Diplomarbeit

Health-related Quality of Life and Social Reintegration after Burns

A Survey among Burn Survivors treated from 2012 to 2019 at the Division of Plastic, Aesthetic and Reconstructive Surgery, Graz

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Graz, am 25.11.2021 *Maria Fernanda Hutter eh.*

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List of abbreviations

ABSI	Abbreviated burn severity index
DGVM	Deutsche Gesellschaft für Verbrennungsmedizin
HRQoL	Health-related quality of life
ICU	Intensive care unit
IQR	Interquartile range
KAGes	Steiermärkische Krankenanstaltengesellschaft m.b.H
SF-36	36-Item Short Form Survey
SR	Social reintegration
TBSA	Total body surface area

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Zusammenfassung

Hintergrund und Zielsetzung: Brandverletzungen stellen ein häufiges und oftmals prägendes Krankheitsbild dar, dessen Folgen das Leben der Patientinnen und Patienten auf physischer, psychischer und sozialer Ebene nachhaltig beeinträchtigen können. In den letzten Jahrzehnten konnte die Mortalität dank vieler Fortschritte in Intensivmedizin, Hautersatzverfahren und chirurgischen Herangehensweisen deutlich reduziert werden. Folglich stellen nicht nur das Überleben, sondern auch die gesundheitsbezogene Lebensqualität (LQ) und die soziale Reintegration (SR) zunehmend wichtigere Outcome-Parameter dar. Die vorliegende Arbeit soll nun einen ersten Schritt zur Erfassung der LQ und SR nach Verbrennungsverletzungen in der österreichischen Bevölkerung setzen.

Material und Methoden: Im Rahmen dieser Single-Center-Follow-up-Studie wurde die LQ und SR von 128 von insgesamt 388 (33,0%) erwachsenen Patientinnen und Patienten, die zwischen 2012 und 2019 aufgrund einer Brandverletzung an der Klinischen Abteilung für Plastische, Ästhetische und Rekonstruktive Chirurgie, Universitätsklinik für Chirurgie, LKH-Univ. Klinikum Graz stationär behandelt wurden, untersucht. Mithilfe des SF-36 V1.0 und weiteren 11 auf die Folgen der Verbrennungsverletzung bezogenen Fragen wurden die LQ und SR erfasst. Die Ergebnisse aus den Fragebögen wurden mit klinischen Daten aus den Krankenakten in Beziehung gesetzt und die statistische Analyse mit SPSS 27.0 für Windows durchgeführt.

Ergebnisse: Von den 128 Teilnehmenden waren 72,7 % männlich und 27,3 % weiblich. Das Durchschnittsalter zum Zeitpunkt der Verletzung betrug 40,0 Jahre (±15,7), und die durchschnittliche %TBSA lag bei 9,2% (±11,0%). Männliche Patienten hatten signifikant großflächigere Verletzungen erlitten ($p = 0,005$). Die Befragung ergab, dass Patientinnen in allen Bereichen des SF-36 durchwegs signifikant ($p < 0,05$) niedrigere Werte erzielten, mit Ausnahme der Rubrik "Körperliche Schmerzen" ($p = 0,061$). Auch bei den Fragen zur SR schnitten Patientinnen vergleichsweise schlechter ab. Signifikante Unterschiede wurden jedoch nur in den Bereichen "Erfüllung" ($p = 0,050$) und "seelisches Wohlbefinden" ($p = 0,015$) festgestellt. Von den vor der Brandverletzung erwerbstätigen Teilnehmenden waren 86 % der Männer zum Zeitpunkt der Befragung erwerbstätig, von den weiblichen 62,9 %, während insgesamt nur 3 Teilnehmende ihre Arbeit verloren haben. Insgesamt war die Arbeitslosigkeit im Studienkollektiv zum Befragungszeitpunkt niedriger als vor der Brandverletzung (6,3% vs. 10,2% zum Zeitpunkt der Befragung).

Der Konsum von Alkohol, Tabak und illegalen Drogen war bei allen Teilnehmenden nach der Brandverletzung zurückgegangen. Psychiatrische Erkrankungen waren bei Frauen häufiger als bei Männern (17,1% vs. 2,2%, p = 0,002).

Diskussion: Die SR nach Brandverletzungen scheint insgesamt gut zu sein. Sowohl die Rückkehrrate an den Arbeitsplatz als auch der Substanzkonsum zeigen einen erfreulichen Trend. Auffallend ist, dass bei Frauen die LQ nach der Brandverletzung niedriger war, auch psychiatrische Komorbiditäten waren bei Frauen häufiger. Weitere Untersuchungen zu Geschlechterunterschieden bei der Rehabilitation und verstärkte Rehabilitationsmaßnahmen für Patientinnen und Patienten mit psychiatrischen Vorerkrankungen könnten zukünftig die LQ und SR dieser verbessern.

Abstract

Background and aim: Burn injuries are common severe and devastating injuries, that can have a lasting impact on the patients' life on a physical, psychological and social level. In recent decades, mortality has been greatly reduced due to many advances in intensive care medicine, skin replacement procedures and surgical management. Consequently, not only survival but also health-related quality of life (HRQoL) and social reintegration (SR) are increasingly important outcome parameters. The present study aims to take a first step towards the assessment of HRQoL and SR after burn injuries in the Austrian population.

Material and methods: In this single-center follow-up study self-reported HRQoL and SR of 128 of overall 388 (33.0%) adult in-patients with former burn injuries, treated between 2012 and 2019 at the Division of Plastic, Aesthetic and Reconstructive Surgery at the Department of Surgery at the University Hospital of Graz were assessed using the SF-36 V1.0 in German and 11 further questions evaluating SR. The questionnaire outcomes were set into relation with clinical data obtained from the medical records. Statistical analysis was performed with SPSS 27.0 for Windows.

Results: Of the 128 participants 72.7% were male and 27.3% female. Mean age at the time of injury was 40.0 years (SD 15.7) and mean %TBSA among the study population was 9.2% (SD 11.0). Male patients had sustained more extensive injuries ($p = 0.005$). The study revealed that female patients scored significantly ($p < 0.05$) and consistently lower in all domains of the SF-36, except for "bodily pain" (p 0.061). Also, female patients scored lower in all domains of SR. However, significant differences were only found in the domain fulfillment ($p = 0.050$) and mental wellbeing ($p = 0.015$). Of the pre-burn employed male participants 86% were employed upon interview and 62.9% of females, while in total only 3 participants had lost their jobs. Overall, unemployment had declined (6.3% vs. 10.2% at the time of interview). Consumption of alcohol, as well as tobacco and illegal drugs decreased for all patients. Psychiatric disorders were more common in women than in men (17.1% vs. 2.2%, $p = 0.002$).

Conclusion: SR after burn injury in this study cohort seems to be good. Return to work, as well as substance consumption have shown a promising trend. Strikingly, HRQoL was lower in women after burn injury, and psychiatric comorbidities were also more common in women. Further research on reasons for this gender discrepancy and focused rehabilitation for patients with psychiatric comorbidities might improve HRQoL and SR for these patients.

1. Introduction

1.1. Epidemiology

Over the last decades there have been many advances in the prevention and treatment of burn injuries, which have led to a lower incidence of burns, less severe burns, reduced mortality and shorter length of hospital stay (1). However, burn injuries are still common. About 20% of all people sustain burn injuries in the course of their lives, however, many of those are never treated by medical professionals (2). The WHO estimates that there are an estimated 180 000 deaths due to burn injuries per year, of which the majority happen in low- or middle-income countries, and about two thirds of those in Africa and South-East Asia. Although most burn victims worldwide are male, females are at greater risk of death from burn injuries. Also, children tend to be more vulnerable to burns and in this age group the fifth most common type of injuries are burn injuries. The greatest predisposing risk factors for sustaining burn injuries are living in low- and middle-income countries and within any country a lower socioeconomic status correlates with a higher burn risk, as well (3,4). With a rate of 80-90% most burns occur at home or at the workplace, where mostly men are admitted due to injury by hot liquids, fire, chemical or electrical burns (5).

According to “Statistik Austria”, 1.503 patients of all ages were admitted to Austrian hospitals for treatment of burn injuries in 2019. 975 of these patients were male (64.9%) and 528 female (35.1%). 22 patients (14 male, 8 female) did not survive the injury. 185 of these patients were treated in Styrian hospitals. 136 patients were aged 15 and older, 97 male (71.3%) and 39 female (28.7%). The mean length of hospital stay were 8.4 days for all patients and 6.9 for patients with hospital stays between 1 and 28 days. Although hospital admissions due to burn injuries account for just about 0,6% of all hospital admissions in Austria in 2019 coded as “Injury, poisoning and certain other consequences of external causes (S00-T98)” according to ICD-10, they can have a strong impact on patients’ lives (6).

1.2. Etiology of burn injuries

Burns are a heterogenous compound of different injury mechanisms. They can occur due to thermal (flame, scald, friction, cold, explosion), chemical (acidic, alkalic) or electrical impact on the skin and underlying tissues. These different agents lead to different physiologic and pathophysiologic responses of the adjacent tissues. Whereas flames or hot oil often lead to immediate deep burn, scalds due to other liquids usually cause superficial burns at first and can later demarcate deeper. Cold bites have a different pathophysiology

where crystallization of fluids with subsequent ischemia and reperfusion are the dominant reasons for tissue damage. With regards to chemical burns acids and alkalis also react differently with the contaminated surrounding, as acids cause a coagulation necrosis, which tends to be self-limiting, and alkalis react with the lipids of the skin creating a soap resulting in a colliquative necrosis that continues to dissolve into deeper skin layers until being neutralized. Electrical burn injuries also show a variety of peculiarities, where contact time, voltage, contact area and the way electricity flows through the body have to be taken into account. The area of skin necrosis may represent the "tip of the iceberg", whereas severe internal injuries affecting bone, musculature and internal organs are common (7–9).

1.3. Assessment of burn injuries

The assessment of the full extent of the burn injury and all concomitant injuries forms the foundation of planning the adequate management of the patient (7). Initially the patient should be treated following the standard advanced trauma life support (ATLS) algorithms to make sure the patient is stabilized, ensuring free airways, sufficient ventilation, and an adequate circulation (10,11).

Careful anamnesis plays an essential role for getting a complete picture of the injury and its circumstances. It should include the mechanism (flame, explosion, electric, contact, chemical), the site (indoor/outdoor), duration of exposition and the cause (e.g. suicide, external influence, seizure, …). In general, identity needs to be checked as well as comorbidities, medication, allergies and immunization status for tetanus (8,11)

Regarding the wounds, total body surface area, depth of burn injury, signs of inhalation injury and concomitant injuries must be assessed in order to initiate the most suitable therapy (2).

1.3.1. Estimation of total body surface area

Total body surface area (TBSA) can be quantified using different rules or schemes, which are recommended for different extents of burn injuries. Importantly, first-degree burn clinically appearing as erythema should not be counted. If less than 15% of TBSA is burned or burned areas are scattered, the surface area of the patient's palm including their fingers, accounting for about 1% of their total body surface area, can be used to estimate the TBSA. Also, this technique can be used for very extensive TBSA by measuring the intact skin and subtracting it from 100%. For burn injuries exceeding 15%, TBSA Wallace rule of nines is a useful tool, in which upper extremity and head with neck each make up 9% of TBSA, the

entire trunk 36%, lower extremities each 18% and the genitals 1%. For exact definition of affected TBSA, Lund and Browder have developed a chart that shows a more detailed breakdown of body areas and considers the age of the patient and consequently different body proportions (8,10).

1.3.2. Depth of burn injury

Burn depth is usually assessed by its clinical appearance and described by different grades and affected skin layer. First degree burns affect only the epidermis and present as painful erythema. Healing occurs usually within one week without any scarring. Second-degree, also considered as partial-thickness, burns affect the dermis and can be categorized in superficial (2a) and deep dermal (2b). In this case damage reaches the dermis, but enough epithelial cells maintain remnant in skin appendages (i.e. hair follicles) in the dermis, so that spontaneous regeneration can occur. Superficial partial-thickness burns show blister building, strong pain due to exposed sensory nerve ends, rosy wound bed with capillary refill, and fixed hair. Regeneration usually happens within 14 days. Scarring is usually absent but altered pigmentation is common. Deeper partial-thickness burns imply that deeper dermal structures and skin appendages as well as sensory nerve branches are partially destroyed, which not only results in blister building, but also in weaker capillary refill, reduced pain and easily releasing hair. They show a dry, mottled pink and white wound bed. Spontaneous healing often occurs with scarring oftentimes resulting in contractures. If spontaneous healing is impeded (e.g. inadequate treatment, infection) it can convert to full-thickness burn. Full-thickness third-degree burns involve the entire dermis and can manifest itself as dry, white, leather-like, hard wound bed or carbonization without pain and hair loss due to damage of skin appendages, vessels, and nerves. The hard eschar can cause respiratory difficulties if the thorax is involved, or lead to ischemia of the limbs, in which case escharotomy is indicated. Taking only clinical appearance into account the two forms of second-degree burn can be difficult to distinguish from one another even for experienced surgeons, which can challenge planning the appropriate treatment. Therefore, instrumental techniques, such as laser-doppler-imaging, have been developed and can be considered for more precise evaluation (2,8,11–13).

1.3.3. Prognosis, mortality

Essentially, the prognosis of the patient depends on the extent and depth of the burn injury, concomitant injuries, comorbidities, patient age and the quality of medical treatment. In order to facilitate a prognosis of a patient, different risk scores have been developed. The

German society of burn medicine (DGVM, Deutsche Gesellschaft für Verbrennungsmedizin) recommends using the ABSI (abbreviated burn severity index) as a valid instrument to assess the mortality risk. Developed in 1982 by Tobiasen and widely established, this tool includes age, sex, %TBSA, inhalation trauma and third-degree burn in the risk calculation (2,8).

Also, this score has proved to be prognostically reliable. It neglects the negative influence of comorbidities such as obesity, nicotine or alcohol abuse on the outcome (2). Another pitfall may be the inconsistent criteria for assessment of inhalation injury (8).

pts.	1	2	3	4	5	6	7	8	9	10
%TBSA	1-10	11-20	21-30	31-40	41-50	51-50	61-70	71-80	81-90	91-100

pts.	1	2	3	4	5
age (years)	0-20	21-40	41-60	61-80	>80

pts.	0	1
sex	male	female
inhalation injury	no	yes
third-degree burn injury	no	yes

prognosis	**survival (%)**	**pts.**
good	99	2-3
moderate	90-99	4-5
moderate-severe	80-90	6-7
severe	50-70	8-9
bad	20-40	10-11
very bad	<10	12-13
infaust	<1	>13

Figure 1. Calculation of the ABSI score (adapted from Kamolz, Herndon and Jeschke, 2009 (2)*)*

Another widely recognized and used tool is the Revised Baux Score. The original Baux score had been described in 1961 by Professor Serge Baux, in which the percent mortality would be calculated as the sum of the age and percent body burned. Since the prognosed mortality rate due to total body surface area has declined over the past decades, the scores needed an update, why in 2008 Osler et. al. adjusted the score to mortality rate relation and extended the Baux Score inserting inhalation injury as a variable with negative prognostic value.

Therefore, now the Revised Baux Score is calculated as a sum of age and total body surface area plus 17, if the patient has an inhalation injury (14). The calculation of the resulting mortality risk is complicated and requires a calculator. That is why in 2015 Williams and Walker have introduced a new nomogram for the calculation of the Revised Baux Score (15).

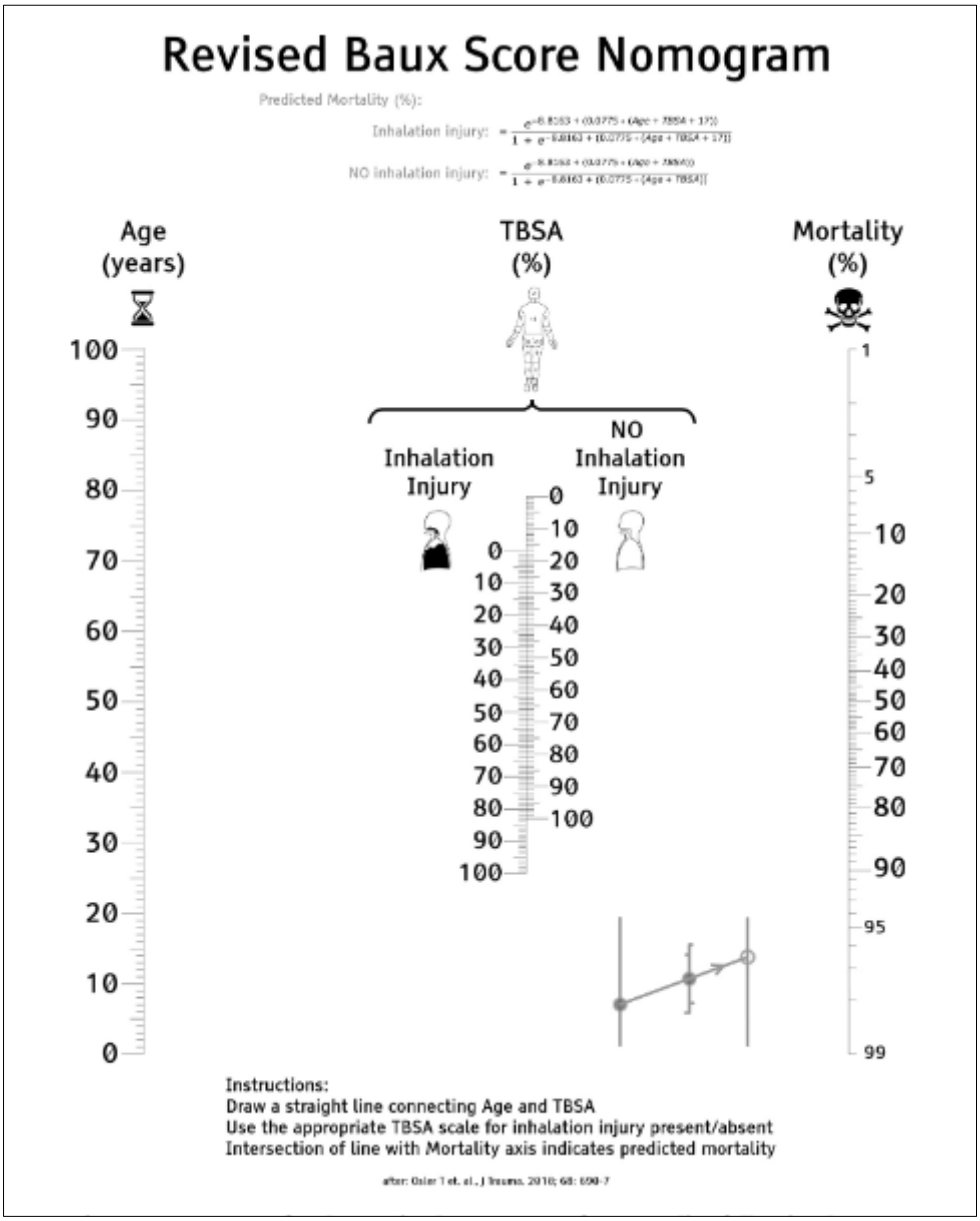

Figure 2. Nomogram for the Revised Baux Score for mortality following burns (from Williams and Walker, 2015 (15)*).*

1.3.4. Inhalation injury

Inhalation injury is defined as damage of the respiratory tract due to direct thermal influence or inhalation of toxins. The assessment of this injury is of eminent importance as it has a huge impact on patient mortality. Inhalation injury alone increases mortality rates by 20%. If it is complicated by pneumonia mortality rates increase by 60% (2).

Inhalation injury is more likely under certain injury circumstances, e.g. if the burn happened in an enclosed place or the patient was found lying unconscious in the scene of fire (13), as well as involvement of smoke, hot gases or steam (8). Physical examination may reveal symptoms such as a cough, stridor, a hoarse voice or difficulties to breath. Patients can show nasal or oral soot, especially when the burn includes the face and the hair is singed in these areas. Inhalation injury can manifest with swollen airways and pulmonary oedema, which can lead to adult respiratory distress syndrome (13).

Arterial blood gas analysis can show impairment of gas exchange, elevated carbon monoxide and methemoglobin. If an inhalation injury is suspected, the airways should be explored by fiberoptic bronchoscopy. Furthermore, chest-x-ray should be performed within 24 hours of admission and repeated during hospital stay for clinical observation (8).

1.3.5. Concomitant injuries

Frequently, patients not only sustain burn injuries to the skin, but also suffer from complicating concomitant injuries. These complex injuries require a multidisciplinary approach. In addition to a thorough case history, radiologic examinations, such as computed tomography or ultrasound may be necessary. If the face is burned, the eyes are often affected as well so that an ophthalmologist should be consulted (16).

Also, it is recommended that an ENT examines the patient for involvement of eardrums or nasal and paranasal sinuses. For the examination of the genital area a urologist should be consulted (2).

Electrical burns often cause deeper injuries that do not correlate with the superficial extent of the burn. Destruction of muscle close to bones can lead to a massive release of potassium and myoglobin necessitating a close monitoring of electrolytes and kidney function. Also, electricity can cause uncontrolled muscle contractions, which can even lead to bone fractures. Furthermore, cardiac arrhythmias up to cardioplegia are common necessitating close monitoring (2). Therefore, especially in cases of electrical burn injury the screening

for concomitant injuries should include checking limbs for compartment syndrome and if in doubt early fasciotomy should be performed (8).

1.3.6. Indication for transfer to a burn center

As burn injuries impose a special type of injury, depending on the severity of the burn injury patients should be transferred to a burn center to receive adequate treatment. The DGVM highly recommends transferring following patients for specialized care:

- 2nd degree burn injuries of 10% TBSA or more
- 3rd degree burn injuries
- Burn injuries to the hands, face or genitals
- Chemical burns
- Inhalation injury (even if the external burn injury is minor and especially must be assumed in explosion accidents)
- Burn patients with concomitant diseases or injuries that complicate treatment
- Burn patients who require special psychological, psychiatric or physical care

Eventually, all burn victims should be given the opportunity to be treated at a burn center.

Furthermore, in Styria (Austria) the Styrian hospital corporation (KAGes, Steiermärkische Krankenanstaltengesellschaft m.b.H) (17) recommends the transfer of following patients to the University Hospital of Graz:

- All infants
- Children with more than 10% TBSA burn injuries
- Adults with burn injuries necessitating surgery (2b and 3rd degree burn injuries)
- All patients with burn injuries to the face/neck, hands, feet, anogenital area, axilla, areas above major joints and other complicated localizations
- Adults with > 10% TBSA 2a degree burn injuries
- All patients with inhalation trauma
- All patients with electrical burn injuries

1.4. Pathophysiology

The primary tissue loss in burn injuries occurs through denaturation of proteins and damage to the cell membrane due to heat exposure at the cellular level. The extent of the damage depends on the temperature and duration of contact, which have a synergistic effect (2).

Subsequently, this cell and tissue damage leads to an activation of inflammatory mediators, especially in the well perfused zone (see below). The resulting oxidants and peptidases inflict further damage to the skin and capillary endothelial cells, which enhances ischemic tissue necrosis and contributes to the so called "afterburning". Additionally, the destruction of collagen junctions and cell membranes promote local edema, more extensive fluid shifts and the further release of inflammatory mediators (e.g. thromboxanes, interleukins and prostaglandins) that affect fluid regulation and trigger systemic inflammatory response. The subsequently activated neutrophils produce radicals, which in turn contribute to destruction of dermal structures, thus enhancing the local response (2).

Burn wounds have a dynamic nature, which can be described by Jackson's thermal wound theory. It can be imagined with three concentric rings, depicting the different zones of a third-degree burn. The inner zone is built by the full-thickness area and called the zone of coagulation. It is surrounded by the zone of stasis, which is characterized by reduced blood flow and may regenerate with adequate resuscitation or degenerate due to inappropriate treatment or infection. Adjacent lies the zone of hyperemia, which shows increased blood flow and only limited inflammation (12). This reversible damage will recover within 7-10 days (10).

Thermal burns evolute and can be described by four phases. At first, within the first 12 hours (emergent phase) catecholamine release due to pain and cardiovascular changes lead to increased heart rate and blood pressure together with peripheral vasoconstriction. Overlappingly after 6 to 48 hours (fluid shift phase) capillary permeability causes a fluid shift into the extravascular space resulting in edema. As the burn wound stabilizes (day 1) the hypermetabolic phase begins characterized by an elevated metabolic rate and need of higher amounts of nutrients. The physical state can last up to two years after the injury. In the final resolution phase, the formation of the scar and remodeling of tissue take place (12).

1.4.1. Systemic effects

In extensive burns (>20%) the local release of cytokines and other inflammatory mediators is so vast, that it can produce a systemic effect and disrupt the cardiovascular system. Extensive thermal injuries cause massive fluid shifts, which result in intravascular hypovolemia on the one hand and edema in burned as well as in unburned tissue and organs on the other. Even despite adequate fluid therapy the circulating inflammatory mediators and stress hormones keep the body functions off balance by increasing microvascular permeability and impairing cell membrane functions. Furthermore, the preservation of water

and salt in the kidneys is promoted and despite adequate preload and adequate volume replacement cardiac contractility is impaired. This stimulates vasoconstriction, which increases pulmonary and systemic vascular resistance and further worsens blood flow to various organs. The results of this complex chain of events are decreased intravascular volume, increased systemic vascular resistance, decreased cardiac output, end organ ischemia, and metabolic acidosis. Early and adequate volume replacement therapy and early necrotomy of burned tissue are crucial to interrupt these effects (2,9).

1.5. Consequences of burn injuries

Burn injuries are not only a great challenge for patients, their relatives and the medical staff treating them during their acute stay, but also have far-reaching consequences for physical and mental health as well as social reintegration (SR) in the longer term. Some sequelae are permanent and have life-changing effects.

Burn wounds represent a loss of the normal barrier functions of the skin resulting in the usual complications, such as infections, loss of body heat, increased water loss through evaporation and a change in the most important interactive functions such as sensitivity and appearance (2).

1.5.1. Early consequences

1.5.1.1. Shock

If more than 10% TBSA in adults is affected the reduction of plasma volume can lead to a hypovolemic shock, which can be counteracted with focused resuscitation. For initial resuscitation the Parkland formula (4ml/kg/%TBSA in 24h) or the modified Brooke-formula (2ml/kg/%TBSA in 24h) can be used. Insufficient resuscitation can lead to underperfusion of organs, whereas overinfusion can cause edema in all organs (e.g. pulmonary edema, myocardial edema), lengthening oxygen diffusion routes, and impairing perfusion (which can convert superficial into deeper burns) because of increased pressure within the tissue and even lead to abdominal compartment syndrome (18). This can also increase the rate of infections and mortality (8).

1.5.1.2. Organ malfunctioning

The main cause for organ malfunctioning is underperfusion, which is mediated by hypovolemia and vasoconstriction due to release of catecholamine, which can cause organs to failure (12).

The patients' kidney function must be monitored closely, as acute renal failure can be a lethal complication. About 50% of all patients necessitating dialysis die, mostly secondary to multiorgan failure. The gastrointestinal system also suffers with burn injuries, resulting in mucosal atrophy and increased intestinal permeability. The development of ulcers and bleedings of the stomach and duodenum is possible but can be prevented with antacid therapy. Another gastrointestinal complication can be reduced gut motility and ileus (16).

Especially electrical injuries can cause alterations in organ functioning. 30% of electrically injured patients show ECG alterations, that is why 12-canal-ECG-monitoring is indicated for at least 24 hours. Massive destruction of muscle fibre leads to myoglobinuria, which can up to a certain extent be managed with fluid replacement but can also necessitate kidney replacement therapy (8).

1.5.1.3. Infection

The main causes of mortality in patients with severe burn injuries are sepsis and multiorgan failure due to infection. Initially burn injuries are sterile. After 48 hours colonization of the wounds begins with gram-positive bacteria of normal skin flora (s. aureus, coagulase-negative staphylococcus). In the course of the next days (> 5) gram-negative bacteria from endogenous transmission of the intestines and lungs (e. coli, klebsiella pneumoniae) and exogenous sources (pseudomonas aeruginosa) start to settle in. These infections cannot be prevented by administration of systemic antibiotics but should be monitored closely and be encountered with topical measures such as removal of eschar and regular dressing changes as well as with targeted antibiotics in case of local as well as blood stream infection (8).

Wound infection can be evaluated using quantitative tissue culture. If contamination is higher than 10^5 organisms per gram of tissue, healing is impeded and the risk of hematogenous scattering increases. Although early debridement of necrotic and infected wound tissue has become a routine procedure, wound surface contamination occurs rapidly and has to be identified early for adequate therapy. That means that any changes in appearance of the wounds should prompt examination by smear and biopsy (2). Other sources of infection can be the respiratory tract, gastrointestinal tract, urinary tract and central venous catheters (16).

Pneumonia is considered the most common form of infection in burn patients and the primary cause of death, being responsible for over 50% of fatal burns. Mostly Staphylococcus aureus and gram-negative opportunistic bacteria are found to be the cause.

Another site of infection are central and peripheral veins, where catheters can cause thrombophlebitis. Staphylococcus aureus can also cause acute endocarditis with valvular lesions. In the worst-case local infections spread to cause bacteriemia and septicemia, which are challenging to get a hold of. New strains of multidrug-resistant organisms pose a pervasive threat at burn wards (2,19).

Even after grafting or healing of extensive burn injuries, superficial infections may occur, very often caused by Staphylococcus aureus. Over the last years, however, the incidence of invasive infections in burn injuries has declined significantly with the implementation of current techniques of burn care. Simultaneously, mortality attributable to infection and the incidence of infection in burn patients have been reduced, and patient survival has increased (2).

1.5.1.4. Pain

Pain caused by burn injuries is considered as one of the most severe forms of pain. It is not always proportional to burn severity and can have different pathophysiologic causes. Nociceptive, inflammatory, and neuropathic pain can be distinguished. Early neuropathic pain occurs when nerval structures are damaged, while late onset of neuropathic pain is caused by unsuccessful regeneration of nerves that sprout into adjacent intact nerves or neuromas. Neuropathic pain does not only develop in burnt areas but can also develop in donor sites. Treatment can be challenging because it is influenced by multiple factors. Depression, fear, disruption of the circadian rhythm, concerns about the future and sleep disorders can have a negative impact on pain. On the other hand, pain can lead to fear, malcompliance in wound care and mobilization, higher morbidity, longer LOS (impairment of wound healing), pain chronification, neuropathic pain syndroms (paraethesia, allodynia, hyperalgesia, dysaesthesia), depression, delir syndroms, posttraumatic stress disorder (20-45%) and latent suicidality after hospital discharge (8).

Pathophysiologically, pain and stress lead to a release of catecholamines, resulting in peripheral vasoconstriction and a direct negative influence on wound healing due to reduced skin perfusion. This can result in the deepening of initially more superficial wounds, which is called “afterburning” (see above) (2).

Furthermore, pain increases the heart rate, blood pressure and the metabolic rate, leading to a catabolic state (20).

This catabolism leads not only to a massive weight loss with a decrease in the number of possible skin removal sites, but probably also to a reduced immunological defense situation with the risk of an increased infection rate. Especially in burn patients with extensive wounds, a reduced immune status could be a significant factor increasing morbidity and mortality (2).

As a consequence, pain control plays an important role on the patients' way to recovery (20). However, with constantly changing pain quality during the intensive care stay due to various activities such as dressing changes and positioning, it is particularly difficult to ensure a therapy-adapted analgesia regime in the burn patient (2).

1.5.1.5. Pruritus

Burn-associated pruritus is a common side effect of burn injuries. It can develop early in the course of treatment and persist for years, putting a strain on the patients' way of recovery and lowering their HRQoL, especially in the psychosocial domain (8).

1.5.1.6. Operative complications

The most common operative complication is skin graft loss due to graft shear, infection or hematoma. Further, every operative procedure such as burn excision and grafting also leads to blood loss. It is estimated to be 0.5ml/cm^2., which can have an influence on the circulation with increasing wound area (16).

1.5.2. Long-term consequences

1.5.2.1. Physical

Scars often accompany patients who suffered burn injuries for the rest of their lives. At best, scars become flat and minimally noticeable discolorations of the skin. However, deep partial-thickness and full-thickness burn tend to result in pathological scarring, such as hypertrophic scars or keloids, especially when healing is prolonged or complicated by an infection. These pathological scars have in common that they compose of excess collagen, forming a thick, non-pliable compound. They do not only have an implication on the appearance, but can be painful, itchy or cause contractions, that limit functionality, thus impacting health-related quality of life (HRQoL). Both types of pathological scarring can occur after burns. The former is more common and forms only in the area of the former wound and is more likely if healing takes longer than 3 weeks. Coloration can be hypopigmented to hyperpigmented. Keloids on the other hand are much rarer and afflict predominantly patients with darker skin pigmentation. The time between injury and appearance can take months to years and when keloids arise, they show tumor-like growth,

that exceeds former wound surface, invading normal tissue. Pigmentation can also range from hypopigmentation to hyperpigmentation, whereas increased pigmentation is more common (7).

Another consequence of delayed wound healing besides the visible scarring is formation of contractures. If re-epithelialization is prolonged, especially wounds located on the flexor surfaces of joints or joints remaining in a flexed position for a longer period are prone to contractures. Here also, uncontrolled collagen deposition from myofibroblast is the main underlying cause. The most common sites of contractures are the hand, the armpit and the neck (20).

A late and rare complication of extensive scarring is scar carcinoma, also known as Marjolin's ulcer. Usually, it occurs many years after the initial burn, with a range of 3 to 60 years post complete healing, the mean latency being 31 years. Histologically the most common types are squamous cell carcinoma (71%), basal cell carcinoma (12%) and melanoma (6%), however sarcomas (5%) have also been diagnosed. Marjolin's ulcer are highly malignant and show aggressive infiltrative growth. Recurrence and regional node metastasis are not uncommon and mortality rate has been reported to be 21% (20)

Heterotopic Ossification is characterized by a pathological deposition of calcium in the soft tissue surrounding joints. This heterotopic bone formation is mostly found around the elbow and shoulder joints. It develops about 1 to 3 months after the injury, reducing range of motion and causing pain. In some cases, the heterotopic calcification can resolve spontaneously, but frequently surgical removal is necessary (11,20).

Electrical burn injuries often lead to devastating sequelae. If extremities are affected, amputation rates from 9-49% have been reported and up to 8% develop cataract (8). Also, neurological symptoms such as pain, sensory deficits, paresthesia or muscle weakness, can occur (20).

As mentioned above pain and pruritus can persist for a long time and occur in the area of the burn scars as well as in the donor sites. Functionally, burn injuries can lead to long-term or permanent limitation in the use of burned limbs, with loss of strength and hinder the patient in recommencing pre-burn activities. Furthermore, there can be physiologic deficits depending on the extent of the damaged skin appendages. A common complaint is intolerance of sun exposure, dryness of the skin and incapacity to sweat, when sebaceous and sweat glands are lost. In some cases, prolonged administration of antibiotics can have

toxic effects leading to deafness or reduced renal function. Pulmonary function can be permanently impaired following inhalation injury (20).

1.5.2.2. Mental

The highest goal in burn care is to restore functionality and at best also a good aesthetic appearance, so that the patient can return back to everyday life and restore psychological balance. Reaching this goal can be challenging for patients and their relatives as rehabilitation can take up to two years and necessitate correctional surgeries, which can put a mental strain on the patients (2).

Burn injuries can change physical appearance for ever, so patients have to learn to handle their changed body and become accustomed to the altered body functions, that may go along with severe burns. Building up new confidence also plays an essential role to be able to face curious looks of others (8). Furthermore, patients sometimes have to cope with persisting itch and pain even years after the initial injury, which can negatively impact HRQoL (21).

Some of the most commonly reported psychological impairments of burn survivors are depression, sleep disorders, anxiety, posttraumatic stress disorder, loss of joy and impotence (2,20,22,23).

1.5.2.3. Social

The psychological impact of burn trauma potentially interferes with their everyday life even years after the injury. Extent and severity of the burn injury as well as a longer length of hospital stay and the number of performed surgeries have been seen to negatively impact return to work, one of the most important components of social reintegration (24).

Especially patients who suffered burn injuries in visible body parts with permanent scarring face social challenges, when trying to return to their pre-burn everyday lives. Many patients experience emotional barriers due to self-consciousness of their new appearance with fear of rejection and feelings of embarrassment. This often leads to avoidance behavior, resulting in social withdrawal and reduced interaction with other people (25). Subsequently, also relationships and sexuality suffer (26). An important hindrance for reintegration after burn injuries are concerns of relatives about the reaction of others to the new appearance and the fear of stigmatization (27).

Altogether, these changes may hinder burn patients to return to work and their pre-burn activities without permanent physical and psychological support from relatives or

professional health care workers. As a result, they cannot fully reintegrate into their familiar pre-burn everyday life (24,28–30).

1.6. Health-related quality of life (HRQoL)

Health-related quality of life is a concept that aims to depict the patient's perception of physical, mental and social wellbeing and sets it in relation to different personal and environmental factors, that influence health (7).

As advances in medicine are proceeding, treatment goals start to shift from sheer mortality rates to improving HRQoL of patients after burn injuries, as well as return to pre-burn activity (31).

Therefore, different tools for assessment of HRQoL have been developed and the short and long-term outcome of burn victims are increasingly being studied. Some tools are burn-specific, so that a deeper insight into burn specific consequences can be perceived, whereas generic tools allow reference to other conditions. The most commonly used tools are the Burn Specific Health Scale Brief (BSHS), the Medical Outcomes Survey Short Form-36 (SF-36) and the EuroQol (EQ-5D) (7).

Many studies investigated the factors influencing HRQoL after burn injuries. Besides the extent of the initial burn injury (32), not only physical sequelae such as persistent bodily pain (21) effect HRQoL but also the patient's own resources, such as social background, previous medical and psychiatric history or his or her own coping strategies (28,29,33).

1.7. Similar studies

So far there have been a number of studies investigating HRQoL and reintegration after burn injuries in different countries, such as Sweden (21,33), Germany (34), Norway (35) or Greece (36). However, HRQoL and social reintegration (SR) have not been assessed in patients after burn injuries in the Austrian population.

1.8. Aim

The aim of this study was to shed light on HRQoL and SR in an Austrian burn population. Furthermore, we aimed to identify predictors for good post-burn HRQoL as well as SR, such as patient and injury characteristics, comorbidities and time from accident to interrogation. This insight might reveal possible targets for rehabilitation and reintegration programs in the future.

2. Material and methods

2.1. Study design

This study was a single-center follow-up study of the self-reported HRQoL and SR after burn injuries of in-patients treated at the Division of Plastic, Aesthetic and Reconstructive Surgery, Department of Surgery at the University Hospital of Graz between January 1st of 2012 and December 31st of 2019. The questionnaire was conducted between November 2020 and Mai 2021.

2.2. Hypothesis and study endpoints

Burn injuries can have a huge impact on the HRQoL and SR on the individual who suffered a burn injury. The hypothesis is that the extent and severity of the burn injury as well as the injury site, the age at which the burn occurred, preexisting co-morbidities and need of intensive care treatment correlate negatively with HRQoL and SR after the burn injury, whereas time from accident correlated positively with both.

The primary study endpoints are the self-reported HRQoL measured with the SF-36 V1.0 in German and SR at the time of questioning. Markers for SR were set as return to work, return to an autonomous living situation, leading an autonomous and self-determined life, feeling needed by others in everyday life, having a fulfilling job or retirement, enjoyable leisure activities and the wish to change aesthetics, functionality or mental health (see appendix).

Secondary endpoints are the relation of the SF-36 and burn specific questions outcomes to clinical data (age at time of injury, sex, time since injury), injury characteristics (TBSA, full-thickness burn, inhalation injury) and therapy related parameters (length of hospital stay, intensive care treatment).

2.3. Patient collective, inclusion and exclusion criteria

All patients with former burn injuries, regardless of mechanism, affected % total body surface area (%TBSA) and depth of the injury, age ≥18 at the time of injury and able to fill out the questionnaire (i.e. no severe cognitive impairment), who were treated as in-patient at the Division of Plastic, Aesthetic and Reconstructive Surgery at the Department of Surgery at the University Hospital of Graz between 2012 and 2019 were found eligible for participating in the study. Also, patients had to have an Austrian phone number. Patients were contacted by telephone, informed about the study and asked whether they wanted to participate in it. If they gave their consent, they received an email with the study information

and a written informed consent, which they were asked to sign and return by email. Patients without access to the internet were sent a letter by post.

Exclusion criteria were unwillingness to participate and cognitive impairment preventing patients from answering the questionnaire and giving informed consent.

2.4. Ethical considerations

The study bore no additional risk for the participants, and the methods did not interfere with the subjects' physical or psychological integrity. Attendance was on an entirely voluntary basis. Participants could recall their attendance at any time point of the study. The collected data was pseudonymized and saved in a password-protected excel file to limit the possibility of traceability. The study was approved by the institutional review board of the Medical University of Graz (EK-number: 32-308 ex 19/20).

2.5. Instruments/Questionnaire

For the assessment of HRQoL the Short-Form-36 Health Survey (SF-36) V1.0 was used, since it is a well-recognized multidimensional tool for assessment of patient reported HRQoL and has also been validated for outcomes in burn survivors (37). The SF-36 exists among 170 languages also in a validated German version and has been normed to the general population of Germany. For Austria there just exists a norm to the SF-12 (38). Version V1.0 was used for the survey as it is not licensed anymore (39–42).

The SF-36 encompasses eight sections (vitality, physical functioning, bodily pain, general health perceptions, physical role functioning, emotional role functioning, social role functioning, mental health). The weighted sums of these eight scales are directly transformed into 0-100 scales, based on the assumption that each section carries equal weight. The lower the score, the more disability. (40,43)

Following the SF-36, the interview was complemented with a second questionnaire consisting of twenty burn-specific, multi-alternative, single-choice questions and one question for open answers. Additionally, participants were asked about their employment, relationship and living status up to the burn injury and at the time of questioning, whether their alcohol, tobacco or drug consumption changed, their highest completed level of education and following questions about their everyday life: whether they led an autonomous and self-determined life, whether they were needed in everyday life, whether they had a fulfilling job or retirement, whether they had leisure activities which they enjoy and finally if they would change something if they could (aesthetics, body functionality, mental

wellbeing). A wish for change of aesthetics was specified by change of perceived unsightly scars. Impaired body functionality was explained with examples such as dry skin in the scarred area or range of motion. Mental wellbeing meant overcoming impairments such as persisting sleep disorders or anxiety. The complete form can be found in the appendix (Appendix: Questionnaire – SF-36 and burn specific questions). The answers to these questions are not transferred into a comparable scoring system, but individually assessed and set into relation with clinical data.

The questionnaire was carried out via telephone. The questions were read to the participants and their answers were filled in on a tablet.

2.6. Collected clinical data

Based on the medical records, following clinical data was collected:

• Age at time of injury
• Gender
• Date of injury
• Injury mechanism
• Extent of injury (in %TBSA)
• Injured site
• If applicable, days at intensive care unit
• Days of mechanical ventilation
• Need for tracheotomy
• Number of operations until discharge
• Grafting technique (Mesh grafting, MEEK grafting, Both MEEK and Mesh grafting, unmeshed graft, free flap, local flap)
• Length of hospital stay (=LOS)
• Complications during treatment (compartment syndrome, blood stream infection, acute kidney injury, acute lung injury, intestinal ischemia, amputation)
• Comorbidities (diabetes mellitus, arterial hypertension, ischemic heart disease, cerebrovascular disease, peripheral vascular disease, psychiatric disorders, history of substance abuse (alcohol, nicotine, drugs))
• Whether or not a burn-rehabilitation program was entered

2.7. Statistical analysis

The statistical analysis is performed with the statistical program SPSS 27.0 for Windows. The correlations are measured by Chi²-test, T-test, Mann-Whitney-U-test, Spearman

correlation and logistic regression analysis. The relative influence of different parameters on the test results is determined by linear regression or binary logistic regression analysis.

3. Results

3.1. Included Patients

416 in-patient cases treated between January 1st of 2012 to December 31st of 2019 for burn injuries (coded by ICD-10 T20.0-T30.7) at the Division of Plastic, Aesthetic and Reconstructive Surgery at the Department of Surgery of the University Hospital of Graz were assessed for eligibility. During screening it turned out that 2 cases were coded incorrectly as burn injuries and 5 cases happened before 2012. 21 cases were subsumed under the according patient-ID as some patients needed secondary hospital admissions or sustained recurrent burn injuries which led to multiple case-ID for a patient. In the next step the 388 patients were assessed for eligibility and contactability. 17 patients had already passed away, 15 lived abroad and had no Austrian phone number, 20 patients had no phone number listed in their contact information and 18 patients suffered from cognitive impairment, so that they could not give informed consent. The remaining 318 patients were contacted. Of those 49 seemed to have an outdated phone number in their contact information, 81 could not be reached and 60 patients were not interested in participating in the study. In total 128 patients (33.0% of all burn victims) were willing to participate in the study, 72.7% (93) male and 27.3% (35) female.

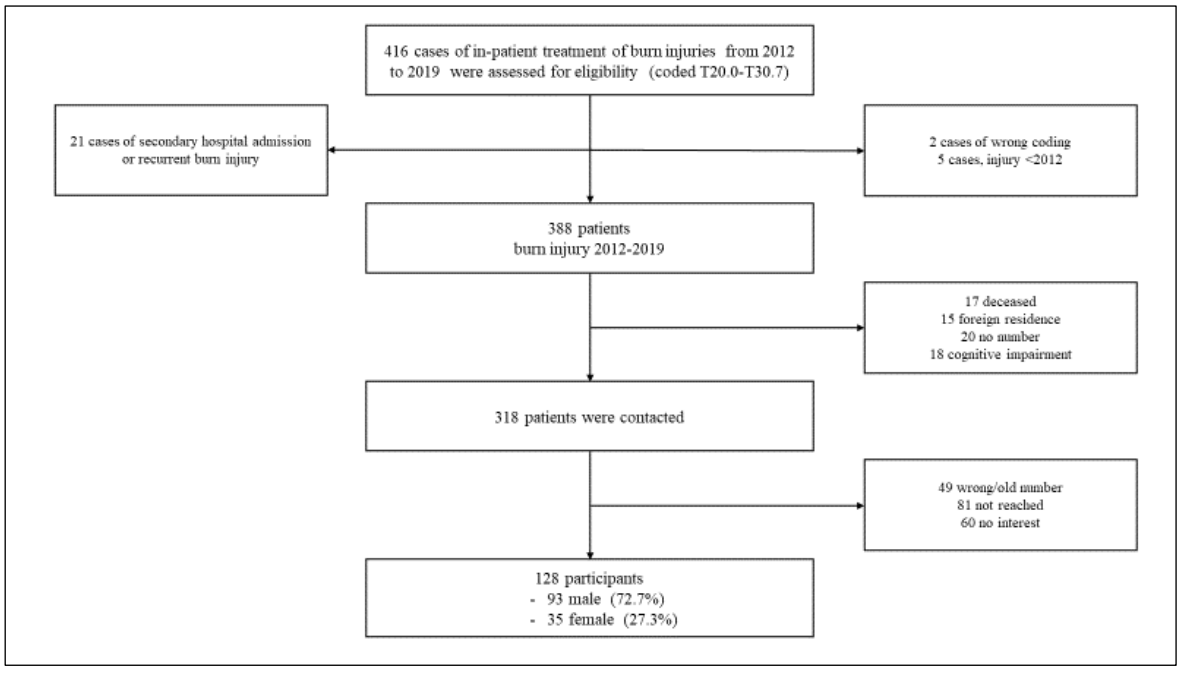

Figure 3. Flowchart outlining the selection of participants.

Table 1. Distribution of patients treated for burn injuries and participants from 2012 to 2019 at the Division of Plastic, Aesthetic and Reconstructive Surgery, Department of Surgery, University Hospital of Graz.

	Patients			Participants		
	Female	**Male**	**Total**	**Female**	**Male**	**Total**
2012	16 (45.7%)	19 (54.3%)	35	2 (14.3%)	12 (85.7%)	14
2013	17 (35.4%)	31 (64.6%)	48	5 (35.7%)	9 (64.3%)	14
2014	15 (34.1%)	29 (65.9%)	44	5 (35.7%)	9 (64.3%)	14
2015	13 (29.5%)	31 (70.5%)	44	3 (20.0%)	12 (80.0%)	15
2016	22 (33.3%)	44 (66.7%)	66	5 (21.7%)	18 (78.3%)	23
2017	19 (37.3%)	32 (62.7%)	51	6 (35.3%)	11 (64.7%)	17
2018	18 (39.1%)	28 (60.9%)	46	3 (18.8%)	13 (81.3%)	16
2019	15 (27.8%)	39 (72.2%)	54	6 (40.0%)	9 (60.0%)	15
Total	134 (34.5%)	254 (65.5%)	388	35 (27.3%)	93 (72.7%)	128

3.2. Demography

Of the 128 participants 93 (72.7%) were male and 35 (27.3%) female. Mean age at the time of injury was 40.0 years (SD 15.7 years) and at the time of inquiry 45.1 years (SD 16.2 years). Female patients were slightly older at the time of injury (41.2 years, SD 16.3) and at the time of inquiry (46.1 years, SD 16.4) versus male patients (39.5 years, SD 15.6 at injury, 44.7 years, SD 16.2 at inquiry), though not significantly. The age range was 18 to 73 years at the time of injury and 21 to 79 at the time of inquiry.

The highest level of education was apprenticeship for most of the participants (n = 82, 64.1%). 19 (14.8%) participants had a university degree, 15 (11.7%) ended their scholar education after middle school and 12 (9.4%) participants had a general qualification for university entrance at the time of inquiry. There were no significant gender differences throughout levels of education.

Documented pre-existing medical conditions were found in about one third of participants (n = 41, 32.0%). The most common disease was arterial hypertension, affecting 19 patients (22% of female participants and 11.8% of male participants). The second most common pre-existing condition was a history of psychiatric disease (n = 8), predominantly affecting female patients (17.1% vs. 2.2% in males, p = 0.002). The same accounted for history of

substance abuse with a higher likelihood of female gender (p = 0.020) as for history of alcohol abuse (p = 0.030).

Table 2. Demography of participants.

Demography of participants				
	Female	**Male**	**Total**	**p-value**
Number of patients (%)	35 (27.3%)	93 (72.7%)	128 (100%)	
Age at injury				
Mean (SD)	41.2 (SD 16.3)	39.5 (SD 15.6)	40.0 (SD 15.7)	0.594*
Age at inquiry				
Mean (SD)	46.1 (SD 16.4)	44.7 (SD 16.2)	45.1 (SD 16.2)	0.662*
Level of education				0.806**
Middle school (%)	6 (17.1%)	9 (9.7%)	15 (11.7%)	
Apprenticeship (%)	20 (57.1%)	62 (66.7%)	82 (64.1%)	
General qualification for university entrance (%)	2 (5.7%)	10 (10.8%)	12 (9.4%)	
University degree (%)	7 (20.0%)	12 (12.9%)	19 (14.8%)	
Pre-existing conditions				
Diabetes mellitus	1 (2.9%)	1 (1.1%)	2 (1.6%)	0.469***
Arterial hypertension	8 (22.9%)	11 (11.8%)	19 (14.8%)	0.118***
Ischemic heart disease	3 (8.6%)	2 (2.2%)	5 (3.9%)	0.095***
Cerebrovascular disease	1 (2.9%)	1 (1.1%)	2 (1.6%)	0.469***
Peripheral vascular disease	1 (2.9%)	0	1 (0.8%)	0.102***
Neurologic disease	3 (8.6%)	2 (2.2%)	5 (3.9%)	0.095***
History of psychiatric disease	6 (17.1%)	2 (2.2%)	8 (6.3%)	**0.002***
History of substance abuse	2 (5.7%)	0	2 (1.6%)	**0.020***
History of alcohol abuse	3 (8.6%)	1 (1.1%)	4 (3.1%)	**0.030***
Documented smoker	3 (8.6%)	10 (10.8%)	13 (10.2%)	0.716***
Other comorbidities	2 (5.7%)	4 (4.3%)	6 (4.7%)	0.736***

*t-test, **Spearman correlation, ***Pearson-Qui-Square

3.3. Injury characteristics

Table 3 provides an overview on injury characteristics overall and per gender. The most common injury mechanism was flame (n = 71, 55.5%), followed by 40 (31.3%) scalds, each 7 (5.5%) contact and chemical burns, and last 3 (2.3%) electric burns. There were no significant differences in the distribution of injury mechanisms between male and female participants (p = 0.292). Most (n = 68, 53.1%) burn injuries occurred at home, 51 (39.5%)

were work-related, 5 (3.9%) happened in traffic accidents, 1 (0.8%) was self-inflicted, 1 (0.8%) burn injury was the consequence of an assault and 2 (1.6%) had other non-specified causes. Injury circumstances differed significantly between genders ($p = 0.011$). Household accidents were the most common cause for burn injuries in both genders (60.0% in female patients, 50.5% in male patients). Work-related injuries occurred way more often among the male cohort (46.2% vs. 22.9% in female patients.)

Overall mean TBSA was 9.2% (SD 11.0) and differed significantly between male and female patients (p-value 0.005), with male patients having sustained greater injuries by TBSA. The extent of %TBSA had a significant positive correlation with length of hospital stay ($p < 0.005$), days at ICU ($p < 0.005$), days on the respirator ($p < 0.005$) and number of surgeries needed ($p < 0.005$). 51.6% (66 patients) had suffered 3rd degree full-thickness burn injuries. The extent of 3rd degree burns had not been documented for most cases and was therefore not assessed. Stepwise linear regression showed that 3rd degree burn injuries were confounded by age at injury (coefficient 0.01, $p = 0.001$), being employed at the time of injury (coefficient 0.16, $p = 0.021$) and male gender (coefficient 0.21, $p = 0.035$). The upper extremity was involved in 82 cases (64.1%), 68 cases affected the lower extremity (53.1%), 17 cases affected the back (13.3%), 30 the anterior thorax/abdomen (23.4%), 6 the genitals (4.7%), 53 the hands (41.4%) and 63 the face and/or neck (49.2%). Relatively, burn injuries to the lower extremity were more common in female patients (65.7% versus 48.4% of each group), whereas in men the upper extremity (69.9% versus 48.6%), the hands (47.3% versus 25.7%) and the face and neck (55.9% versus 31.4%) were more often affected. 5 (3.9%) patients, all male, sustained inhalation injuries additionally to external burns.

The severity of the burn injuries was depicted by the ABSI score. Data showed that the median ABSI was 5 in all cohorts, with only the IQR differing between female (IQR 4 – 6), male patients (IQR 3 - 6) as well as for the entire study population together (IQR 3.5 -6). Spearman correlation showed on average a lower ABSI score for male participants (-0.203, $p = 0.021$). For detailed data see figure 3.

Table 3. Injury characteristics of participants.

Injury characteristics				
	Female	**Male**	**Total**	**p-value**
Injury mechanism				0.292*
Flame (%)	15 (42.9%)	56 (60.2%)	71 (55.5%)	
Scald (%)	14 (40.0%)	26 (28.0%)	40 (31.3%)	
Contact burn (%)	3 (8.6%)	4 (4.3%)	7 (5.5%)	
Chemical burn (%)	3 (8.6%)	4 (4.3%)	7 (5.5%)	
Electric burn (%)	0	3 (3.2%)	3 (2.3%)	
Circumstances				**0.011***
Work-related	8 (22.9%)	43 (46.2%)	51 (39.5%)	
Household	21 (60.0%)	47 (50.5%)	68 (53.1%)	
Traffic accident	2 (5.7%)	3 (3.2%)	5 (3.9%)	
Self-inflicted	1 (2.9%)	0	1 (0.8%)	
Assault	1 (2.9%)	0	1 (0.8%)	
Other	2 (5.7%)	0	2 (1.6%)	
% TBSA				
Mean (SD)	5.6 (SD 7.3)	10.6 (SD 11.8)	9.2 (SD 11.0)	**0.005****
No. of patients with 3rd degree burns (%)	15 (42.9%)	51 (54.8%)	66 (51.6%)	0.227*
Affected body area				
Upper extremity	17 (48.6%)	65 (69.9%)	82 (64.1%)	
Lower extremity	23 (65.7%)	45 (48.4%)	68 (53.1%)	
Back	4 (11.4%)	13 (14.0%)	17 (13.3%)	
Anterior thorax/abdomen	8 (22.9%)	22 (23.7%)	30 (23.4%)	
Genitals	1 (2.9%)	5 (5.4%)	6 (4.7%)	0.548*
Hands	9 (25.7%)	44 (47.3%)	53 (41.4%)	**0.024***
Face/neck	11 (31.4%)	52 (55.9%)	63 (49.2%)	**0.014***
Inhalation injury	0	5 (5.4%)	5 (3.9%)	0.162*

*Pearson-Chi-Square, **t-test

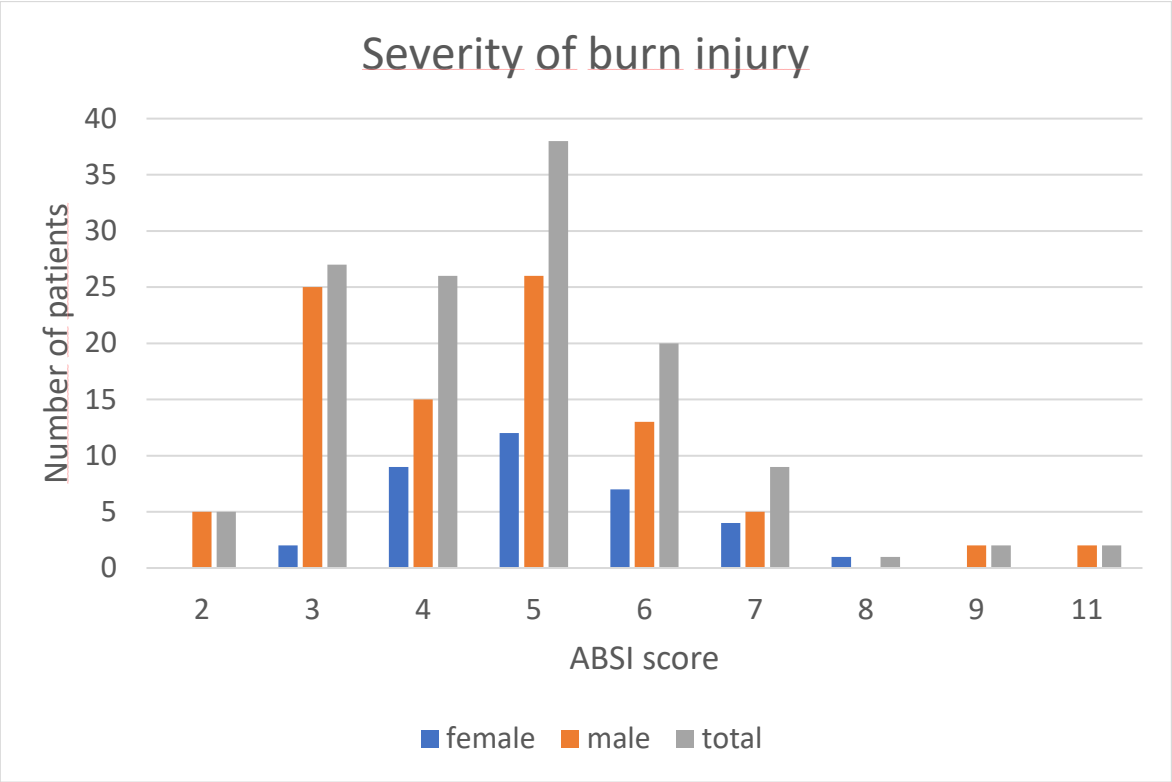

Figure 4. Severity of the burn injury among the participants based on the ABSI score by gender.

3.4. Treatment

Mean length of stay (LOS) in the hospital was 15.5 days (SD 16.4). Older patients had a significant longer LOS ($p = 0.005$). Patients with longer LOS significantly spent more days at the ICU ($p < 0.001$), spent more days on the respirator ($p < 0.001$) and underwent more surgeries ($p < 0.001$). 24 patients required intensive care treatment at the ICU (22 male and 2 female) and stayed there on average for 12.0 days (range 1 – 47). Of those 21 had to be intubated and spent a mean of 8.7 days on the ventilator (range 1 – 37). 7 patients required tracheotomy (5 male and 2 female). The majority of patients (n = 91, 71.1%) required at least one surgery, with a mean number of surgeries of 1.1 (range 0 - 7). Patients, who required more surgeries were significantly older ($p = 0.007$), had a significantly greater affected %TBSA ($p < 0.001$), spent more days at the ICU ($p < 0.001$) and more days on the respirator ($p < 0.001$). The most frequently applied grafting technique was mesh (44 patients, 34.4%), followed by unmeshed skin grafts, which was applied on 36 patients (28.1%). Furthermore, there were 1 meek (0.8%), 1 full-thickness skin graft (0.8%), 2 local flaps (1.6%) and 2 free flaps (1.6%). Following acute hospital stay 22 patients (17.2%), and more men than women (20 vs. 2, $p = 0.035$), entered a rehabilitation program. Patients undergoing

rehab were on average 42 (SD 12.0) years old. Compared to patients who did not enter rehab after injury, rehab-goers' mean %TBSA was 22.1% (SD 17.4) versus 6.5% (SD 6.5, p-value < 0.001), mean LOS was 37.1 days (SD 26.0) versus 11.0 days (SD 8.5, p < 0.001), mean days spent at ICU was 10.9 (SD 16.0) versus 0.5 days (SD 2.4, p 0.006), mean days on the respirator was 7.8 (SD 12.3) versus 0.3 days (SD 2.2, p 0.010) and number of surgeries 2.5 (SD 1.7) versus 0.9 (SD 0.8, p < 0.001).

3.5. Health-related quality of life

At the time of inquiry mean time since injury was 61.1 months (SD 25.4) and did not differ significantly between both genders. First, the answers of the SF-36 were broken down by gender. It revealed that female patients scored significantly and consistently lower in all domains, except for the domain bodily pain. For detailed data see figure 5 and table 4.

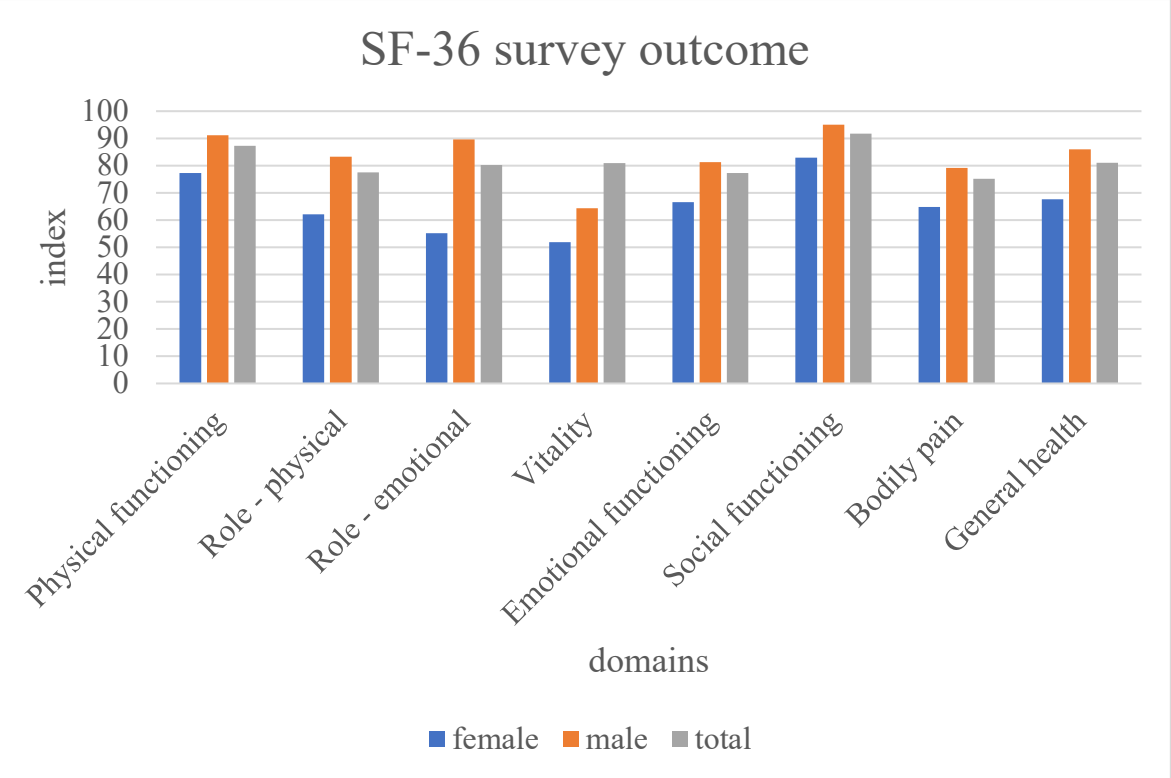

Figure 5. Mean of SF-36 domains by gender.

Table 4. Survey outcome of SF-36 domains.

Survey outcome				
	Female	**Male**	**Total**	**p-value***
Months since injury (mean, SD)	58.9 (SD 26.5)	62.0 (SD 25.1)	61.1 (SD 25.4)	0.538
SF-36 scale scores (mean, SD)				
Physical functioning	77.3 (SD 29.0)	91.2 (SD 16.3)	87.3 (SD 21.4)	**0.010**
Role – physical	62.1 (SD 47.5)	83.3 (SD 35.09)	77.5 (SD 40.0)	**0.020**
Role – emotional	55.2 (SD 49.8)	89.6 (SD 30.3)	80.2 (SD 40.0)	**0.000**
Vitality	51.9 (SD 21.0)	64.3 (SD 18.1)	80.9 (SD 19.7)	**0.003**
Mental health	66.6 (SD 21.9)	81.3 (SD 13.7)	77.3 (SD 17.5)	**0.001**
Social functioning	82.9 (SD 33.9)	95.0 (SD 17.9)	91.7 (SD 23.9)	**0.050**
Bodily Pain	64.8 (SD 40.3)	79.2 (SD 30.3)	75.2 (SD 33.8)	0.061
General health	67.6 (SD 29.8)	86.0 (SD 20.8)	81.0 (SD 24.9)	**0.002**

*t-test

Next, stepwise linear regression analysis was performed to detect variables that influenced individual domains of the SF-36. Suspected variables were clinical data (age at injury, gender, time since injury, %TBSA, 3rd degree burn injury, burn of hands, burn of genitals, burn of face or neck, inhalation injury and LOS).

The physical functioning domain correlated significantly positively with male gender ($p < 0.001$, coefficient 16.86), negatively with days LOS ($p = 0.000$, coefficient -0.55), also negatively with 3rd degree burn injury ($p = 0.023$, coefficient -7.40) and age at injury ($p = 0.037$, coefficient -0.21).

Role limitations due to physical health had a significant correlation with LOS ($p < 0.001$, coefficient -0.75) and male gender ($p = 0.001$, coefficient 24.19). Age at injury also had a negative correlation but was not significant ($p = 0.077$). For the domain role limitations due to emotional health the strongest confounders were male gender ($p < 0.001$, coefficient 36.77) and 3rd degree burn injury ($p = 0.002$, coefficient -20.00). Vitality, as well, correlated positively with male gender ($p < 0.001$, coefficient 13.48) and inversely with 3rd degree burn injury ($p = 0.028$, coefficient -7.42). The same was observed for the domain emotional

wellbeing (male gender, $p < 0.001$, coefficient 15.85; 3rd degree burn $p = 0.002$, coefficient -8.95). Social functioning had a significant correlation with male gender only ($p = 0.010$, coefficient 12.12). Significantly correlating variables for the domain pain were LOS ($p = 0.001$, coefficient -0.81), male gender ($p = 0.010$, coefficient 16.63) and TBSA ($p = 0.024$, coefficient -0.83). Affection of the hands also influenced pain, but not significantly ($p = 0.060$, coefficient -11.29). At last, general health correlated significantly with male gender ($p < 0.001$, coefficient 20.31), 3rd degree burn injury ($p = 0.014$, coefficient -10.53) and LOS ($p = 0.005$, coefficient -0.41). Inhalation injury correlated with a p-value of 0.072 (coefficient 20.71).

3.6. Social reintegration

The majority of participants (n = 95, 74.2%) was employed before they sustained the burn injury, 20 (15.6%) had already retired and 13 (10.2%) participants were unemployed. Pupils and students were counted as unemployed. More male participants were employed at the time of injury (n = 77, 81.1%) than female participants (n = 18, 51.4%). Relatively, more female (n = 9, 25.7%) than male participants (n = 11, 11.8%) were retired at the time of injury. The unemployed participants at the time of injury consisted of 8 female patients (22.9%) and 5 male patients (5.4%).

After the burn injury 57.1% of female participants (n = 20) and 72.0% of male participants (n = 67) were able to return to their pre-burn jobs with the same number of working hours. 2.9% of females and 7.5% of males changed their jobs but continued with the same working hours. 2.2% of male participants stayed in the same job but reduced their working hours. 2.9% of female and 4.3% of male participants changed their jobs and working hours. 17.1% of females and 2.2% of males reintegrated into working life without having a job before the injury. 11.4% of the female patients and 8.6% of the male patients had retired between the time of injury and inquiry. 5.7% of the women and 1.1% of the men had lost their job. 1 woman and 2 men continued unemployed.

In total 88 (68.8%) of the participants were employed at the time of inquiry, 32 (25.0%) had retired and 8 (6.3%) were unemployed. The number of employed females stayed the same, while the number of employed males declined to 70 (75.3%). The rates of retirees increased in both groups, each to 37.1% (+4) among female participants and 20.4% (+8) among male participants. Unemployment declined in both groups, overall – 3.9%, -11.5% for female participants and -1.1% for male participants. 6.3% of patients (n = 8; 6 females and 2 males),

who were unemployed before the burn injury got a job after recovery of the burn trauma. For detailed data see table 5.

Stepwise regression analysis showed that being employed after the burn injury highly correlated with being employed before the burn injury (coefficient 0.54, $p < 0.001$), age at injury (coefficient 0.02, $p < 0.001$) and also with a lower level of education (coefficient -0.22, $p = 0.012$).

Table 5. Employment status of participants pre- and post-burn injury.

Employment				
		Female	**Male**	**Total**
Pre-burn*	Self-employed	2 (5.7%)	10 (10.8%)	12 (9.4%)
	Employee/civil servant	12 (34.3%)	35 (37.6%)	47 (36.7%)
	Worker	4 (11.4%)	32 (34.4%)	36 (28.1%)
	Retiree	9 (25.7%)	11 (11.8%)	20 (15.6%)
	Unemployed	8 (22.9%)	5 (5.4%)	13 (10.2%)
Post-burn**	Self-employed	2 (5.7%)	11 (11.8%)	13 (10.2%)
	Employee/civil servant	14 (40%)	34 (36.6%)	48 (37.5%)
	Worker	2 (5.7%)	25 (26.9%)	27 (21.1%)
	Retiree	13 (37.1%)	19 (20.4%)	32 (25.0%)
	Unemployed	4 (11.4%)	4 (4.3%)	8 (6.3%)
Change of employment	Same job and hours***	20 (57.1%)	67 (72.0%)	87 (68.0%)
	Change of job***	1 (2.9%)	7 (7.5%)	8 (6.3%)
	Change of hours***	0	2 (2.2%)	2 (1.6%)
	Change of job and hours***	1 (2.9%)	4 (4.3%)	5 (3.9%)
	Got a job	6 (17.1%)	2 (2.2%)	8 (6.3%)
	Retired	4 (11.4%)	8 (8.6%)	12 (9.4%)
	Lost job	2 (5.7%)	1 (1.1%)	3 (2.3%)
	Still unemployed	1 (2.9%)	2 (2.2.%)	3 (2.3%)

*Pearson-Chi-Square **p = 0.003**, **Pearson-Chi-Square **p = 0.023**, ***Spearman correlation p = 0.898

Participants were also asked about their relationship status. Before the burn injury 75.8% of participants (n = 97) were in a relationship (54 were married, 43 unmarried). There were no significant differences in the relationship status of female and male participants (p = 0.289). After the burn injury at the time of questioning 67.2% of participants (n = 86) were in a relationship (53 married, 33 unmarried). At the time of questioning the rate of female participants in a relationship had reduced from 80.0% (n = 28) to 60.0% (n = 21) and of male participants from 74.4% (n = 69) to 69.9% (n = 65). These relative changes between both genders were not significant (p = 0.157). For detailed data see table 6.

By analyzing the data with stepwise linear regression it was found that being in a relationship after the burn injury was associated with being in a relationship before the burn injury (coefficient 0.74, p < 0.001), male gender (coefficient -0.22, p = 0.012), burn of the genital area (coefficient -0.54, p = 0.034) and burn of the face or neck area (coefficient -0.24, p = 0.027).

Table 6. Relationship status of participants pre- and post-burn injury.

Relationship status				
		Female	**Male**	**Total**
Pre-burn*	Married	16 (45.7%)	38 (40.9%)	54 (42.2%)
	Relationship, not married	12 (34.3%)	31 (33.3%)	43 (33.6%)
	Single	5 (14.3%)	23 (24.7%)	28 (21.9%)
	Widowed	2 (5.7%)	1 (1.1%)	3 (2.3%)
Post-burn**	Married	12 (34.3%)	41 (44.1%)	53 (41.4%)
	Relationship, not married	9 (25.7%)	24 (25.8%)	33 (25.8%)
	Single	11 (31.4%)	27 (29.0%)	38 (29.7%)
	Widowed	3 (8.6%)	1 (1.1%)	4 (3.1%)

*Pearson-Chi-Square p = 0.289, **Pearson-Chi-Square p = 0.157

All participants stated living independently in an owned or rented house or apartment before as well as after the burn injury. No patient had to move into an assisted living or a care facility after recovery of the burn trauma. Before the burn injury 76 (59.4%) patients lived in an owned house or apartment and 52 (40.6%) lived in a rented house or apartment. The majority of female participants (n = 20, 57.1% vs. male n = 32 , 34.4%) lived in a rented

house or apartment, whereas the majority of male participants (n = 61, 65.6% vs. female n = 15, 42.9%) lived in an owned house or apartment. Chi-Square-Test revealed a significant difference (p = 0.020) between female and male living circumstances. After the burn injury at the time of questioning 81 (63.3%) patients lived in an owned house or apartment and 47 (36.7%) lived in a rented house or apartment. Also, at the time of inquiry, there was a significant difference (p = 0.034) between female (17, 48.6%) and male (64, 68.8%) patients' living circumstances. At this time point, 48.6% of females (n = 17) and 68.8% of males (n = 64) lived in an owned house or apartment, whereas 51.4% of females (n = 18) and 31.2% of males (n = 29) lived in a rented house or apartment.

Furthermore, substance consumption (alcohol, tobacco and drugs) before and after the burn injury of the participants was assessed. In total 69.5% (57.1% of females, 74.2% of males) of patients continued drinking alcohol in the same frequency as before the injury. 26.6% (34.3% of female, 23.7% of male participants) reduced their drinking habits. Only 3.9% of participants (3 female, 2 male patients) stated to drink alcohol more frequently at the time of questioning compared to before the injury. In comparison male patients consumed alcohol significantly (p = 0.001) more regularly than female patients pre-burn as well as post-burn (p < 0.001). Confounders for the frequency of alcohol consumption after the burn injury by stepwise linear regression were found to be the frequency of alcohol consumption before the burn injury (coefficient 0.66, p < 0.001) and male gender (coefficient 0.35, p = 0.042).

Also, tobacco consumption among the participants declined after the burn injury. 13.3% of all patients (20.0% of females, 10.8% of males) reduced their smoking habits. Before the burn injury 49 participants (38.3%) smoked at least 1 package of cigarettes per week and after the burn injury 40 (31.3%) stated that they smoked more than 1 package of cigarettes per week. The number of occasional smokers (less than 1 package of cigarettes per week) dropped from 11 (8.6%) to 7 (5.5%). Only 4 patients (1 female, 3 male) increased their tobacco consumption. There were no significant gender differences in tobacco consumption. Stepwise linear regression showed an association with tobacco consumption before the burn injury (coefficient 0.68, p < 0.001).

Ten male patients stated to have used drugs up to the year before the burn injury. Three of them stated they had not used drugs ever since. Here, also, stepwise linear regression showed that drug consumption before the burn injury (coefficient 0.70, p < 0.001) was the strongest

confounder for drug consumption after the burn injury. For detailed data on substance consumption see table 7.

Table 7. Change of consumption of alcohol, tobacco and illegal drugs before versus after the burn injury.

Substance consumption pre- and post-burn injury					
		Female	**Male**	**Total**	**p-value**
Alcohol consumption					
Pre-burn	Never	10 (28.6%)	13 (14.0%)	23 (18.0%)	**0.001***
	1x/month	12 (34.3%)	9 (9.7%)	21 (16.4%)	
	2-4x/month	7 (20.0%)	34 (36.6%)	41 (32.0%)	
	2-3x/week	3 (8.6%)	30 (32.3%)	33 (25.8%)	
	>4x/week	3 (8.6%)	7 (7.5%)	10 (7.8%)	
Post-burn	Never	16 (45.7%)	19 (20.4)	35 (27.3%)	**0.000***
	1x/month	8 (22.9%)	15 (16.1%)	23 (18.0%)	
	2-4x/month	9 (25.7%)	32 (34.4%)	41 (32.0%)	
	2-3x/week	2 (5.7%)	23 (24.7%)	25 (19.5%)	
	>4x/week	0	4 (4.3%)	4 (3.1%)	
Tobacco consumption					
Pre-burn	>1pcg/week	11 (31.4%)	38 (40.9%)	49 (38.3%)	0.318*
	<1pcg/week	3 (8.6%)	8 (8.6%)	11 (8.6%)	
	Never	21 (60.0%)	47 (50.5%)	68 (53.1%)	
Post burn	>1pcg/week	9 (25.7%)	31 (33.3%)	40 (31.3%)	0.175*
	<1pcg/week	0	7 (7.5%)	7 (5.5%)	
	Never	26 (74.3%)	55 (59.1%)	81 (63.3%)	
Drug consumption					
Pre-burn	Yes	0	10 (10.8%)	10 (7.8%)	**0.043****
Post-burn	Yes	0	7 (7.5%)	7 (5.5%)	0.095**

*Pearson correlation, **Pearson-Chi-Square

Furthermore, to assess social reintegration, participants were asked whether they led an autonomous and self-determined life (autonomy), whether they felt needed in everyday life (dependence), whether they had a fulfilling life or retirement (fulfillment), whether they had enjoyable leisure activities (joy) and whether they would change their appearance (aesthetics), their body functionality (functionality) or their mental wellbeing (mental health).

The outcomes for autonomy (97.8% vs. 94.3%), dependence (95.7% vs. 94.3%), fulfillment (90.3% vs. 77.1%) and joy (94.6% vs. 85.7%) were consistently stated better by male participants than for female. However, significant differences only found in the domain fulfillment ($p = 0.050$) and mental wellbeing ($p = 0.015$, see table 8).

Table 8. Outcome of questions considering social reintegration.

Social reintegration				
	female	**male**	**total**	**p-value***
Autonomous, self-determined life	33 (94.3%)	91 (97.8%)	124 (96.9%)	0.302
Needed in everyday life	33 (94.3%)	89 (95.7%)	122 (95.3%)	0.736
Fulfilling job/retirement	27 (77.1%)	84 (90.3%)	111 (86.7%)	**0.050**
Enjoyable leisure activities	30 (85.7%)	88 (94.6%)	118 (92.2%)	0.094
Would change aesthetics	11 (31.4%)	20 (21.5%)	31 (24.2%)	0.243
Would change body functionality	14 (40.0%)	29 (31.2%)	43 (33.6%)	0.347
Would change mental wellbeing	11 (31.4%)	12 (12.9%)	23 (18.0%)	**0.015**

*Pearson-Qui-Square

Hereafter, logistic regression analysis was performed assessing dependent variables. For autonomy no connection to clinical data could be found. Dependence has shown to positively correlate with longer LOS (OR 0.95, $p = 0.004$). The same was observed for fulfillment (OR 0.96, $p = 0.036$). Months since injury was found to be a negative confounder for joy (OR 0.97, $p = 0.030$). The test further showed that the wish to change aesthetics correlated with longer LOS (OR 1.05, $p = 0.007$), younger age at injury (OR 0.96, $p = 0.018$), male gender (OR 0.36, $p = 0.045$) and 3rd degree burn injury (OR 2.97, $p = 0.046$). The wish for better body functionality correlated with age at injury (OR 0.94, $p < 0.001$), burn injury of the face or neck (OR 0.29, $p = 0.011$) and burn injury of the hands (OR 3.05, $p = 0.021$). Confounders

for the desire to change mental wellbeing were male gender (OR 0.25, p = 0.007) and 3rd degree burn injury (OR 4.06, p = 0.010).

4. Discussion

The novelty of the present study is that it is the first study examining HRQoL and SR after burn injuries in the Austrian population. The present study was able to assess the HRQoL and SR of 33.0% of all patients treated at the at the Division of Plastic, Aesthetic and Reconstructive Surgery at the Department of Surgery of the University Hospital of Graz in the study period.

The hypothesis was that the extent and severity of the burn injury as well as the injury site, the age at which the burn occurred, preexisting co-morbidities and need of intensive care treatment would correlate negatively with the HRQoL and SR after the burn injury and that it is proportional to the time between incident and questioning.

STUDY POPULATION

In this study population the majority of participants were male (72.7%), which aligns with several other studies considering worldwide burn injury trends showing a male predominance in adult burn injuries (1,44,45). Female and male participants herein did not differ significantly regarding age or education. A significant difference between those two groups was seen regarding co-morbidities. Most screened for pre-existing conditions affected only a paucity of study participants, which might have rooted in the relatively young age of participants (40.0 years, SD 15.7 years). A history of psychiatric disease, substance abuse and alcohol abuse, however, was seen in 9.4% of participants and had been reported in the medical records significantly more often within the female cohort. Psychiatric disease had been documented in 17.1% of female participants compared to 2.2% of male participants. However, there is a certain blurriness in this data, as mental health was not assessed at admission nor in the course of rehabilitation, which could have been impaired due to the trauma. Dyster-Aas et. al. (46) have observed that two-thirds of their burn patients developed at least one psychiatric diagnosis during the course of their lives, however a great part had already suffered from a psychiatric disease before the burn injury.

Though, the numbers of both latter pre-existing conditions assessed from the medical records stood in contradiction to the findings of the questionnaire's burn specific questions. In the questionnaire no women stated having used drugs within one year before the burn injury or after, whereas two had a history of substance abuse documented in their medical records. A possible explanation could be, that consumption may have stopped earlier and therefore might not have had an influence on recovery of the burn injury. On the other hand, 10 men

stated having consumed drugs within a year before the burn injury and 7 had also consumed drugs since the burn injury, whereas no men had a history of substance abuse documented in their medical records. A reason could be that drug consumption was not assessed at the initial treatment of the burn injury.

Flame burns and scalds were the predominant injury mechanism among the study population, being the cause for 86.8% of all burn injuries, which is comparable to the etiology in the rest of Europe (45). All in all, injury mechanisms did not differ between female and male participants. Regarding circumstances, the vast majority of burn injuries in this study was unintentional, comparable to international and European data (44,45). A great part of all burn injuries (92.6%) happened due to domestic or work-related accidents. Regarding circumstances, there were significant differences in the distribution of injury circumstances. Work-related injuries occurred way more often among the male cohort (46.2% vs. 22.9% in female patients.), which may be caused by the fact that high-risk occupations are still more often held by men than by women (5,44).

The mean %TBSA among the study population was 9.2% (SD 11.0) and differed significantly between female and male patients, with a positive correlation with male gender. On average male participants had suffered burns almost twice the size as female participants (5.6 (SD 7.3) versus 10.6 (SD 11.8)). 51.6% of all participants had sustained 3rd degree burn injuries and only 5 male patients had inhalation injuries. 3rd degree burn injuries were associated with higher age at injury, being employed at the time of injury and male gender. Both latter confounders could be explained by the fact that male participants had sustained work-related traumas more often than female participants.

Interestingly, female participants had more often their lower extremities burnt than male participants (65.7% versus 48.7%), whereas male participants had more often their upper extremities (69.9% versus 48.6%), the hands (47.3% versus 25.7%) and the face and neck (55.9% versus 31.4%) injured.

Greater %TBSA was significantly associated with longer LOS, days at ICU, days on the respirator and number of surgeries needed.

Female participants had a significantly higher ABSI score than male participants, which is logical as female gender automatically adds one point to the ABSI score.

SF-36

One of the main findings was that HRQoL and SR is predominantly influenced by gender. Female patients scored lower in all domains of the SF-36 survey though significantly only in 7 out of 8 domains, with the exception of the domain bodily pain, which is especially interesting as in the present study women sustained significantly less extensive burn injuries. This was also observed in other studies (47,48), such as in a Finnish study (49), where, though most patients had regained mostly normal HRQoL after 6 months post injury, women had worse outcomes than men, as well as patients with mental disorders and especially major depressive disorder. It also discovered that in their study cohort women suffered more often from mental disorders and alcohol abuse and were more often unemployed. A history of psychiatric disease, especially depression, has shown to impose an important barrier to growth (50), which may hinder patients to regain a normal HRQoL. A Swedish study (46) found out that about two-thirds of burn victims have a lifetime history of psychiatric disease, which increases the risk for further episodes postburn. Therefore, screening for psychiatric disease in burn victims and focusing on psychological rehabilitation could be a possible way of assisting those patients to regain a normal HRQoL.

Another factor for a lower score in the SF-36 survey were 3rd degree burn injuries. They led to a lower result in the domains physical functioning, role limitation due to emotional functioning, vitality, emotional wellbeing and general health. Longer LOS showed a significant correlation with lower perceived physical functioning, role limitation due to physical functioning, pain and general health. Older patients reported a significantly lower physical functioning and scored lower in the role limitation due to physical functioning domain. This was also noted in an Australian study (51), in which higher age had a negative impact on physical functioning and to a lesser degree on role limitations due to physical functioning, bodily pain, vitality and role emotional domains. Though, these impairments should be relativized as a decline in bodily functions and arising of comorbidities is a part of ageing. Also, Spronk et. al. (47) discovered in a systematic review that the study situation is incoherent about the impact of age on HRQoL after burn injuries.

%TBSA had only a significant correlation with the domain pain. Inhalation injury showed an insignificant correlation with general health, which might be due the low incidence of inhalation injuries among the study population.

Another interesting finding was, that against expectation no correlation between time since the injury or time since discharge and the self-reported HRQoL assessed with the SF-36 could be found. Furthermore, time since injury and time since discharge did not influence the answers to the burn specific questions. Several studies (35,49,52,53) showed that HRQoL after burn injuries was affected in the short term but increased and stabilized within the first few years. In the present study the time since injury ranged from 17 to 107 months with a mean of 61.1 months (SD 25.4). As many participants were interviewed many months after that stabilizing period, this could be a possible reason for the dissociation of time since injury and the SF-36 domains.

WORK

Unexpectedly a positive development in the employment status was found. Of the pre-burn injury employed male participants 86% were employed upon interview and 62.9% of females. Only 3 previously employed participants were unemployed at the time of interview and compared to the time of the injury unemployment had declined. At the time of the inquiry there were only 8 unemployed participants (-3.9%). The strongest confounders for return to work were an employment before the injury and, interestingly, higher age. Also, a lower level of education showed a correlation with return to work. Having a job before the trauma could have been motivating for the patients in the process of recovery to return to their normal life. Orwelius et. al. (33) found unemployment to have the strongest effect on HRQoL in their study population and on the other hand Dyster-Aas et. al. (28) discovered in their study cohort, that patients who were working not only achieved better HRQoL but also physical and psychological health were significantly better than in those individuals who were not working. Another aspect that should not be left out is, as Goei et. al. (30) pointed out, that absenteeism from work contributes to societal costs for burn victims.

RELATIONSHIP

Male and female patients did not differ significantly regarding their relationship status neither before nor after the burn injury, though male gender showed a negative correlation with being in a relationship after the burn injury. After the burn injury about two-thirds of participants were in a relationship, which was less than before the accident in both gender cohorts. Being in a relationship before the burn injury was found to be most strongly connected to being in a relationship before the burn injury. A negative correlation with being in a relationship and having sustained burn injuries to the genitals and face or neck was

found. A possible explanation could be scars in the face or genital area, that affect the patients' self-esteem and relationship with other people.

LIVING SITUATION

Another favorable observation was seen in the living situation of participants prior and after the burn injury, which revealed that the injury did not seem to have had a negative impact on autonomous living. No patient had to move into assisted living or into a care facility after the burn injury.

SUBSTANCE CONSUMPTION

Another unexpected finding was, that substance consumption of alcohol, as well as tobacco and illegal drugs decreased for all patients after the burn injury. Though, 69.5% of participants stated to have continued their drinking habits as before the burn injury, 26.6% reduced their drinking habits and drank alcohol less frequently compared to before the burn injury. The frequency of alcohol consumption after the burn injury was highly associated with the frequency before the burn injury, which aligns with the finding that the majority continued their drinking habits. What has to be taken into consideration, however, is that due to the present COVID-19 pandemic during the time of interview bars and restaurants were mostly closed and therefore social drinking might have been reduced in that period of time.

The questionnaire also revealed that male participants drank significantly more often alcohol than female participants, which stood in contrast to the medical records, in which more female participants than male participants had a history of alcohol abuse.

Tobacco consumption declined, as well. At the time of interview the number of non-smokers had increased by 10.2% and also the number of occasional smokers had declined, which might have also been influenced by the lockdowns due to the COVID-19 pandemic as bars were closed during the time of interview. However, the strongest confounder was tobacco consumption before the burn injury.

As mentioned above, stated drug consumption stood in opposition to the medical history of participants. Of the female patients with a history of substance abuse none have stated to having consumed drugs in the year before the burn injury nor after, which is also a positive finding and self-reported drug consumption in the male cohort has decreased by 2.3%.

SOCIAL REINTEGRATION

The self-reported aspects of SR autonomy, dependence, fulfillment and joy have shown to be fulfilled by the vast majority of participants. For the domain dependence a negative correlation with LOS could be found. A possible explanation could be that patients with a longer LOS usually sustained more severe and extensive injuries, which might have led to them needing more support from their environment instead of them being able to giving support to others. This could also be a reason for the association with longer LOS and fulfillment. Only in the domain fulfillment with job or retirement there was a significant difference between female and male participants, in which less women felt fulfilled in their job or retirement. For a possible explanation further research is necessary. Unexpectedly, months since injury was found to be a negative confounder for joy, for which no explanation could be found.

When asked, what participants would like to change, if they could, about a quarter of patients stated the aesthetics of the wounds, a third would like to improve body functionality and 18.0% would change their mental wellbeing. Patients, who wished to change their aesthetics had significantly longer LOS, were younger at the time of injury, female and had more likely sustained 3rd degree injuries. A reason could be that patients with longer LOS and 3rd degree injuries had evolved more scars, that changed their appearance. Also, physical appearance plays a more important role in the younger than in older age groups and female patients have been seen to have a poorer opinion of their scars than male patients (54).

At last, the wish for a better mental wellbeing was significantly more frequent among female participants, which aligns with the findings mentioned above, that significantly more female than male participants had a history of psychiatric disease. Also, a wish for better mental health was significantly associated with 3rd degree burn injuries, which could either be due to the trauma itself being a formative experience for the patient with lasting psychological burden or due to necessary intensive treatment, that can be a strain for the patients.

Better body functionality was wished significantly more often by younger patients and by those who had sustained an injury of their hands, as joints tend to lead to contractures and thereby can strongly impair functionality. Injury to the face or neck, interestingly, was negatively correlated with the wish for better functionality, which could be a sign that the healing of these injuries left little to no physical impairments.

4.1. Outlook and suggestions for further research

Severity of burn injuries and psychological response have a huge influence on HRQoL. Knowledge of the connection between characteristics of the burn injury and the patient's history (resources, employment, social situation, pre-existing conditions) provide useful information for optimized, individualized follow-up treatment and rehabilitation. This way patients can be identified who might need intensified rehabilitation and reintegration care.

With the knowledge that female patients have significantly lower HRQoL outcomes than male participants, further studies should focus on reasons for a lower HRQoL after burn injuries of female patients to get better insight on focused rehabilitation measures. Screening for patients, who require psychological support, as psychiatric or psychologic problems may be underreported (33), could also be considered. This way these patients could be better supported early on and reintegration could be facilitated.

Conducting a SF-36 survey in the general Austrian population could impose a valuable asset to have a reference for future studies, so that future treatment outcomes can be compared to an Austrian norm.

Another helpful tool for future research of burn injuries, their treatment and outcomes of patients in Austria could be a national, regional or institutional burn repository, as in the USA, GB, Germany (55–57). This could allow more accurate information about the representation of study populations and show trends of different aspects of burn injuries, for example injury mechanisms and severity.

4.2. Strength and Limitations

4.2.1. Strength

About a third of all patients treated at the Division of Plastic, Aesthetic and Reconstructive Surgery at the Department of Surgery at the University Hospital of Graz between 2012 and 2019 participated in the study, which is a high proportion. As the participants were accompanied through the questions by the interviewer, upcoming unclear questions could be answered immediately and no questions were left blank.

4.2.2. Limitations

First of all, the study was conducted during the SARS-CoV-19 pandemic, that put a strain on most peoples' lives as many struggled with illness, social withdrawal, isolation and altered employment situations.

Secondly, the study was conducted retrospectively and had no baseline data from before the accident nor from an earlier rehabilitation point. This means that the study was not able to assess how HRQoL developed and whether it returned to the individual pre-injury value.

Thirdly, there is a certain blurriness considering psychiatric co-morbidity and its influence of HRQoL and SR. This data was derived from the patients' medical records of this hospital only. After the burn injury there was no standardized assessment of mental burden. Therefore, there may have been patients with undiagnosed psychiatric co-morbidity and others who may have developed psychiatric illness after the trauma, which might have played a role in the process of rehabilitation and reintegration.

Furthermore, most participants suffered minor burns and had a relatively short LOS, which might have been a probably less formative experience with little scaring and other complications. It is possible that, the patients that could not be reached or were not willing to participate had sustained more extensive and severe injuries.

Although, the SF-36 was conceptualized for paper-pencil, as well as for telephone administration (58), some patients had difficulties following along the questions and the various response options. This could have impacted the given answers. Another influence on the accuracy of the answers could be the lack of anonymity during the interview, as the patients had to answer to the interviewer instead of filling out the form anonymously in their pace.

5. Conclusion

The present study was conducted in order to assess HRQoL and SR of burn survivors at the Division of Plastic, Aesthetic and Reconstructive Surgery at the Department of Surgery at the University Hospital of Graz of Graz treated for acute burn injuries between 2012 and 2019 and get an insight on possible targets for better support of patients in the future. 128 of 388 in-patients agreed to participate in this study.

First of all, this study shows that there was a male predominance among in-patients in burn injuries at this center. As work-related injuries play a major role in the injury circumstances for male burn victims, further enhancement of work safety measures in risky occupations could reduce cases of burn injuries. Secondly, female gender was a significant negative predictive factor for a lower perceived HRQoL after burn injury. Moreover, female patients display a higher rate of psychological comorbidities already before the burn injuries, which may limit the patients' resources to regain a normal HRQoL after the burn injury and impede SR. Thirdly, burn injuries seem to not have a negative impact on return to work. The vast majority of patients, who were employed before the burn injury, had returned to work at the time of interview and furthermore at the time of interview there were less unemployed participants than at the time of injury. Fourth, there was a positive trend on substance consumption. Compared to before the injury participants stated to consume less alcohol, tobacco and drugs at the time of interview, which was an unexpected finding. Fifth, the self-reported aspects of SR autonomy, dependence, fulfillment and joy have shown to be fulfilled by the vast majority of participants, which, together with the findings regarding employment after burn injuries, is a sign that most of the participants had reintegrated well into society. Sixth, only about a quarter of patients would like to change the aesthetics of the wounds, a third would like to improve body functionality and 18.0% would change their mental wellbeing. Seventh, all participants lived autonomous before the burn injury and could return to autonomous living after the burn injury.

At last, it must be considered that these findings depict the outcomes for only about a third of the patients treated between 2012 and 2019 and there is the risk of bias, that patients with worse outcomes were not reached or unwilling to participate.

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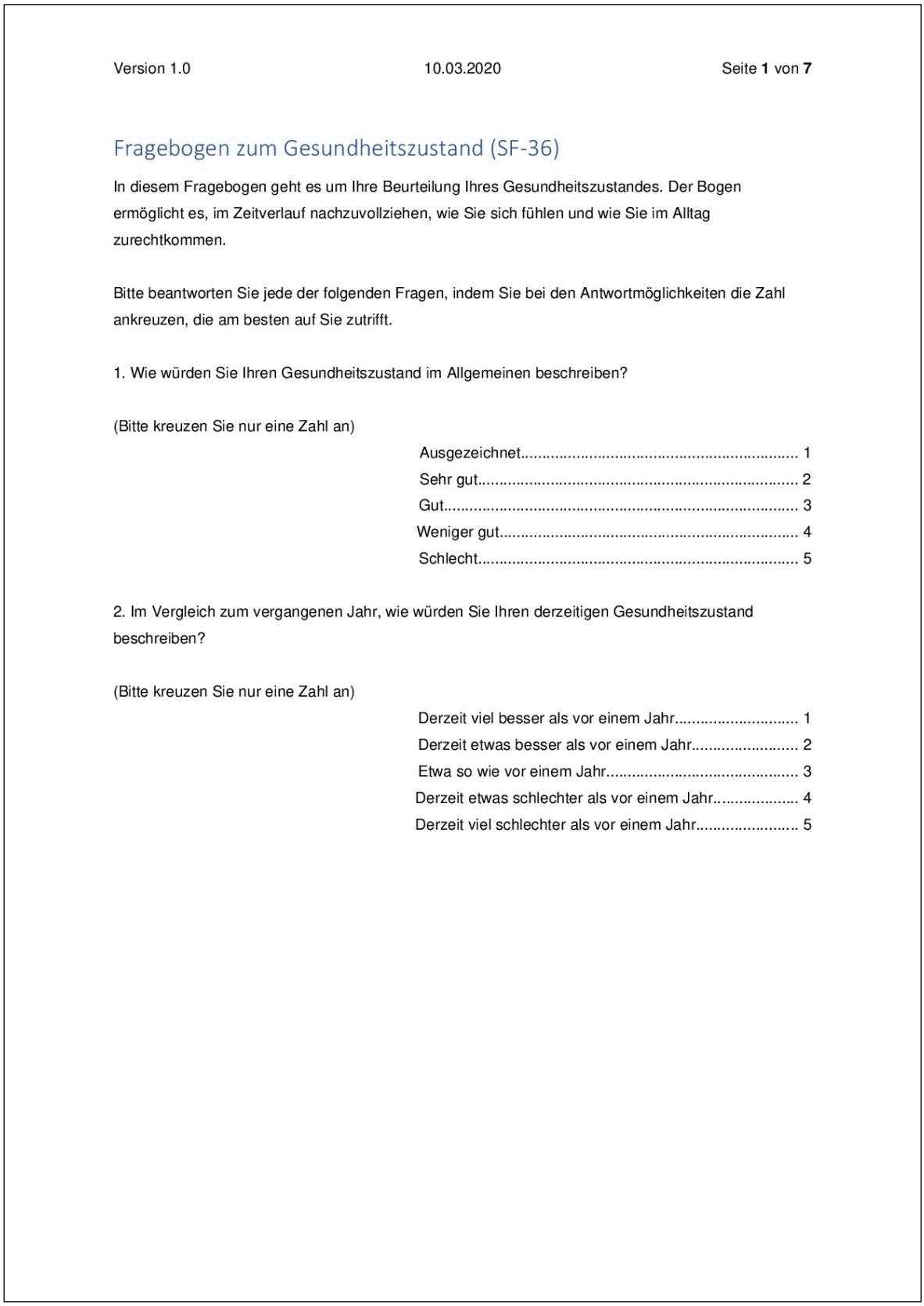
Appendix

Questionnaire – SF-36 and burn specific questions



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Fragebogen zum Gesundheitszustand (SF-36)

In diesem Fragebogen geht es um Ihre Beurteilung Ihres Gesundheitszustandes. Der Bogen ermöglicht es, im Zeitverlauf nachzuvollziehen, wie Sie sich fühlen und wie Sie im Alltag zurechtkommen.

Bitte beantworten Sie jede der folgenden Fragen, indem Sie bei den Antwortmöglichkeiten die Zahl ankreuzen, die am besten auf Sie zutrifft.

1. Wie würden Sie Ihren Gesundheitszustand im Allgemeinen beschreiben?

(Bitte kreuzen Sie nur eine Zahl an)

Ausgezeichnet..... 1
Sehr gut..... 2
Gut..... 3
Weniger gut..... 4
Schlecht..... 5

2. Im Vergleich zum vergangenen Jahr, wie würden Sie Ihren derzeitigen Gesundheitszustand beschreiben?

(Bitte kreuzen Sie nur eine Zahl an)

Derzeit viel besser als vor einem Jahr..... 1
Derzeit etwas besser als vor einem Jahr..... 2
Etwa so wie vor einem Jahr..... 3
Derzeit etwas schlechter als vor einem Jahr..... 4
Derzeit viel schlechter als vor einem Jahr..... 5

Figure A1. Questionnaire page 1.

3. Im Folgenden sind einige Tätigkeiten beschrieben, die Sie vielleicht an einem normalen Tag ausüben. Sind Sie durch Ihren derzeitigen Gesundheitszustand bei diesen Tätigkeiten eingeschränkt? Wenn ja, wie stark?

(Bitte kreuzen Sie in jeder Zeile nur eine Zahl an)

TÄTIGKEITEN	Ja, stark eingeschränkt	Ja, etwas eingeschränkt	Nein, überhaupt nicht eingeschränkt
a. anstrengende Tätigkeiten, z.B. schnell laufen, schwere Gegenstände heben, anstrengenden Sport treiben	1	2	3
b. mittelschwere Tätigkeiten, z.B. einen Tisch verschieben, staubsaugen, kegeln, Golf spielen	1	2	3
c. Einkaufstaschen heben oder tragen	1	2	3
d. mehrere Treppenabsätze steigen	1	2	3
e. einen Treppenabsatz steigen	1	2	3
f. sich beugen, knien, bücken	1	2	3
g. mehr als 1 Kilometer zu Fuß gehen	1	2	3
h. mehrere Straßenkreuzungen weit zu Fuß gehen	1	2	3
i. eine Straßenkreuzung weit zu Fuß gehen	1	2	3
j. sich baden oder anziehen	1	2	3

Figure A2. Questionnaire page 2.

4. Hatten Sie in den vergangenen 4 Wochen aufgrund Ihrer körperlichen Gesundheit irgendwelche Schwierigkeiten bei der Arbeit oder anderen alltäglichen Tätigkeiten im Beruf bzw. zu Hause?

(Bitte kreuzen Sie in jeder Zeile nur eine Zahl an)

SCHWIERIGKEITEN	JA	NEIN
a. Ich konnte nicht so lange wie üblich tätig sein	1	2
b. Ich habe weniger geschafft als ich wollte	1	2
c. Ich konnte nur bestimmte Dinge tun	1	2
d. Ich hatte Schwierigkeiten bei der Ausführung (z.B. ich musste mich besonders anstrengen)	1	2

5. Hatten Sie in den vergangenen 4 Wochen aufgrund seelischer Probleme irgendwelche Schwierigkeiten bei der Arbeit oder anderen alltäglichen Tätigkeiten im Beruf bzw. zu Hause (z.B. weil Sie sich niedergeschlagen oder ängstlich fühlten)?

(Bitte kreuzen Sie in jeder Zeile nur eine Zahl an)

SCHWIERIGKEITEN	JA	NEIN
a. Ich konnte nicht so lange wie üblich tätig sein	1	2
b. Ich habe weniger geschafft als ich wollte	1	2
c. Ich konnte nicht so sorgfältig wie üblich arbeiten	1	2

6. Wie sehr haben Ihre körperliche Gesundheit oder seelischen Probleme in den vergangenen 4 Wochen Ihre normalen Kontakte zu Familienangehörigen, Freunden, Nachbarn oder zum Bekanntenkreis beeinträchtigt?

(Bitte kreuzen Sie nur eine Zahl an)

Überhaupt nicht.....1
Etwas.....2
Mäßig.....3
Ziemlich.....4
Sehr.....5

Figure A3. Questionnaire page 3.

7. Wie stark waren Ihre Schmerzen in den vergangenen 4 Wochen?

(Bitte kreuzen Sie nur eine Zahl an)

Ich hatte keine Schmerzen.....1
Sehr leicht 2
Leicht.....3
Mäßig.....4
Stark.....5
Sehr stark.....6

8. Inwieweit haben die Schmerzen Sie in den vergangenen 4 Wochen bei der Ausübung Ihrer Alltagstätigkeiten zu Hause und im Beruf behindert?

(Bitte kreuzen Sie nur eine Zahl an)

Überhaupt nicht.....1
Ein bißchen.....2
Mäßig.....3
Ziemlich.....4
Sehr.....5

9. In diesen Fragen geht es darum, wie Sie sich fühlen und wie es Ihnen in den vergangenen 4 Wochen gegangen ist. (Bitte kreuzen Sie in jeder Zeile die Zahl an, die Ihrem Befinden am ehesten entspricht).

Wie oft waren Sie in den vergangenen 4 Wochen...

(Bitte kreuzen Sie in jeder Zeile nur eine Zahl an)

BEFINDEN	Immer	Meistens	Ziemlich oft	Manchmal	Selten	Nie
a. …voller Schwung	1	2	3	4	5	6
b. …sehr nervös	1	2	3	4	5	6
c. …so niedergeschlagen, dass Sie nicht aufheitern konnte	1	2	3	4	5	6
d. …ruhig und gelassen	1	2	3	4	5	6
e. …voller Energie	1	2	3	4	5	6
f. …entmutigt und traurig	1	2	3	4	5	6
g. …erschöpft	1	2	3	4	5	6
h. …glücklich	1	2	3	4	5	6
i. …müde	1	2	3	4	5	6

Figure A4. Questionnaire page 4.

10. Wie häufig haben Ihre körperliche Gesundheit oder seelischen Probleme in den vergangenen 4 Wochen Ihre Kontakte zu anderen Menschen (Besuche bei Freunden, Verwandten usw.) beeinträchtigt?

(Bitte kreuzen Sie nur eine Zahl an)

Immer.....1
Meistens.....2
Manchmal.....3
Selten.....4
Nie.....5

11. Inwieweit trifft jede der folgenden Aussagen auf Sie zu?

(Bitte kreuzen Sie in jeder Zeile nur eine Zahl an)

AUSSAGEN	Trifft ganz zu	Trifft weit-gehend zu	Weiß nicht	Trifft weit-gehend nicht zu	Trifft über-haupt nicht zu
a. Ich scheine etwas leichter als andere krank zu werden	1	2	3	4	5
b. Ich bin genauso gesund wie alle anderen, die ich kenne	1	2	3	4	5
c. Ich erwarte, dass meine Gesundheit nachlässt	1	2	3	4	5
d. Ich erfreue mich ausgezeichneter Gesundheit	1	2	3	4	5

Figure A5. Questionnaire page 5.

Fragen zu Ihrem alltäglichen Leben in Bezug auf Ihre Brandverletzung

Im Folgenden finden Sie Fragen zu Ihrer Ausbildung, Ihrem Berufstand sowie zu Ihrem Sozialen Umfeld und Ihrer Wohnsituation VOR und NACH Ihrer Brandverletzung.

(Bitte kreuzen Sie nur jeweils eine Antwortmöglichkeit an)

VOR Ihrer Brandverletzung	NACH Ihrer Brandverletzung
Inwieweit waren Sie berufstätig?	Inwieweit sind Sie DERZEIT berufstätig?
a. Selbstständig, in leitender Position b. Angestellter, Beamter c. Arbeiter d. Pensionist e. Arbeitssuchend	a. Selbstständig, in leitender Position b. Angestellter, Beamter c. Arbeiter d. Pensionist e. Arbeitssuchend
	Sofern Sie noch berufstätig sind, inwieweit hat sich Ihre Tätigkeit verglichen mit der Zeit vor der Brandverletzung verändert?
	a. gar nicht, ich bin im selben Beruf wie zuvor mit demselben Beschäftigungsausmaß b. gleicher Beruf wie zuvor aber mit geringerem Beschäftigungsausmaß (z.B. 50%). c. anderer Beruf als vorher (z.B. nach einer Umschulung) mit vollem Beschäftungsausmaß d. anderer Beruf als vorher (z.B. nach einer Umschulung) mit geringerem Beschäftungsausmaß
Waren Sie VOR Ihrer Brandverletzung in einer Beziehung?	Sind Sie DERZEIT in einer Beziehung?
a. ja, verheiratet b. ja, unverheiratet c. nein, alleinstehend d. nein, verwitwet	a. ja, verheiratet b. ja, unverheiratet c. nein, alleinstehend d. nein, verwitwet
Wie war Ihre Wohnsituation VOR der Brandverletzung?	Wie ist Ihre DERZEITIGE Wohnsituation?
a. Eigentumswohnung/eigenes Haus b. Mietwohnung c. Betreutes Wohnen d. Pflegeeinrichtung	a. Eigentumswohnung/eigenes Haus b. Mietwohnung c. Betreutes Wohnen d. Pflegeeinrichtung
Wie oft haben Sie VOR Ihrer Brandverletzung Alkohol getrunken?	Wie oft trinken Sie DERZEIT Alkohol?
a. nie b. etwa 1-mal pro Monat c. 2-4-mal pro Monat d. 2-3-mal pro Woche e. 4-mal oder öfter pro Woche	a. nie b. etwa 1-mal pro Monat c. 2-4-mal pro Monat d. 2-3-mal pro Woche e. 4-mal oder öfter pro Woche
Haben Sie VOR Ihrer Brandverletzung Tabakwaren konsumiert?	Konsumieren Sie DERZEIT Tabakwaren?
a. ja (>1 Pkg./Woche) b. gelegentlich (<1 Pkg./Woche) c. nie	a. ja (>1 Pkg./Woche) b. gelegentlich (<1 Pkg./Woche) c. nie
Haben Sie in dem Jahr VOR Ihrer Brandverletzung Drogen konsumiert?	Haben Sie SEIT Ihrer Brandverletzung Drogen konsumiert?
a. ja b. nein	a. ja b. nein

Figure A6. Questionnaire page 6.

1. Welche ist Ihre höchste abgeschlossene Ausbildung?

(Bitte kreuzen Sie nur eine Zahl an)

Pflichtschule……1
Lehre……2
Matura……3
Fachhochschule/Universitätsabschluss……4

2. Wenn Sie Ihre jetzige Lebenssituation beschreiben müssten, welche der folgenden Aussagen trifft zu?

(Bitte kreuzen Sie nur eine Zahl an)

	JA	NEIN
Ich führe ein selbstständiges und selbstbestimmtes Leben.	1	2
Ich werde im Alltag gebraucht.	1	2
Ich habe einen Beruf / einen Pensionsalltag, der mich erfüllt.	1	2
Ich habe Freizeitbeschäftigungen, die mir Freude bereiten.	1	2
Wenn ich könnte, würde ich etwas ändern.	1	2

3. Was würden Sie ändern wollen, wenn Sie es könnten?

(Bitte kreuzen Sie nur eine Zahl an)

Ihr Aussehen (z.B. bei als unschön empfundenen Verbrennungsnarben)……1
Ihre körperliche Funktionalität (z.B. keine trockene Haut im Narbenbereich, Beweglichkeit)……2
Ihr seelisches Wohlbefinden (z.B. wenn anhaltende Schlafstörungen, oder Ängstlichkeit bestehen)….3

4. Gibt es noch etwas, das Sie uns gerne mitteilen möchten?

Bitte schreiben Sie hier Ihre Antwort: _____

Figure A7. Questionnaire page 7.

Participant information and informed consent

Teilnehmerinformation und Einwilligungserklärung zur Teilnahme an der Vergleichs-Studie

Gesundheitsbezogene Lebensqualität und Reintegration[1] in den Alltag nach Brandverletzungen

Sehr geehrte Dame, sehr geehrter Herr!

Wir laden Sie herzlich dazu ein an der im Folgenden beschriebenen Studie teilzunehmen. In einem detaillierten Gespräch wird die Aufklärung über den Studienablauf erfolgen.

Die Teilnahme an dieser Studie ist freiwillig, weshalb Sie auch jederzeit ohne Angabe von Gründen aus der Studie ausscheiden können. Eine Ablehnung der Teilnahme bzw. ein Ausscheiden aus der Studie hat für Sie keine weiteren Folgen.

Für die Durchführung dieser Studie ist Ihr schriftliches Einverständnis notwendig. Bitte lesen Sie sich den nachfolgenden Text zum Informationsgespräch aufmerksam durch. Bitte zögern Sie bei Fragen nicht, diese zu stellen.

Bitte unterschreiben Sie die Einwilligungserklärung nur, wenn Sie:

- Sich über Ablauf und Art der Studie im Klaren sind,
- Einer Teilnahme zustimmen und
- Über Ihre Rechte als TeilnehmerIn einer Studie Bescheid wissen.

Von der Ethik-Kommission wurde sowohl für die vorliegende *Einwilligungserklärung und Teilnehmerinformation* als auch für die Studie eine positive Stellungnahme abgegeben.

1. Was ist der Zweck dieser Vergleichs-Studie?

Verbrennungen sind häufige und schwere Verletzungen, die für manche Betroffene lebenslange Folgen nach sich ziehen können. Körperliche Beeinträchtigungen durch Narben oder gar den Verlust von Gliedmaßen sind häufig, aber genauso können seelische Folgeerscheinungen wie Schlafstörungen, Ängste, Depressionen und sozialer Rückzug Auswirkungen auf das alltägliche Leben nach Brandverletzungen haben.

Die gesundheitsbezogene Lebensqualität bezeichnet die von jemandem selbst empfundene Lebensqualität in Zusammenhang mit körperlichen, seelischen und sozialen Gegebenheiten. Die gesundheitsbezogene Lebensqualität ist dabei nicht zwingend von den jeweiligen gesundheitlichen und sozialen Hindernissen beeinflusst, sondern hängt auch stark davon ab, wie gut jemand selbst mit diesen Hindernissen zurechtkommt. Man vermutet außerdem,

[1] Wieder-Einfindung, z.B. Rückkehr zum Arbeitsplatz, selbstständige Bewältigung von Alltagstätigkeiten wie Einkaufen

Figure A8. Participant information and informed consent page 1.

dass kulturelle und gesellschaftliche Gegebenheiten ebenso einen Einfluss auf die gesundheitsbezogene Lebensqualität haben.

Es ist bekannt, dass die gesundheitsbezogene Lebensqualität nach Brandverletzungen nach einer gewissen Zeit wieder vergleichbar mit der Lebensqualität unverletzter Probandinnen und Probanden ist. Allerdings ist bis jetzt wenig über die Reintegration in den Alltag nach Brandverletzungen bekannt. Außerdem wurde bisher noch nicht direkt verglichen, ob es zwischen verschiedenen Ländern und Kulturen Unterschiede hinsichtlich der gesundheitsbezogenen Lebensqualität und Reintegration in den Alltag nach Brandverletzungen gibt.

Mit dieser Studie sollen anhand von klinischen Daten zur Brandverletzung und einem Fragebogen zur gesundheitsbezogenen Lebensqualität und Reintegration in den Alltag folgende 3 Punkte erhoben werden:

- Wie gut sind gesundheitsbezogene Lebensqualität und Reintegration in den Alltag nach Brandverletzungen?
- Wie stehen gesundheitsbezogene Lebensqualität und Reintegration in den Alltag in Zusammenhang mit den klinischen Daten[2] zu Ihrer Verletzung?
- Gibt es dahingehend Unterschiede zwischen den Ländern Österreich und Schweden?

2. Wie läuft diese Vergleichs-Studie ab?

Ihnen wird im Zuge dieser Befragung ein Fragebogen vorgelegt werden. Wir werden Sie darum bitten diesen genau durchzulesen und die Fragen selbstständig und wahrheitsgemäß zu beantworten. Sie erhalten ausreichend Zeit den Fragebogen durchzulesen und auszufüllen. Bei Fragen können Sie sich selbstverständlich jederzeit an uns wenden. Sie werden von uns außerdem mündlich nach ihrem vollen Namen sowie dem Geburtsdatum gefragt werden, um eine etwaige Verwechslung mit einer/m anderen Patientin/en auszuschließen.

Maximal 1000 Personen werden an der ersten Phase dieser Studie teilnehmen. Für diese Vergleichsstudie werden im selben Zeitraum Patientinnen und Patienten in Schweden denselben Fragebogen (in schwedischer Sprache) ausfüllen.

Die Studie wird in 2 Phasen unterteilt:

1) In der **aktiven Phase** benötigen wir Ihre Mitarbeit und bitten Sie darum den Ihnen ausgehändigten Fragebogen gewissenhaft auszufüllen.
2) In der **passiven Phase** werden die Antworten aller Teilnehmer aus allen Fragebögen zusammengetragen und in Zusammenschau mit den klinischen Daten statistisch[3] ausgewertet.

Die von Ihnen erhaltenen Informationen werden ausschließlich im Rahmen dieser Studie verwendet und ausgewertet. Die maximale Dauer der Studie beträgt 3 Jahre.

3. Welche Daten werden erfasst?

Zusätzlich zu den von Ihnen ausgefüllten Fragebögen bitten wir um Ihre Erlaubnis Einsicht in Ihre Krankengeschichte nehmen zu dürfen. Es werden ausschließlich Daten die in direktem Zusammenhang mit Ihrer Brandverletzung stehen erhoben, einschließlich Alter, Geschlecht,

[2] Persönliche, krankheits- bzw. verletzungsbezogene Daten, wie Alter, Geschlecht und Verletzungsausmaß
[3] rechnerisch

Figure A9. Participant information and informed consent page 2.

Verletzungsausmaß, Daten zur durchgeführten Therapie (z.B. Anzahl der Operationen), sowie die Krankenhausaufenthaltsdauer erhoben. Das ist einerseits notwendig, da sich nur in Zusammenschau mit diesen klinischen Daten bestimmen lässt, welche Faktoren nun tatsächlich maßgeblichen Einfluss auf das Leben nach Brandverletzungen haben. Andererseits ist nur anhand dieser Daten ein Vergleich zwischen verschiedenen Patienten möglich, da davon auszugehen ist, dass schwerere Verletzungen Lebensqualität und Reintegration in den Alltag stärker beeinflussen.

Ihre Informationen werden in anonymisierter Form gespeichert, es ist somit bei Bearbeitung der Daten kein direkter Rückschluss auf Ihre Person möglich.

Sollten Sie sich für einen vorzeitigen Studienabbruch entscheiden, werden keine weiteren Daten über Sie erhoben. Allerdings können zur Verschwiegenheit verpflichtete, dafür autorisierte Personen auf Grund von gesetzlichen Dokumentationspflichten in einem fix eingeschränkten Zeitraum Einsicht in Ihre Daten nehmen. Auf Ihren expliziten Wunsch hin können die von Ihnen erhobenen Daten sofort gelöscht werden.

4. Worin liegt der Nutzen einer Teilnahme an dieser Studie?

Durch die Teilnahme entsteht kein unmittelbarer Vorteil für die Studienteilnehmer. Allerdings können die Ergebnisse dieser Studie darauf hinweisen, in welchen Aspekten hinsichtlich Lebensqualität und Reintegration in den Alltag nach Brandverletzungen Verbesserungsbedarf besteht.

Durch die Studie entstehen für einen Teil der Teilnehmer zwangsläufig außerplanmäßige Kontaktaufnahmen, die dem behandelnden Zentrum auch abseits der Studie Rückschluss über die Qualität des eigenen Behandlungskonzeptes geben. Gleichzeitig hat jeder Teilnehmer die Möglichkeit sich bei Rückfragen, Anliegen oder Beschwerden persönlich an die Prüfer zu wenden. Gegebenenfalls können so Studienteilnehmer auf Wunsch nach Abschluss der aktiven Phase der Studie weiterführenden Behandlungen zugeführt werden.

5. Gibt es spezielle Risiken im Zusammenhang mit dieser Studie?

Das größte (theoretische) Risiko liegt im Bekanntwerden persönlicher Daten. Da im Zuge dieser Studie keine Daten erhoben werden, die direkten Rückschluss auf Ihre Person erlauben, ist davon auszugehen, dass eine Teilnahme an der Studie kein Risiko mit sich bringt.

6. Wann wird die Studie vorzeitig beendet?

Sie können Ihre Teilnahmebereitschaft an der Studie jederzeit und ohne Angabe von Gründen widerrufen. Ein Ausscheiden aus der Studie hat für Sie keine weiteren Folgen.

Die Studie wird von Seiten der PrüferInnen vorzeitig beendet, wenn sich herausstellt, dass schon bei geringer Teilnehmeranzahl deutliche Unterschiede zwischen österreichischen und schwedischen Brandverletzten hinsichtlich Lebensqualität und Reintegration in den Alltag offensichtlich werden.

7. Datenschutz

Bei den Daten, die über Sie im Rahmen dieser klinischen Studie erhoben und verarbeitet werden, ist grundsätzlich zu unterscheiden zwischen

1) jenen personenbezogenen Daten, anhand derer Sie direkt identifizierbar sind (z.B. Name, Geburtsdatum, Adresse, Bildaufnahmen...),

Figure A10. Participant information and informed consent page 3.

2) pseudonymisierten (verschlüsselten) personenbezogenen Daten, bei denen alle Informationen, die direkte Rückschlüsse auf Ihre Identität zulassen, durch einen Code (z. B. eine Zahl) ersetzt bzw. (z.B. im Fall von Bildaufnahmen) unkenntlich gemacht werden. Dies bewirkt, dass die Daten ohne Hinzuziehung zusätzlicher Informationen und ohne unverhältnismäßig großen Aufwand nicht mehr Ihrer Person zugeordnet werden können und
3) anonymisierten Daten, bei denen eine Rückführung auf Ihre Person nicht mehr möglich ist.

Der Code zur Verschlüsselung wird von den verschlüsselten Datensätzen streng getrennt und nur an Ihrem Prüfzentrum aufbewahrt.

Zugang zu Ihren nicht verschlüsselten Daten haben der Prüfarzt und andere Mitarbeiter des Studienzentrums, die an der klinischen Studie oder Ihrer medizinischen Versorgung mitwirken. Die Daten sind gegen unbefugten Zugriff geschützt. Zusätzlich können autorisierte und zur Verschwiegenheit verpflichtete Beauftragte der Abteilung für Plastische, Ästhetische und Rekonstruktive Chirurgie der Medizinischen Universität Graz sowie Beauftragte von in- und/oder ausländischen Gesundheitsbehörden und jeweils zuständige Ethikkommissionen in die nicht verschlüsselten Daten Einsicht nehmen, soweit dies für die Überprüfung der ordnungsgemäßen Durchführung der klinischen Studie notwendig bzw. vorgeschrieben ist.

Eine Weitergabe der Daten erfolgt nur in verschlüsselter oder anonymisierter Form. Auch für etwaige Publikationen werden nur die verschlüsselten oder anonymisierten Daten verwendet.

Sämtliche Personen, die Zugang zu Ihren verschlüsselten und nicht verschlüsselten Daten erhalten, unterliegen im Umgang mit den Daten der Datenschutz-Grundverordnung (DSGVO) sowie den österreichischen Anpassungsvorschriften in der jeweils gültigen Fassung.

Im Rahmen dieser klinischen Studie ist keine Weitergabe von Daten in Länder außerhalb der EU vorgesehen.

Sie können Ihre Einwilligung zur Erhebung und Verarbeitung Ihrer Daten jederzeit widerrufen. Nach Ihrem Widerruf werden keine weiteren Daten mehr über Sie erhoben. Die bis zum Widerruf erhobenen Daten können allerdings weiter im Rahmen dieser klinischen Studie verwendet werden.

Aufgrund der gesetzlichen Vorgaben haben Sie außerdem, sofern dies nicht die Durchführung der klinischen Studie voraussichtlich unmöglich macht oder ernsthaft beeinträchtigt, das Recht auf Einsicht in die Ihre Person betreffenden Daten und die Möglichkeit der Berichtigung, falls Sie Fehler feststellen.

Sie haben auch das Recht, bei der österreichischen Datenschutzbehörde eine Beschwerde über den Umgang mit Ihren Daten einzubringen (www.dsb.gv.at).

Die voraussichtliche Dauer der klinischen Studie ist 2 Jahre. Die Dauer der Speicherung Ihrer Daten über das Ende der klinischen Studie hinaus ist durch Rechtsvorschriften geregelt. (Anmerkung: dies gilt nicht für alle Studien und ist im Einzelfall zu prüfen/ zu begründen)

Falls Sie Fragen zum Umgang mit Ihren Daten in dieser klinischen Studie haben, wenden Sie sich zunächst an Ihren Prüfarzt. Dieser kann Ihr Anliegen ggf. an die Personen, die am Studienzentrum für den Datenschutz verantwortlich sind, weiterleiten.

Figure A11. Participant information and informed consent page 4.

Kontaktstelle zum Datenschutz am LKH-Univ. Klinikum Graz (datenschutz@medunigraz.at);
Kontaktstelle zum Datenschutz in den Krankenanstalten der KAGes (datenschutz@kages.at).

8. Entstehen für die Teilnehmer Kosten? Gibt es Kostenersatz oder Vergütung?

Für die Studienteilnehmer entstehen keine Kosten. Es sind kein Kostenersatz und keine Vergütung vorgesehen

9. An wen soll ich mich wenden, falls Fragen zur Studie auftreten sollten?

Ass. Dr. Christian Smolle

Cand. med. Maria-Fernanda Hutter

Univ.-Prof. Dr. Lars-Peter Kamolz

Erreichbar unter (+43 316) 385 14685 bzw. plastischechirurgie@medunigraz.at

Adresse:

Klinische Abteilung für Plastische, Ästhetische und Rekonstruktive Chirurgie

Universitätsklinik für Chirurgie

Medizinische Universität Graz

Auenbruggerplatz 29, 8036 Graz, Österreich

10. Wo kann ich mich weiter über die Studie informieren?

Steiermärkische PatientInnen- und Pflegeombudschaft

Tel.: 0316-877-3350

Email: ppo@stmk.gv.at

Adresse: Haus der Gesundheit, Friedrichgasse 9, 8010 Graz

Als TeilnehmerIn an dieser Studie haben Sie jederzeit die Möglichkeit, entweder selbstständig oder mit Hilfe der oben angeführten Kontaktstelle weitere studienspezifischen Informationen einzuholen.

Figure A12. Participant information and informed consent page 5.

11. Einwilligungserklärung:

Name des Teilnehmers in Druckbuchstaben: ……

Geburtsdatum: ……

Code: ……

Hiermit erkläre ich mich dazu bereit an der Studie „Gesundheitsbezogene Lebensqualität und Reintegration in den Alltag nach Brandverletzungen“ teilzunehmen.

Ich wurde von Frau/Herrn (Dr.med.) ……..genau und verständlich über den Ablauf der Studie und damit verbundene mögliche Risiken (theoretisch bekanntwerden persönlicher Daten, wobei ein Rückschluss auf die eigene Person a priori ausgeschlossen ist) aufgeklärt. Außerdem wurde mit mir die Bedeutung und Tragweite der Studie und die sich für mich daraus ergebenden Anforderungen genau besprochen.

Die Teilnehmerinformation habe ich eigenständig und in Ruhe durchgelesen. Meine Prüferin/mein Prüfer hat meine Frage genau und zufriedenstellend beantwortet. Mir stand genug Zeit zur Verfügung, eine Entscheidung zu treffen. Im Moment habe ich keine Fragen mehr.

Den Anordnungen, die für die Durchführung der Studie erforderlich sind, werde ich Folge leisten. Ich behalte mir aber das Recht vor, jederzeit ohne Angabe von Gründen meine freiwillige Mitwirkung an der Studie zu beenden. Das Ausscheiden aus der Studie bringt keine Nachteile für mich mit sich.

Ich bin damit einverstanden, dass die im Rahmen der Studie gesammelten Informationen über mich abgespeichert werden. Ich wurde darüber informiert, dass zur Überprüfung auf Richtigkeit der Datenaufzeichnung von Beauftragten der zuständigen Ethik-Kommission, den Behörden und in gewissen Fällen den Auftraggebern der Studie über die Prüferin/den Prüfer Einsicht genommen werden kann.

Ich stimme ausdrücklich zu, dass meine im Rahmen dieser Studie erhobenen Daten wie im Abschnitt „Datenschutz“ dieses Dokuments beschrieben verwendet werden.

Ja O Nein O

Ich habe eine Kopie der Teilnehmerinformation und Einwilligungserklärung erhalten. Das Original liegt bei der Prüferin/dem Prüfer.

……

(*Datum und Unterschrift des Teilnehmers*)

……

(*Datum, Name und Unterschrift des verantwortlichen Prüfers*)

(*Der Teilnehmer erhält eine unterschriebene Kopie der Teilnehmerinformation und Einwilligungserklärung, das Original verbleibt im Studienordner der Prüferin/des Prüfers*).

Figure A13. Participant information and informed consent page 6.

Email Template

Email Einwilligungserklärung Version 2.0 25.11.2020

Sehr geehrte/r Frau/Herr [Name],

Sie haben sich mündlich dazu bereiterklärt an der Studie „Gesundheitsbezogene Lebensqualität und Reintegration in den Alltag nach Brandverletzungen“ teilzunehmen.

Vielen Dank, dass Sie sich die Zeit genommen haben!

Im Anhang dieser Mail finden Sie ein Informationsschreiben zur Studie, in dem alle Informationen, die Sie von uns bereits telefonisch erhalten haben, zusammengefasst sind.

Wir sind dazu verpflichtet zusätzlich zu ihrer mündlichen Einverständniserklärung auch Ihre schriftliche Einwilligung zur Teilnahme an der Studie einzuholen. Daher möchten wir Sie bitten, den untenstehenden Text an den gelb markierten Stellen mit Ihren persönlichen Daten zu ergänzen und in ausgefüllter Form an die folgenden beiden Emailadressen zu retournieren: christian.smolle@medunigraz.at; maria.hutter@stud.medunigraz.at

Mit freundlichen Grüßen,

Maria Fernanda Hutter

Schriftlicher Einwilligungstext, ausgefüllt an den Prüfer zu retournieren:

Sehr geehrte Damen und Herren!

Ich, [Ihr Vorname & Nachname], geboren am [Ihr Geburtsdatum], erkläre mich dazu bereit an der Studie „Gesundheitsbezogene Lebensqualität und Reintegration in den Alltag nach Brandverletzungen“ teilzunehmen. Ich habe die Patienteninformation zur Studie erhalten und erkläre mich gemäß der in Punkt 11 beschriebenen Bedingungen zu einer Teilnahme bereit.

Mit freundlichen Grüßen [Ihr Vorname & Nachname]

Figure A14. Email template.