	<i>n</i> = 159	11.1% (SD 22.4)*	<i>n</i> = 54	20.7% (SD 25.8)*
Percent activity impairment (participants with % activity impairment >0)	<i>n</i> = 76	38.0% (SD 25.2)	<i>n</i> = 46	38.5% (SD 26.2)	<i>n</i> = 30	37.3% (23.9)
Mean percent work time missed (absenteeism) <sup>1</sup>	<i>n</i> = 148	5.1% (SD 18.3)	<i>n</i> = 115	4.0% (SD 16.5)	<i>n</i> = 33	9.1% (SD 23.2)
Percent work time missed (participants with missed time >0)	<i>n</i> = 13	58.0% (SD 27.7)	<i>n</i> = 8	56.8% (SD 32.0)	<i>n</i> = 5	60.0% (SD 22.4)
Mean percent impairment while working (presenteeism) <sup>1</sup>	<i>n</i> = 140	8.2% (SD 17.2)	<i>n</i> = 109	5.4% (SD 14.2)*	<i>n</i> = 31	18.1% (SD 22.7)*
Percent impairment while working (participants with % impairment while working >0)	<i>n</i> = 38	30.3% (SD 20.7)	<i>n</i> = 21	28.1% (SD 20.6)	<i>n</i> = 17	32.9% (SD 21.1)
Mean percent overall work productivity loss <sup>1</sup>	<i>n</i> = 142	12.2% (SD 24.1)	<i>n</i> = 110	8.4% (SD 20.9)*	<i>n</i> = 32	25.5% (SD 29.7)*

<sup>1</sup>Include employed participants only.

\*Statistically significant different (*P* < .01).



**Figure 1.** Changes in participants' work situation due to the burn injury for subgroups based on burn severity.

on average a lower BSHS-B total score compared to those without productivity loss (144.8 vs 153.9; *P* < .001). Except for the subscale simple abilities, subscale scores significantly differed between participants with and without productivity loss. Participants with productivity loss reported somewhat less problems with function, including hand function, whereas more problems were reported on all other subscales.

### Associations Between BSHS-B Subscales and Activity Impairment and Work Productivity

Table 4 presents the univariate- and multivariate analyses of the BSHS-B subscales associated with participation, for activity impairment and work productivity separately. In univariate analyses, all BSHS-B subscales except for

“hand-function” were statistically significantly associated with activity impairment, whereas in multivariate analyses only the subscales “work” and “affect” were associated with activity impairment. For work productivity loss, univariate analyses showed that all subscales except for “simple abilities” and “hand function” were associated with work productivity loss, whereas “work” and “affect” were the only subscales significantly associated in multivariate analyses.

### DISCUSSION

Five to seven years following burns, 36% reported impairments in daily activities due to burn-related problems. Activity impairment

**Table 3.** Burn-specific health-related quality of life (BSHB-B) outcomes according to participation status

BSHS-B outcomes	Total sample (n = 155)	Activity impairment (n = 155)		Employment (n = 155)		Productivity loss <sup>1</sup> (n = 108)	
	(Mean, SD)	No (n = 103) (Mean, SD)	Yes (n = 52) (Mean, SD)	Yes (n = 112) (Mean, SD)	No (n = 43) (Mean, SD)	No (n = 77) (Mean, SD)	Yes (n = 31) (Mean, SD)
BSHS-B total	150.1 (13.3)	153.6 (8.9)*	140.6 (18.0)*	151.7 (12.0)*	145.2 (15.8)*	153.9 (9.7)*	144.8 (16.2)*
BSHS-B mean total	3.8 (0.3)	3.8 (0.2)*	3.5 (0.5)*	3.8 (0.3)*	3.6 (0.4)*	3.8 (0.2)*	3.6 (0.4)*
<b>BSHS-B subscales</b>							
Simple abilities	3.8 (0.7)	3.8 (0.8)*	3.9 (0.4)*	3.9 (0.7)*	3.8 (0.7)*	3.8 (0.8)	4.0 (0.1)
Heat sensitivity	3.4 (0.8)	3.6 (0.6)*	3.1 (1.0)*	3.5 (0.7)	3.3 (0.9)	3.6 (0.6)*	3.1 (0.8)*
Hand function	3.8 (0.7)	3.8 (0.8)*	3.8 (0.4)*	3.9 (0.7)*	3.8 (0.6)*	3.8 (0.8)*	3.9 (0.1)*
Treatment regimens	3.8 (0.4)	3.9 (0.1)*	3.6 (0.7)*	3.9 (0.4)	3.8 (0.6)	3.9 (0.1)*	3.7 (0.6)*
Work	3.7 (0.7)	3.9 (0.3)*	3.2 (1.0)*	3.8 (0.5)*	3.3 (1.0)*	3.9 (0.3)*	3.4 (0.8)*
Body image	3.5 (0.8)	3.7 (0.6)*	3.2 (0.9)*	3.6 (0.6)*	3.2 (1.0)*	3.7 (0.5)*	3.3 (0.7)*
Affect	3.7 (0.6)	3.9 (0.3)*	3.4 (0.8)*	3.9 (0.4)*	3.4 (0.8)*	3.9 (0.3)*	3.7 (0.6)*
Interpersonal relationships	3.9 (0.3)	4.0 (0.2)*	3.8 (0.5)*	3.9 (0.3)	3.8 (0.3)	4.0 (0.2)	3.8 (0.6)
Sexuality	3.8 (0.5)	3.9 (0.4)*	3.6 (0.8)*	3.9 (0.4)*	3.6 (0.8)*	3.9 (0.4)	3.8 (0.3)

<sup>1</sup>Include employed participants only, and four participants did not complete all items to assess productivity loss.

\*Statistically significantly different ( $P < .05$ ).

**Table 4.** Associations between BSHS-B subscales and activity impairment and work productivity loss

Factors	Activity impairment (n = 155)						Work productivity loss (n = 108)					
	Univariate regression			Multivariate regression*			Univariate regression			Multivariate regression <sup>†</sup>		
	Regression coefficient	SE	P	Regression coefficient	SE	P	Regression coefficient	SE	P	Regression coefficient	SE	P
Severe burns	4.743	4.27	.268				15.776	4.87	.002			
<b>BSHS-B subscales</b>												
Simple abilities	-3.664	2.75	.185				1.233	3.29	.708			
Heat sensitivity	-9.968	2.19	<.001				-7.099	3.08	.023			
Hand function	-3.000	2.84	.292				0.836	3.26	.798			
Treatment regimens	-14.074	4.06	.001				-17.266	5.534	.002			
Work	-18.340	1.99	<.001	-15.406	2.08	<.001	-20.728	3.65	<.001	-15.524	4.16	<.001
Body image	-11.928	2.19	<.001				-11.923	3.18	<.001			
Affect	-23.736	2.75	<.001	-11.401	3.08	<.001	-22.259	4.69	<.001	-13.464	4.99	.008
Interpersonal relationships	-24.972	5.02	<.001				-23.345	5.45	<.001			
Sexuality	-14.551	3.22	<.001				-11.416	5.14	.029			

\*Explained variance: 44.8%.

<sup>†</sup>Explained variance: 29.9%.

was related to burn severity; however, the degree of impairment was not. Seventy percent of the participants was employed; with a higher employment rate (80%) in participants with mild/intermediate burns compared to those with severe burns (59%). Work productivity loss was predominantly reported in the group with severe burns. Nineteen percent reported changes in their work situation (partly) because of the burn injury. Activity impairment and work productivity loss were both associated with lower burn-specific health-related quality of life, particularly with the BSHS-B subscales “affect” and “work.”

Five to seven years after burns, a substantial part of the burn population had some degree of activity impairment due to their burn injury. This is in line with shorter follow-up studies

that indicated lower social integration of the burn population compared to the general population, and lower levels of social participation post-burn compared to pre-burn.<sup>6,11</sup> Our result is also in accordance with an earlier study that showed that daily activities in the burn population did not recover to the level of the general population on average 4.6 years after injury.<sup>12</sup> Of notice, a lower proportion of participants with mild/intermediate burns experienced activity impairment, but if experienced, the degree of impairment was comparable to participants with severe burns. Thus, the activity impairment seems to be related to burn severity; however, the degree of impairment is not.

The majority of the study participants (70%) were employed. This finding supports earlier studies that indicated

an employment rate of 70% of those who had a job before the burn injury.<sup>4, 17, 25</sup> The proportion of participants employed is comparable to that of the general Dutch population: 67% in 2017 and 68% in 2018.<sup>33</sup> Of notice, the employment rate in participants with more severe burns (59%) was lower compared to participants with mild/intermediate burns (80%) which was also reported in other studies.<sup>18–22, 25</sup> However, in our study, the more severely burned participants were on average older and had more often comorbidity which may partly explain this difference in employment rates.

Our study showed that work productivity loss due to burn-related problems was on average 12%. This proportion was more than three times higher in those with severe burns (26%) compared to those with mild/intermediate burns (8%). It is hard to compare these findings to other studies as we only focused on work productivity loss due to burn-related problems; we did not assess work productivity loss due to other factors. To the best of our knowledge, this has not yet been studied in the burn population.

One out of five employed participants underwent a change in their work situation that was (partly) caused by their burns. Severely burned participants reported more often changes compared to those with mild/intermediate burns. These are important findings to include in the aftercare of burn patients as a considerable part of the patients has to deal with finding another job due to their burns. Therefore, not only counselling regarding return to work is important, but also regarding potential other employment opportunities is an important part of the rehabilitation of burn patients.

Participants with activity impairment, those who were unemployed, and those with work productivity loss had a significantly poorer HRQL compared to their counterparts. This in congruence with earlier studies that showed that participants without employment had a poorer long-term HRQL.<sup>25, 26</sup> Our multivariate analyses showed that the subscales “work” and “affect” were independently associated with both activity impairment and work productivity loss. The subscale “work” was expected to be related to these outcomes. The subscale “affect” includes psychological problems, particularly low mood. Activity impairment and work problems are related to psychological problems rather than physical problems 5–7 years post-burn. This finding supports results from earlier studies<sup>18, 20, 26</sup> that showed that psychological problems were associated with not returning to work, may constitute barriers to return to work, and impeded work performance.<sup>22, 34–36</sup>

A substantial part of the participants experienced activity impairment, unemployment, work productivity loss and/or had to change jobs due to their injury. This indicates that support to assist patients returning to daily activities and work is important. The guideline and evidence-based framework developed by Stergiou-Kita et al that recommends a systematic evaluation using seven key processes might be helpful to provide optimal support.<sup>37</sup> In addition, recently, important initiatives have been started to guide and assist in returning to work and social life that might be valuable in supporting patients.

This study is one of few investigating long-term activity impairment, work status, work productivity, and changes in the work situation in burn survivors providing new insights into long-term consequences of burn injuries. Another strength is the use of WPAI-GH as this is the most often used instrument to measure work productivity loss.<sup>38</sup> Other strengths

included the relatively large sample size and the multicenter aspect of this study. The study has some limitations. First, we did not collect information about pre-burn work-status of the participants, so we were not able to study whether participants returned to their pre-burn job. Second, no information on retirement was collected. Consequently, participants who were on pre-retirement (before the age of 66), may have increased the number of unemployed participants. It is important for future studies to include these aspects. Third, only a part (48%) of the invited population participated in our study. Outcomes of non-responders might differ from that of participants, which might have led to participation bias. Participants were older and more often female than non-responders. Females and older individuals are more likely to be unemployed, which might have led to an underestimation of the proportion of the study population being employed. Another limitation is the 27% loss to follow-up in present study; these participants were not included in the BSHS-B analyses.

## CONCLUSION

In about one third of the participants with mild/intermediate burns and over half of the participants with severe burns, daily activities were affected by burn-related problems 5–7 years after injury, showing the long-term impact of burns. In addition, a substantial part of the study population was unemployment, had work productivity loss, and/or reported changes in their work situation due to their injury. Particularly patients with severe burns reported productivity loss and had lower employment rates. This subscribes the importance of addressing work-related functioning in the rehabilitation of burn patients.

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## SUPPLEMENTARY DATA

Supplementary data are available at *Journal of Burn Care & Research* online.

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