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RSTNCOVID Burns: A multi-centre service evaluation and stakeholder survey of the impact of COVID-19 on burns care in England, Wales and Northern Ireland

Georgina S.A. Phillips^a, Justin C.R. Wormald^{b,*},
Ryo Yoshimura^c, Matthew D. Gardiner^{b,d},
Jeremy N. Rodrigues^{b,e}, Declan P. Collins^{a,f}, on behalf of the
RSTNCOVID Burns Collaborative

^a Department of Burns and Plastic Surgery, Chelsea and Westminster Hospital, London, United Kingdom

^b Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences (NDORMS), Botnar Research Centre, University of Oxford, United Kingdom

^c Hull York Medical School, John Hughlings Jackson Building, University Road, Heslington, York, United Kingdom

^d Department of Plastic & Reconstructive Surgery, Wexham Park Hospital, Slough, United Kingdom

^e Department of Plastic & Reconstructive Surgery, Stoke Mandeville Hospital, Aylesbury, United Kingdom

^f Department of Surgery and Cancer, Imperial College, South Kensington Campus, London, United Kingdom

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Abstract As the UK entered the first wave of the COVID-19 pandemic, the National Health Service published consensus guidance to the UK burns services advising changes to the acute management of burns to allow the continuation of safe care while protecting limited hospital resources. We aimed to describe the demographics of burns service users, changes to clinical pathways and experiences of the burns team during the first wave of the COVID-19 pandemic. All burns services in the UK were invited to participate in a national collaborative, trainee-led study supported by the Reconstructive Surgery Trials Network. The study consisted of (1) a service evaluation of patients receiving burns treatment during the COVID-19 pandemic; (2) a multidisciplinary team survey. Analyses were descriptive and narrative depending on data types.

* Corresponding author.

E-mail address: justin.wormald@ndorms.ox.ac.uk (J.C.R. Wormald).

Social media: (J.C.R. Wormald), (D.P. Collins)

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Collaborators from 18 sites contributed data from burns MDT surveys and 512 patients. Patient demographics were consistent with typical burns patterns in the UK. The delayed presentation occurred in 20% of cases, with 24 patients developing complications. MDT surveys indicated substantial adaptations and challenges as a result of the pandemic. Access to theatres and critical care were limited, yet a comprehensive acute burns service was maintained. Telemedicine was utilised heavily to reduce patient footfall.

Adaptations in the provision of burns care, including greater outpatient care and telemedicine, have emerged out of necessity with reported success. The impact of reduced scar therapy and psychological interventions for burns patients during the pandemic requires longer-term follow-up. Lessons from the UK experience can be used to strategise for future pandemics.

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Introduction

As the UK entered the first wave of the COVID-19 pandemic, the National Health Service (NHS) for England published consensus guidance to the UK burns services advising on changes to the acute management of burns in order to allow the continuation of safe burns care while protecting limited hospital resources.¹ These included recommendations for a more non-operative approach to the management of burns and steps to limit hospital attendances. A conservative approach to burns was further supported by the findings of studies reporting increased post-operative pulmonary complications and mortality in COVID-19 positive patients.^{2,3} This study aimed to establish the effect the COVID-19 pandemic had on referral pathways, patient presentation, management decisions and the structure of burns services. By collating the experience of burns centres, units and facilities across the UK, we aim to provide a representative study of the challenges faced by the UK burns service and reflect on adaptations and improvements in burns care that have been achieved in this challenging time. We aim to make recommendations that will help to improve burn care delivery during both the ongoing and future pandemics and use the lessons learned for the improvement of day-to-day clinical care.

Methods

This project was part of a national, collaborative, trainee-led research effort, orchestrated by the Reconstructive Surgery Trials Network (RSTN) and supported by the Royal College of Surgeons of England and Wales. All burns services in the UK were invited to participate. Collaborators were recruited via the RSTN communications (website, mailing list, Twitter feed, WhatsApp group and Facebook page), the British Burns Association (BBA) and British Association of Plastic, Reconstructive and Aesthetic Surgeons (BAPRAS) mailing list. Collaborators at each site attained local approvals for service evaluation with their audit departments prior to gaining access to study materials. In order to be cited as a collaborator, specific requirements were set out at the invitation to the project. Those that did not meet collaborator status but still contributed to the project are acknowledged.

The study consisted of two elements: (1) a service evaluation of patients receiving in-patient and outpatient burns treatment during the COVID-19 pandemic; (2) a comprehensive multidisciplinary team (MDT) survey of the wider burns service to determine the effect of the pandemic on all relevant clinical care stakeholders. The steering group designed the data collection tool and MDT survey. These were then peer-reviewed within the RSTN before being piloted at a burns centre. Once piloted, both service evaluation and survey were refined and uploaded onto the Research Electronic Data Capture (REDCap) platform, hosted at Kennedy Institute of Rheumatology, University of Oxford^{4,5}. REDCap is a secure, web-based application designed to support data capture for research studies, providing (1) an intuitive interface for validated data entry; (2) audit trails for tracking data manipulation and export procedures; (3) automated export procedures for seamless data downloads to common statistical packages and (4) procedures for importing data from external sources.

Service evaluation

Data collected addressed five key areas: patient demographics, burn injury details, changes in referral pathways, delays in patient presentation and alterations in burn management decisions and rationale. (Appendix 1 - data dictionary for service evaluation). The inclusion criteria for both retrospective and prospective cohorts were that the burn was assessed by a burns doctor at first presentation. The retrospective data capture occurred during the peak of the first wave of the pandemic, from 6 to 30 April 2020.⁶ Retrospective cases were excluded if they did not have sufficient documentation to allow adequate data capture. The prospective data capture commenced 1 May 2020, with collaborators requested to collect at least 10 consecutive cases.

MDT survey

The survey was completed during the next appropriate burns MDT meeting at each site, involving all members: surgeons, nurses, therapists, psychologists, dieticians, pharmacists and social workers. The collaborating burns consultant was requested to conduct the survey during the meeting, ensuring all aspects of burns care were addressed (Appendix 2 - data dictionary for survey). The survey responses

were collated by the consultant/trainee and uploaded onto the REDCap database.

Data collection and analysis

Data collection and management adhered to Caldicott II principles and GDPR. Service evaluation data were explored with histograms to assess distribution. Continuous parametric data were summarised descriptively using means with standard deviations (SDs). Nominal and ordinal data were presented as totals with proportions expressed as percentages. Thematic analysis was used to collate and analyse survey responses. Data from both elements of the study were combined to describe the impact of the pandemic on burns services and to make recommendations.

Results

Service evaluation

In total, 512 patients from 18 paediatric and adult burns services were included in this study (299 cases retrospective, 213 prospective, [Table 1](#)). This included 16 of the 21 centres

and units providing burn care in England, Wales and Northern Ireland (76% response rate, 8 centres, 8 units - [Figure 1](#)). Two burns facilities also provided data. Of the 512 included participants, 92% ($n = 470$) were treated in England, 4% ($n = 22$) in Wales and 4% ($n = 20$) in Northern Ireland. The most common burn injuries in all patients were scalds, resulting in mostly partial-thickness injuries with a mean TBSA of 2.4%. Only 18.5% ($n = 92$) of burns patients were offered a COVID-19 test during the course of their treatment, with 2 patients testing positive. During the peak cohort of the first wave and following this peak, 82% of patients were not tested for COVID-19.

There was a delay in patients seeking medical attention for their burns in 20% ($n = 104$) of cases, with COVID-19 reported as a factor in causing this delay in 7% ($n = 35$) of cases. A delay in onward referral to a burns service was experienced by 8% ($n = 44$) of patients. Delayed presentation to the burns service resulted in an adverse outcome for 24 patients (5% of the cohort) most often resulting in infection ($n = 12$) or burn progression ($n = 12$). Patients with superficial partial-thickness burns were more likely to suffer a complication from the delayed presentation.

The majority of burns were managed as outpatients (73%, $n = 373$). Changes in management were reported in 34% ($n = 177$) of outpatients, including increased patient

Table 1 Patient demographics.

		All patients ($n = 512$)	Retrospective (peak cohort, $n = 299$)	Prospective (post-peak cohort, $n = 213$)
Region (%)	England	470 (92)	278 (93)	192 (90)
	Wales	22 (4)	11 (4)	11 (5)
	N. Ireland	20 (4)	10 (3)	10 (5)
Age (%)	Under 18	183 (36)	108 (36)	75 (5)
	19-30	81 (16)	47 (16)	34 (16)
	31-40	82 (16)	49 (16)	33 (15)
	41-50	65 (13)	42 (14)	23 (11)
	51-60	44 (9)	26 (9)	18 (8)
	61-70	28 (5)	10 (3)	18 (8)
	>70	29 (6)	17 (6)	12 (6)
Burn aetiology (%)	Scald	233 (46)	147 (49)	86 (40)
	Flame	88 (17)	51 (17)	37 (17)
	Chemical	46 (9)	24 (8)	22 (10)
	Electrical	3 (1)	2 (1)	1 (0.5)
	Contact	103 (20)	53 (18)	50 (23)
	Other	39 (8)	22 (7)	17 (8)
% TBSA burn (mean, SD)		2.4 (4.4)	2.32 (3.95)	2.72 (5.14)
Burn depth (%)	Superficial	72 (14)	42 (14)	30 (14)
	Partial thickness	235 (46)	143 (48)	92 (43)
	Mixed	126 (25)	69 (23)	57 (27)
	Deep dermal	36 (7)	20 (7)	16 (8)
	Full thickness	43 (8)	25 (8)	18 (8)
COVID-19 status (%)	Positive	2 (0.5)	2 (1)	0 (0)
	Negative	90 (18.5)	39 (13)	51 (24)
	Not tested	420 (82)	258 (86)	162 (76)
Referral pathway (%)	A&E	286 (56)	168 (56)	118 (55)
	GP	23 (4)	8 (3)	15 (7)
	UCC	17 (3)	11 (4)	6 (3)
	Telemedicine	172 (34)	103 (34)	69 (32)
	Other	14 (3)	9 (3)	5 (2)

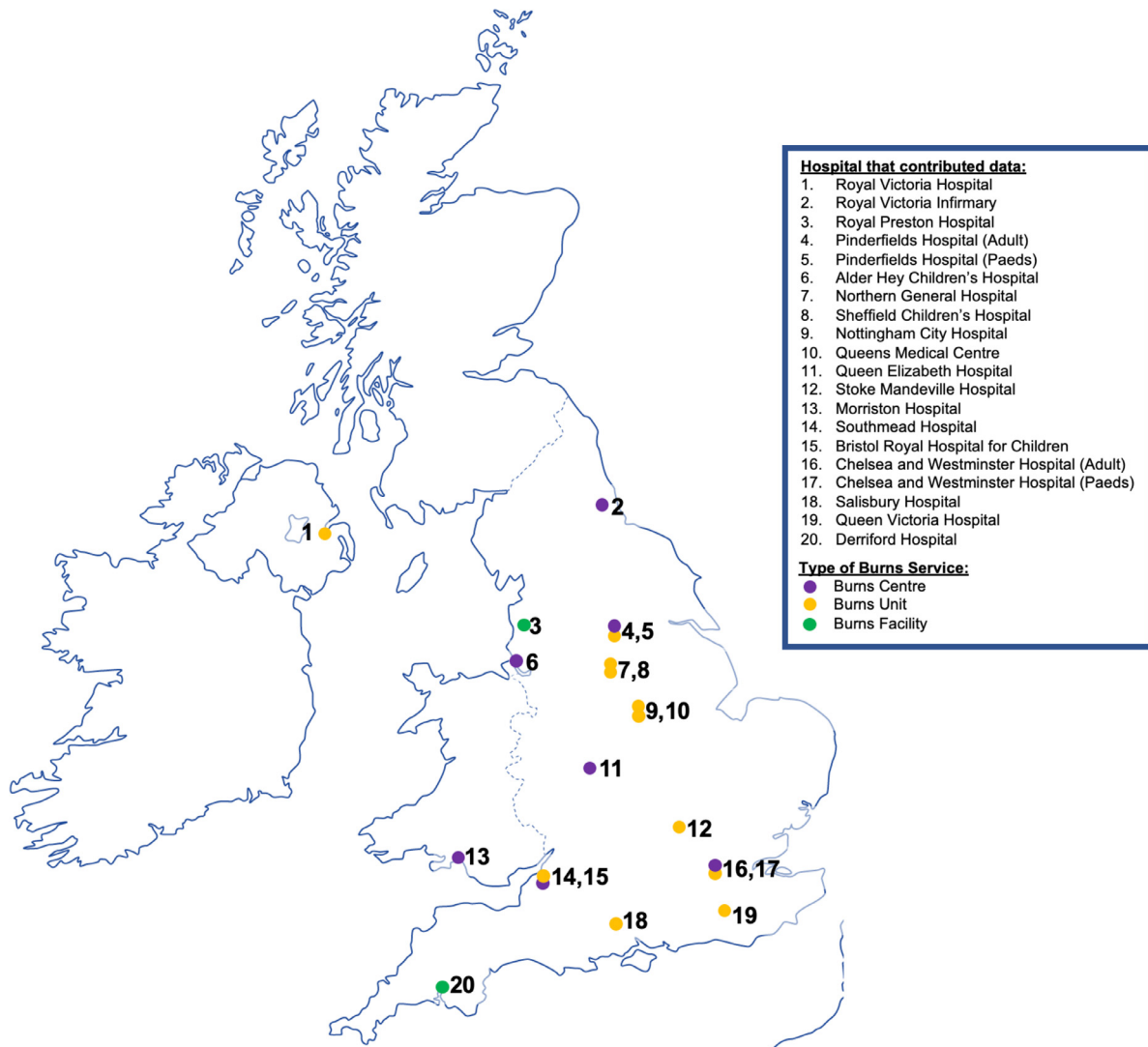


Figure 1 Sites that contributed to this study across England, Wales and Northern Ireland.

education to allow self-directed care (22%), patient-led dressings management, district nurse or GP-led follow-up (24%) and increased use of telemedicine follow-up (31%). In pre-COVID-19, 10% ($n = 51$) of the included patients would have been managed operatively but were managed non-operatively instead. The majority of services reported making changes to their referral pathways ($n = 12$). Changes included the introduction of telemedicine referral systems, review of emails or clinical photographs, acceptance of patients from outside the unit's catchment area, increased use of outreach services to provide initial burns assessments and providing a walk-in burns service.

MDT survey

Burns MDT

All 18 included sites provided complete MDT surveys. Redeployment of members of the burns MDT as part of the COVID-19 response was common and occurred across the MDT ($n = 15$ sites). Redeployment was primarily to inten-

sive care and medical wards (Supplementary Figure 1). Service delivery was affected by redeployment ($n = 7$ sites) and staff sickness or shielding ($n = 9$ sites). Staff return to work was limited by delays in access to COVID-19 testing which was initially limited⁷. Seven sites reported changes to social services provision, including difficulty in accessing social services review due to remote working and limitations in resources available, a delay in the provision of services due to reduced access to nursing homes, difficulty in performing ward-based assessments and redeployment of the discharge co-ordinator.

Scar therapy was not available in nine sites and was provided virtually in five sites. Outpatient psychology input continued to be offered by ten sites, although this was largely remote ($n = 9$ sites). Eight sites were not able to offer an outpatient psychology service due to staff redeployment and a reduction in appointment capacity with remote working. This resulted in increased waiting lists in five sites. COVID-19-related anxiety and depression led to an increase in patient complexity ($n = 4$ sites). Inpatient psychology provision was variable with some sites only offering remote

Table 2 Effect of redeployment, staff sickness and shielding on the MDT.

Scar therapy services	Psychology services	Burn ward staffing
Reduced inpatient services	In-patient only service	Reduction in senior nurse presence
No face-to-face appointments	Increase in outpatient waiting lists	Increased workload, shift changes and leave cancellations
Suspension of outpatients' scar clinic	No face-to-face appointments	Reduced capacity of services
No pressure garment fitting		Theatre delays

assessments (Table 2). The majority of sites ($n = 14$ sites) continued to deliver consultant elective outpatient clinics. These were delivered through a combination of methods: telephone ($n = 14$ sites), face-to-face ($n = 9$ sites) and video ($n = 8$ sites). Psychology teams raised concerns that remote working affected their ability to integrate with the MDT. Remote working also reduced the feasibility of delivering more complex trauma-based psychological therapies. Furthermore, as well as reduced ability to deliver the intervention, the psychological needs and complexity of burns patients was exacerbated by COVID-19-related anxiety and depression.

Social service input was similarly affected by remote working, with an increasing backlog of patients with complex needs awaiting discharge. This was usually due to difficulties repatriating patients to local hospitals, poor access to care services and reduced patient transport availability.

Theatres and critical care

In pre-COVID-19, ten sites operated in dedicated burns theatres and 15 had access to dedicated theatre lists for the treatment of acute burns. During the pandemic, six sites completely lost their dedicated burns theatre lists with eight reporting reduced access. This led to reduced operative capacity ($n = 11$ sites), negotiations for space on shared emergency lists and pressure to perform procedures under local anaesthetic. The majority of sites stopped elective burns surgery provision ($n = 15$ sites) and reported changes to the delivery of scar therapy services ($n = 17$ sites). All laser services were stopped.

A reduction in critical care availability was reported by six sites. This affected the ability to accept referrals ($n = 2$ sites), provide adequate post-operative support ($n = 2$ sites) and provide usual patient care ($n = 1$ sites). Sites also reported a reduced capacity to accept patients, stricter triage of referrals and liaison with other services to ensure appropriate management of patients requiring higher-level support.

Burns service adaptations

The majority of sites ($n = 16$ sites) reported improvements in burn care delivery they would carry forward, especially continued integration of telemedicine into their services. Limitations placed on services by staff redeployment, illness and remote working led to the introduction of triage systems for scar and dressing clinic by some sites. In addition, there was a push towards increased patient and parent education and management of simple dressings at home with email contact to send images if concerned. This reduced the number of clinic appointments required and allowed remote discharge. One unit encouraged the emer-

gency department to debride and dress simple burns, allowing a 48-hour window before the patient required further dressing change on the burns unit. Another reported benefit in losing their dedicated theatre lists and space during the pandemic. Their hospital equipped more theatres with heating improving suitability for major burns surgery.

Use of telemedicine

All sites increased their use of telemedicine during the pandemic with most reporting that it had resulted in opportunities to improve patient care ($n = 10$ sites). The use of telemedicine referral systems streamlined triage, allowing prioritisation of complex or more severe burns and encouraged local management of straightforward burns. It reduced the need for cross-site patient reviews and improved patient follow-up by community services. For patients, it allowed more self-directed management of wound dressings and reduced the need for hospital review and admission. For patients with transport problems or financial difficulties, telemedicine provided more convenient follow-up and reduced missed appointments.

Increased use of telemedicine also came with challenges. Staff had to adapt and be trained on how to assess burns via telemedicine, telephone consultations were time consuming and prone to technical failures. For patients, some had no access to email or a smartphone to take and send photos, leading to difficulty accessing vulnerable patients. Several scar therapists reported difficulty delivering their service; stating they "cannot assess scars and long-term patients by telehealth". Some clinicians reported concern that telemedicine led to technical issues in assessing burns and that "patients appear to have been managed at arms-length rather than reviewed and interventions delivered".

Supply chain and personal protective equipment (PPE)

Supply chains were interrupted in 5 sites, affecting the supply of dressings and pressure garments, silicone and splints for scar therapy. Five sites reported PPE shortages, especially FFP3 masks, this increased staff anxiety, caused frustration at having to source alternatives for patient and staff safety and led to reductions in service provision.

The majority of sites provided PPE training ($n = 17$ sites) and staff felt safe using the PPE they were provided with ($n = 16$ sites). Wearing PPE affected staff's ability to work in theatre ($n = 12$ sites). PPE use described as "uncomfortable", "tiring" and "dehydrating", masks muffled voices and visors affected visual acuity and frequently caused accidental decontamination of equipment. These issues were overcome by improving team communication by the use of walkie talkies and whiteboards, limiting operating time,

taking regular breaks and increasing pre-operative patient testing to reduce the need for PPE.

Discussion

This study aimed to review and appraise changes in response to the COVID-19 pandemic, as progress is often considered to have been made in health sciences during periods of crisis⁸. However, the pandemic changed more than just clinical pathways and systems. Population behaviours changed, potentially altering the aetiology of injuries sustained, and patients' subsequent presentations to health services. We first considered burns presentations, both as standalone findings, and also to be able to understand system changes as entities that are independent from simply adjustments to short-lived COVID-19-based changes in referrals. The demographics of burn injury seen during the first wave of the COVID-19 pandemic reflected the usual burden of injury seen in the UK, with a predominance of superficial partial-thickness burns, usually scalds and below 5% TBSA.⁹ Delayed presentation as a result of COVID-19 led to burn progression and infection in 5% of patients, both common complications of delayed burn presentation.^{10,11} These delays are in line with published reports of delayed presentation to both primary care and secondary care during the pandemic for conditions, such as myocardial infarction, stroke and paediatric illness.¹²⁻¹⁶ These delays are disproportionately seen in vulnerable groups, caregivers, patients with multiple co-morbidities and the BAME population.¹⁷ Specific to the atypical context of the study, actually, few injuries in this cohort were caused by patients attempting to treat or prevent COVID-19 with steam inhalation. This is in contrast to the findings of Brewster et al¹⁸ earlier in the pandemic, who reported an increase in these injuries. Potential explanations for this include improved awareness through campaigns by organisations like the British Burns Association¹⁹ and BAPRAS²⁰ to highlight risks of preventable plastic surgical trauma during the pandemic. Such campaigns can be used to also encourage patients to engage with burns services during pandemics, with the reassurance that services have adapted to improve patient safety. Given this, it seems reasonable to be able to appraise the process and system changes made to burns care as being potentially generalisable to non-pandemic periods that we expect to return to in future.

Across services, we identified a shift towards a more conservative management of burns, when safe. As a national system burns care might be more likely to move in a coordinated fashion than other clinical specialties, due to regional networks existing, organised and auditable standards of care, and close clinical relations and communication between teams around the UK. This strategy aligned with NHS England guidance. It aimed to reduce the pressure on hospital resources, the risk of COVID-19 transmission¹ and addressed concerns regarding increased perioperative mortality following general anaesthetic in COVID-19 infection²¹.

As well as stemming from proactive strategic leadership, some system changes probably also reacted to operational impacts. Around half of the services saw a reduction in their acute operative capacity during the pandemic, resulting in delayed day-case procedures and a push towards performing

procedures under local anaesthetic. Despite such changes being imposed rather than necessarily chosen, some units reported positive effects of reduced dedicated theatre capacity, including an increase in non-burns theatres adapting to manage burns patients and an increase in ward-based care. Such changes might transpire to be the kind of crisis-driven accelerated system changes that have occurred in the past. Long-term studies with comprehensive prospective outcome data would be required to definitively assess their effect on patient outcomes.

Burn severity is a clinical diagnosis, and the surveyed burns units have reported that telemedicine can allow the assessment of acute burn injury, demonstrated by the majority of services (78%) opting to manage minor burns local to the patient and using telemedicine to provide remote follow-up. Burns services globally describe an integration of telemedicine into their day-to-day work²² in some cases allowing entirely remote patient management.²³ Better patient education and access to burns advice, improved remote communication and shifts to community-based dressings resulted in the majority of sites reporting more efficient wound care follow-up as a result of the pandemic. Telemedicine requires high-quality platforms, developed to allow accurate burns assessment. That being said, a human approach to burn care is difficult to maintain with telemedicine, and vulnerable patients may be missed²⁴.

The importance of the Burns MDT is well recognised,²⁵ and one of the greatest challenges experienced during the pandemic was its disruption. Facilitating integration of the Burns MDT within the adaptations to the overall burns service is crucial in future pandemics. It has not been possible to quantify the impact that redeployment, and staff sickness would have had on staff morale, knowledge base and decision making across the MDT. Further studies will need to examine how these services recover and the impact that increased waiting lists have on patients' physical and psychological recovery.

Although initially there were challenges facing some units supply chains, this has now been resolved. Such shortages have been reported elsewhere in Europe and have highlighted the importance of hospitals having a supply of such products in stock to cover longer periods of time.²⁶ The use of PPE in theatres led to communication difficulties, accidental decontamination of equipment by visors, reduced theatre staff capacity and increased physical demands of operating in warmed burns theatres. The introduction of widespread COVID-19 testing has reduced PPE requirements in theatre while other issues have been addressed by improved communication, reduced operating times and increased breaks.

While the UK burns service maintained high standards of acute burn care during the pandemic, there remain concerns regarding the impact of the pandemic on the longer-term care that patients require following burn injury. This particularly relates to scar therapy, psychology and elective burn surgery. These services were significantly affected by staff redeployment and remote working, occurring across the burns MDT. In addition, a reduction in routine burns outpatient services has resulted in substantially increased waiting lists for scar therapy and psychology. If maintained, such system changes need to be monitored for their impact on outcomes, and innovative ways to deliver care explored.

Limitations

This study provides both quantitative and qualitative cross-sectional data of burn patient demographics and burns service provision during the first peak of the pandemic and following this peak. As such we are not able to comment on the longer-term outcomes that changes to services may have on patients. Nevertheless, the roll-out of the vaccine programme may mean that future pandemics will impact burns services in different ways. Therefore, the flexibility and adaptability of burns services described in this study will be essential in future major crises.

Conclusion

Burns services in the UK have managed a similar demographic of patients during the COVID-19 pandemic compared to the pre-pandemic era. Service adaptations including increased use of telemedicine have allowed services to continue providing care, despite staff redeployment, social distancing and resource constraints. Adaptive ways of providing burns care, including greater outpatient care and telemedicine, have emerged out of necessity with reported success. Further studies with longer-term follow-up are required to ensure outcomes are not adversely affected as a result. The impact of reduced social and psychological interventions for burns patients during the pandemic need further evaluation. Positive adaptations and lessons from the UK experience to date can be used to strategise for future pandemics and more efficient services in non-pandemic times.

Contributor statement

GSAP and JCRW produced the manuscript.
GSAP, JCRW, RY and DPC form the steering group for RST-NCOVID Burns and designed and conducted the study.
DPC, MDG and JNR provided input on the manuscript and methodology.

RSTNCOVID burns collaborative

Jamie Clements, Abid Rashid, Jonathan Herron, Mohammed Farid, Alan Kay, Anthony Sack, Ian Mackie, Karen Coy, Kaneka Bernard, Alexander Freethy, Muntazir Mahdi, Alexandra Murray, Siobhan O'Sullivan, Komal Khan, Nikita Joji, Baljit Dheansa, Li Yenn Yong, Sian Falder, Mary Kennedy, K. Skaria Alexander, Andrea Cronshaw, Julia Sarginson, Jolita Zakaraite, Whitney Chow, Salma E Elamin, Eunan Tiernan, Nola Lloyd, Benjamin Wood, Martin Wiener, Liz Nicholls, John Gibson, Peter Drew, Parvathi Varma, Mohammad Anwar, Preetha Muthayya, Christopher Lewis, Vinay Itte. Mel Wolfenden, Maxine Shaw, Donagh McLoughlin, Rachel Currie, Jake Clements, Dawn Turner, Christina Cooper, Catalina Estela, Shirin Pomeroy, Julia Cadogan, Rebecca Johns, Elise Thrompson, Olivia Berry, Fadi Issa, Maria Chicco, Helen Corkhill, Andy Ward, Bethany Angell, Liz Pounds-Cornish, Joy Ana Barria, Nora Nugent, Alexander Trevatt, Sheila Perkins, Louise Frost, Gemma Bryant, Adel

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Declaration of Competing Interest

None.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:[10.1016/j.bjps.2021.11.086](https://doi.org/10.1016/j.bjps.2021.11.086).

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