

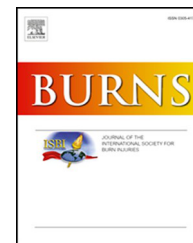


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# Impact of COVID-19 and containment measures on burn care: A qualitative exploratory study

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## ABSTRACT

**Background:** Burn care in India is limited by multiple constraints. The COVID-19 pandemic and the containment measures restricted access to non-COVID emergency conditions, including burns. The aim of this study was to explore the impact of the pandemic on burn care in India.

**Methods:** Using the qualitative exploratory methods, we conducted in-depth interviews (IDI) with plastic and general surgeons representing burn units from across India. Participants were selected purposively to ensure representation and diversity and the sample size was guided by thematic saturation. Thematic analysis was undertaken adopting an inductive coding using NVivo 12 Pro.

**Results:** 19 participants from diverse geographic locations and provider types were interviewed. Three major emerging themes were, change in patient and burn injury characteristics; health system barriers, adaptation, and challenges; and lessons and emerging recommendations for policy and practice. There was change in patient load, risk factors, and distribution of burns. The emergency services were intermittently disrupted, the routine and surgical services were rationally curtailed, follow-up and rehabilitation services were most affected. Measures like telemedicine and decentralising burn services emerged as the most important lesson.

**Abbreviations:** ICU, Intensive Care Unit; IDI, In-depth Interview; NABI, National Academy of Burns in India (NABI); COREQ, Consolidated Criteria for Reporting Qualitative Studies (COREQ); HR, Human Resources (HR); PPE, Personal Protective Equipment (PPE); LMIC, Low and Middle-Income Countries (LMIC); OOPE, Out of Pocket Expenditure (OOPE); PMJAY, Pradhan Mantri Jan Arogya Yojana (PMJAY); NPPMBI, National Program for Prevention and Management of Burn Injuries; HWC, Health and Wellness Centres (HWC)

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*Conclusions:* The ongoing pandemic has compounded the challenges for burns care in India. Urgent action is required to prioritise targeted prevention, emergency transport, decentralise service delivery, and harnessing technology for ensuring resilience in burns services.

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## 1. Introduction

Burns is one of the leading causes of mortality, morbidity, and disability globally. The South Asian countries contribute to around 23% of the annual global incidence and 26% of the mortality burden due to fire, heat, or hot substances. In India, an estimated 1.5 million injuries and around 27 thousand deaths are attributed to burns annually [1]. Burn injury is often an acute emergency requiring immediate care. Burn care in India is afflicted by multiple constraints, such as inadequate infrastructure, limited human resources, and lack of integration into the overall health care delivery system [2]. The network of specialised burn care centres in the country is limited. The estimated burn beds per 100,000 population is 0.1 as compared to 0.59 in the United States [3,4]. Only 15.9% of the total population live within 2 hour travel time from a burn centre with an Intensive Care Unit (ICU) and skin bank [3]. Poor referral linkages and communication between providers and survivors are additional documented bottlenecks for burn care in India [5].

The rise of COVID-19 cases in India was first reported in mid-March 2020, followed by a strict nationwide lockdown between April and May 2020 and thereafter gradual relaxation in restrictions from June 2020. The challenges of Indian health care infrastructure, human resources, and financial constraints are well recognised, and the system lacked the resilience required to cope with the sudden demand of the pandemic [6,7]. The response to the COVID-19 pandemic and the transmission risk disrupted essential health services, thus limiting access to non-COVID emergency conditions.

The COVID-19 pandemic shifted the burden and distribution of burn cases with some studies reporting a 43% reduction in burn admissions, higher proportions of paediatric burns, greater burn severity, comparatively lower duration of hospital stays but no decline in the need for intensive care [8–12]. The pandemic also posed significant challenges for the functioning of burn units, particularly protecting the staff and patients from infection [13]. Despite precautions, COVID-19 infections were reported among 3.7% of burn patients screened for routine procedures and 8.7% of health workers tested in a burn unit in India [10].

Considering the impact of the COVID-19 pandemic on the overall health system, we explored the impact of the pandemic, containment measures, and disruption in health care delivery on burn care in India. This study was guided by the following research questions:

1. What is the burn care practitioner's perspective on the impact of COVID-19 and containment measures on burn patients?

2. What is the experience of burn care practitioners about the impact of disruption of health system for burn care?
3. What are the emerging lessons for improving burn care services?

## 2. Material and methods

### 2.1. Study design

We conducted a qualitative inquiry to understand the perspective of burn care professionals about the impact of COVID-19, containment measures, and disruption in health systems on burn care in India. Data were collected by In-depth Interview (IDI) with purposively selected participants. An IDI guideline was developed and used to guide the interviews (Supplementary File 1). Topics covered in IDI guidelines included routine burns care at the facility, impact on COVID-19 on health systems and burns care, and lessons.

### 2.2. Study setting and participants

A list of burn units, available on the website of the National Academy of Burns in India (NABI) which is a professional association of burn practitioners, was used to identify potential participants. Participants were selected using purposive snowball sampling. The head of burn units was invited to participate and reflect on collective perspective and experience for the entire unit. All participants were either plastic or general surgeons, and the head of the burn unit, or a nominated team member. The sample size was guided by thematic saturation, geographic distribution, and public-private providers. India is a large country with six major geographic regions; central, northern, eastern, north-eastern, western, southern regions. We approached a total of 35 burn centres from all six geographic regions. The list of invitees was selected purposively to include burn centres from all regions and follow-up was done to ensure participation from each region. The invitation was sent via email or telephonically with message comprising a brief description of the study, the purpose of conducting this research, the IDI guideline, and an introduction of the interviewer (VRK). Nineteen of the 35 participants responded and were included in the final sample. Fourteen participants who were invited did not respond and two participants declined the invite citing time constraints.

### 2.3. Data collection and ethical consideration

All interviews were conducted in English by the first author (VRK), who is a medical doctor with specialisation in public health and experience in the field of public health practice

**Table 1 – Respondent's profile.**

Respondent	Gender	Location	Type of Institution (Public / Private)	Overall Experience	Burn Unit for Acute Burn Care	Burn Intensive Care Unit
R – 1	Female	Central India	Private	> 30 years	yes	yes
R – 2	Male	Northern India	Public	> 20 years	yes	yes
R – 3	Male	Northern India	Public	> 20 years	yes	yes
R – 4	Male	Northern India	Public	> 15 Years	yes	yes
R – 5	Male	Northern India	Public	> 5 years	yes	no
R – 6	Male	Northern India	Public	> 20 years	yes	no
R – 7	Male	Northern India	Public	> 10 years	yes	no
R – 8	Male	Eastern India	Public	> 10 years	yes	no
R – 9	Female	North-Eastern India	Public	> 30 Years	yes	yes
R – 10	Female	South India	Public	> 20 Years	yes	yes
R – 11	Male	Western India	Private	> 40 Years	yes	no
R – 12	Male	Northern India	Public	> 30 Years	yes	no
R – 13	Male	Eastern India	Public	> 30 Years	yes	yes
R – 14	Male	Western India	Private	> 20 Years	yes	no
R – 15	Female	South India	Public	> 10 Years	yes	yes
R – 16	Female	Northern India	Public	> 5 years	yes	yes
R – 17	Male	North-Eastern India	Private	> 30 Years	yes	no
R – 18	Male	Northern India	Private	> 20 Years	yes	yes
R – 19	Male	Southern India	Private	> 20 years	yes	no

and research. The interviewer was neither directly involved in burn care nor a member of any network of burn care professionals, however, five participants were acquainted with the interviewer owing to their involvement in ongoing collaborative research work. All interviews took place after the first wave of COVID-19 in 2020 and before the second wave in 2021.

The date, time, and mode of the interview were pre-decided by mutual agreement. Based on the participant's preference, 6 interviews were conducted face-to-face (socially distanced, masked), 3 via video conferencing, and 10 via telecalling. All in-person interviews took place at the workplace of the respondents where no third person was present. During the video or telephonic interviews, only the interviewer and respondents were present. Ethical approval for this study was granted by the Institute Ethics Committee (ref. no. 13/2019). Verbal consent was obtained from each of the participants and the process was recorded with their permission. Three participants did not consent to recording, therefore extensive field notes were taken during these three interviews. Recorded interviews were transcribed by the first author, a research assistant, and transcription professionals. All transcriptions were thoroughly reviewed by the first author. The recordings were destroyed after the transcriptions were finalized. Response saturation was noted after 15–16 interviews; however, we completed interviews with all 19 respondents who responded to participate. Additional interviews helped in validating the pattern. The average time for each interview was 40 min, with a range of 25–73 min.

#### 2.4. Analysis and rigour

All transcripts were read and discussed between lead authors (VRK & JJ), and notes were taken to identify the initial ideas and possible codes. Thereafter the transcripts were imported to NVivo software version 12.0 for analysis [14]. An inductive

approach was adopted for generating the codes. Initial coding was done by VRK and reviewed by JJ. The coding tree is presented as a [Supplementary File 2](#). After initial coding for all interviews, a mixed approach was adopted to generate themes. Potential codes were collated into similar groups for developing themes and sub-themes. An inductive heuristic method was used to generate initial sub-themes and themes, followed by a minor reorganisation of themes according to specific research questions using a deductive approach. Regular discussion between co-authors helped in refining themes. Once initial themes and sub-themes were identified, a review was done to ascertain dual criteria of internal homogeneity and external heterogeneity as suggested by Parton [15]. To ensure additional rigour and quality, a document with de-identified themes and sub-themes was shared with the study participants for final member cross-checking. Two participants suggested additional inputs to two sub-themes, which were included in the final results. The study adheres to COREQ criteria for reporting qualitative results, and the completed COREQ checklist is available as [Supplementary File 3](#).

### 3. Results

#### 3.1. Study participants

Of the 19 respondents, 5 were female and 14 were male; 13 were from public hospitals and 6 were from private hospitals. All participants were affiliated to tertiary level burn care centres. Geographically, 9 interviewees were from north, 3 from south, 2 each from north-east, west, east, and 1 from central India, representing 14 out of 28 states. Participants were mid-career to senior clinicians with experience ranging from 7 to over 30 years. All participants were currently engaged in burn management in the burn unit at their

**Table 2 – Theme –1: Patients and burn injury characteristics - subthemes and supporting quotes.**

Sub-themes	Supporting Quote
Impact on risk factors and patient load in hospital	<p>“During COVID number of steam burns cases were seen. Now people would use it because somebody told them that COVID can be treated by steam inhalations and they keep taking steam inhalations for a long time and get burns and come to us.” (R-12, public hospital)</p> <p>“In our centre, admissions which is very high percentage of self-immolation, it got reduced. It was reduced only during COVID time. May be because people were at home, they are all together, work from home, many were not going for work. So, maybe they didn't have that loneliness to face to go into this sort of suicidal attempt.” (R-10, public hospital)</p> <p>“But there was drastic fall in number of patients coming to the hospital. As you know it happens everywhere. In our hospital also, including other cases we had also fall of patients reporting to the hospital. But it was not nil. It was around 1–2 cases daily. (R-17, private hospital)</p> <p>“We are a high volume center. So, in general our burn intake in a month is about 100 plus minus 10. But in COVID month and during lockdown, it dropped down to say 10 or 12 in a month. So, it was like not even 10% of what we were getting. But it is actually very difficult to comment on the factors.” (R-16, public hospital)</p> <p>“We did a screening for all burn patients of COVID, whosoever was positive was shifted to COVID area for treatment, and we and our team were going there for dressings etc. and in burn unit we are managing only those patients who were negative.” (R-12 public hospital)</p>
Access to hospital, patterns of patients, and types of burns	<p>“People were not allowed to move out and they were not able to reach hospital. I mean people were not coming to hospitals for minor bit, people were coming to hospital for dire emergencies only.” (R-4, public hospital)</p> <p>“It's not like that there is no burn at all, definitely it was there. People couldn't travel. Suppose somebody is there at a remote part of the state, they will not come to our hospital. They will be treated at civil hospital nearby.” (R-17, private hospital)</p> <p>“So late presentations were there. It was there. Even a small boy, he had knee contracture, not able to stand also. They didn't turn up at all. They came after 4 months. If we asked why, then they said because they were not able to get transportation for coming. So actually, we had to do a release surgery for clear.” (R-10, public hospital)</p> <p>“Most of the burns were sustained by children because they were not going to school, they were not allowed go out of the house, they have small huts, and there was boiling water or maybe boiled milk in the house. The children were slipping into those containers of hot milk, hot oil. So, what I noticed personally was that the number of children that we got during or immediately after lockdown was more.” (R-16, public hospital)</p> <p>“I don't know whether our people will be able to log in and then show the problem through the teleconsultation, their education level and other things from the government side are big barrier” (R-10 public hospital)</p>

institution, however, only 10 out of 19 reported availability of a dedicated burns ICU at their centre (Table 1).

### 3.2. Themes and sub-themes

The major themes were identified through an iterative review of data and codes. The three main themes were: the impact of COVID-19 on patients and burn injury characteristics; health system barriers, adaptations, and challenges; and lessons and reflection on policy and practices for burn care.

#### 3.2.1. Patients and burn injury characteristics

The main sub-themes and their interpretation are discussed below. Selected quotes portraying these arguments are mentioned in Table 2.

**3.2.1.1. Risk factors and impact on patient load.** As a result of containment and infection control measures, changes in the distribution of burns patients and burn injury characteristics were noted. There was a noticeable change in risk factors, in particular, in the exogenic environment, such as decreased industrial activities, people spending more time at home,

children remaining at home due to school closure, restrictions of movement, and non-availability of chemicals and acid. There was almost a complete absence of mass burns, at both industrial and community levels. An emerging risk for burns was increased use of steam inhalation as a perceived method of prevention from COVID-19 infection. Views regarding the burns patient load in hospitals were divergent: some participants reported decline in patient load, while others did not think there was a significant decline, as their burn units were getting patients on regular basis. Respondents also opined about the need for community-level data to better understand changes in incidence. These comments are well denoted in selected quotes from participants.

Overall, the patient load was also influenced by the local hospital policies which varied across settings. Mandatory COVID screening for burn patients was implemented in most of the burn units, but the process of admission and variability in the functioning of the burn unit also influenced the patient load. Private sector burn units were more challenged and hence reported lower patient load as compared to the public sector. The level of COVID spread, health system response and capacity, and type of health facility also impacted the burn patient load.

3.2.1.2. *Access to hospital, pattern and volume of patients, and type of burns.* Access to the hospital due to restrictions in movement, and lack of transport, and fear of COVID-19 infection were identified as important limitations, altering the flow of patients. Many participants believed restricted access to the hospital led to a reduction in patient load. Restricted access also resulted in late presentation for burn treatment after the COVID-19 restrictions were relaxed. A few patients developed complications and deformities as a result. Many follow-up patients also avoided visiting the hospital due to financial constraints, lack of awareness about the availability of services and alternative ways for accessing services, lack of awareness about long-term burns consequences, and fear of COVID-19 infection.

There was an observed increase in the proportion of minor paediatric burn patients while suicidal and homicidal cases declined. The proportions of accidental, mostly domestic burns were higher. The decline in suicidal and homicidal cases was thought to be due to family members spending more time together at home. Homicidal burns including 'bride burning' were almost negligible during this period. A few respondents mentioned higher proportions of urban patients, which could be a shift in incidence or reflective of better access to care. Minor scald burns were more common than flame burns and the proportion of chemical and industrial burns was considerably reduced.

### 3.2.2. *Health system barriers, adaptation, and challenges*

The country-wide lockdown and containment measures caused significant disruption in the health system, necessitating quick adaptation, and causing significant challenges for burn care. The key messages emerging for each sub-theme are discussed below and quotes related to them are mentioned in [Table 3](#).

3.2.2.1. *Disruption in routine and emergency health services.* Overall, the health system was significantly disrupted due to redirection of significant human resource and infrastructure capacity towards COVID-19 management. People avoided visiting the hospital except for dire emergencies. Reduced patient loads in the private sector instigated discussions around the financial feasibility of running these services. The views regarding the disturbances in the general and emergency services were divergent. Emergency services continued to run uninterrupted at many centres, but at a few centres, services were initially disturbed. Many private hospitals were either closed for services initially or were fully dedicated for COVID-19 care but slowly resumed their normal services with limited capacity. Most of the participants reported a reduction in the proportion of burn patients from the rural area as compared to the urban area, denoting access, and transport-related challenges. However, there were diverging views, a few participants also opined no change in rural-urban patient load attributing this to lack of alternate burn services in the peripheral rural area. Home-based care via teleconsultation or self-treatment guided by online resources were popular during the lockdown period. Community outreach and prevention programs were completely halted due to lockdown and restrictions.

3.2.2.2. *Infrastructure re-organisation and long pathway of care within hospital.* Most of the respondents reported some alteration in burn unit infrastructure. Some centres also reported closure of their burn unit intermittently due to COVID-19 positivity among staff members. At many centres, the burn ICUs were converted into COVID-19 ICUs. COVID-19 infected burn patients posed significant challenges due nature of close contact burn care. Owing to strict protocol, mandatory screening, and reorganised patient pathways within hospitals, the care-seeking route for the patient was prolonged and tedious.

3.2.2.3. *Human resource challenges.* Human Resources (HR) challenges were complex and multifaceted. There was a shortage of capacity in burn units, as many staffs were diverted to the COVID-19 response. Fear among staff due to COVID-19 positivity among colleagues was another concern. Issues like lack of motivation, especially among low-paid support staff on contractual appointments also emerged as a concern. The contractual staff members argued about their risk of contracting COVID-19 outweighing the benefit to continue working. In some centres, senior doctors, and staff above 50 years of age were safeguarded from direct patient contact, and young staff performed most procedures. A few respondents also reported the struggles to obtain Personal Protective Equipment (PPE), N95 masks, and other protective equipment due to initial shortages. However, there were also a few divergent views on HR suggesting no shortage as the patient load for burn was also low. Overall, despite challenges, the emerging viewpoint suggested that they could manage to provide services by following the protocols and rationale posting of HR.

3.2.2.4. *Unique challenges of private sector burn units.* In the private sector, the major financial challenge of running a burn unit was explained from both the hospital and patient's perspectives. While private hospitals faced financial crisis due to low patient turnout, the patients faced hardship in paying for treatment. The financial protection to patients from publicly financed health insurance schemes was reported to be grossly insufficient to fulfil this gap.

3.2.2.5. *Impact on burn care services, quality of care, and recovery outcome.* Acute burn services ran continually in most of the centre. A few centres reported temporary closure of all services for a brief period. Surgical services for burns were mainly restricted to emergency surgery and routine or elective surgery was either stopped or deferred. Rehabilitation services were most affected as many respondents described the challenges, such as non-integration of burn care into emergency services, and non-availability of staff. A few respondents also suggested that rehabilitation requires a 360-degree approach and it had to start from day one, so they provided preliminary services, but comprehensive rehabilitation was missing. Follow-up care was also adversely affected as the patients had difficulty in accessing the hospital and services were limited due to COVID-19 protocol.

Many respondents said that the quality of care improved due to increased compliance to infection prevention

**Table 3 – Theme –2: Health systems barriers, adaptations, and challenges - subtheme and supporting quotes.**

Sub-themes	Supporting quote
Disruption in routine and emergency health services	<p>“15 days after the first phase of national lockdown, emergency services were restored in the hospital, in a separate building.” (R6 – public hospital)</p> <p>“There is no impact on emergency care, except only impact that all emergency patients had to wait for the COVID test report.” (R7 – Public hospital)</p> <p>“Mostly during lock down or shut down, whatever happened, but also due to fear people did this, even if the lockdown was not there, except in emergencies of that nature of health issue, people were not getting out, so that also psychologically affected many people.” (R-13, public hospital)</p> <p>“Overall health system, there was drastic reduction in patients. In our hospital, it was difficult to run because, patients were not coming. We had about less than 20% of bed occupancy, may be 10% bed occupancy. So, we had lot of problems.” (R17 – private hospital)</p> <p>“During this period, most of the burn cases from urban area than rural area. Rural people were probably unable to access the transport facility to reach to the burn facility.” (R-3 – public hospital)</p>
Infrastructure re-organisation and long pathway of care within hospital	<p>“Initially, the hospital was declared to be fully COVID, thus resulting in a patient being directed to other facilities.” (R2 – Public hospital)</p> <p>“We created special alleys in the ward, separate from the beds and the beds number were decreased, they were spaced out. They were put in halls, instead of those narrow wards, which had two opposing rows of patients in front of each other. We made a single row and on one side, on the other side we could easily go in to take rounds and talk to the patient. So, it all came pretty much in place in June, but May and April were actually chaotic.” (R16 – Public hospital)</p> <p>“If they were not tested, we could not take the patients in the burn unit because they're all you know, immunodeficient patient. So, we could not bring in any patient without having their COVID test done.” (R-9, public hospital)</p>
Human resource challenges	<p>“Then one of the you know cleaners, she developed COVID, high fever and as tested and found COVID positive, and then the whole staff, all the doctors, patients including our all plastic surgeons, everyone they tested and became positive then some attendants also came, they became positive.” (R-9, public hospital)</p> <p>“We tried to ascertain that mostly young people, mostly our MCh student and the residents, they were more involved with the surgical part. The senior people above 50 or 60 years they have given the protocol on how to do cases and all that, but they don't get physically involved as some people have comorbidities, plastic surgeons, or somebody.” (R-13, public hospital)</p> <p>“The other human resource management problem is like many people do not want to do COVID duty. Lot of our staffs are contractual staffs, the staff who are very low paid in terms of 10–12 thousand rupees per month on outsourcing and contract. It is very challenging to retain these people during this COVID time because they say I don't want to do this duty I will quit job, because they see that the risk is more than the benefits.” (R-4, public hospital)</p> <p>“No, I said there was no shortage of human resources because the number of patients was less, so we could manage with given human resources.” (R-5, public hospital)</p>
Challenges of private sector burn units	<p>“See, financial hardships are always there. Because poor patients only come. So, government has got a facility that they give Atal Amrit Abhiyan, there is a Ayushman Bharat scheme. State government has got one Atal Amrit Abhiyan. The Central government has got Ayushman Bharat. There burn patients also get insurance coverage but that is the very less amount. For a 20% burn, they get only 13 thousand rupees.”</p> <p>(R-17, private hospital)</p>
Impact on burn care services, quality of care and recovery outcome	<p>“Number of patients of course has decreased, so financial part, because we have to pay the staff. It's not something we had not paid the staff; you have to pay the staff. So, mainly the financial little burden increased, input is less, output was just more or less same.” (R-14, private hospital)</p> <p>“Our entire hospital turned into COVID because ours is a government hospital so everything else in the hospital turned COVID except the burns ward and the obstetrics. Since nobody else in the city could take care of the burn patients free of cost during the COVID we continued the burns service.” (R-15, public hospital)</p> <p>“The routine operation / surgical services for burns were closed during the lockdown period.” (R-3, public hospital)</p> <p>“One more thing is skin bank. Actually, we have a skin also here. There we didn't get donors. Donation was not there at all.” (R-10, public hospital)</p> <p>“Rehabilitation starts during admission only and require psychological as well as physical rehabilitation. At home, you cannot have a full-fledged rehab since it was affected.” (R-18, private hospital)</p> <p>“Follow up suffered a lot, because many patients who had some post-burn deformities also, we were not able to treat them. Now gradually we are starting to treat them.” (R-7, public hospital)</p> <p>“We had set up our protocol and everyone followed, and it led to improvement in care. All staff were visibly satisfied with improved quality of care and thus, also the recovery outcome improved in terms of lower mortality rate as compared to previous years. The mortality rate has gone down in 2020 by almost 10% as compared to previous years and more than 10% as compared to average since 2015. Pandemic made us to do our work in a better way. ” (R-8, public hospital)</p>

**Table 4 – Theme –3: Lessons and reflections for practice and policy reform – sub-themes and supporting quotes.**

Sub-themes	Supporting quote
Robust and resilient emergency services and preparedness	<p>“The emergency services should be made more resilient to absorb the shock of a pandemic like COVID-19, especially burn emergency services.” (R-7, public hospital)</p> <p>“Rather than diverting the resources from critical care like burn, there should be dedicated training of HR for pandemic response” (R-3, public hospital)</p> <p>“So, we learned that basic protocols and distancing and simple makes things better. They were more than enough. PPE more talked about, but they are only being used in our hospital at cases where COVID positive patients are being treated.” (R-4, public hospital)</p> <p>“Essential and very highly specialised services like burn should not be diverted because these services are not available in peripheral health facilities. Prioritisation is important which was done this time also and this should be done in future as well.” (R-5, public hospital)</p>
Strengthening burn care services and improving epidemiological understanding of burns	<p>“See burn care has to be done through government because it is a service which requires lot of money and lot of resources which are not available with the private parties, and private parties do not want to spend so much of money because they don't get the return as such.” (R-17, private hospital)</p> <p>“So, my suggestion to the Ministry of Health would be patients who get a major burn, even if they do not fall in eligible group for golden card (health insurance card), please make a golden card for them because a burn patient in two or three months' time will need so much money that the family if they have to support, they will get almost bankrupt. That is the situation of burns everywhere in India.” (R-12, public hospital)</p> <p>“I think in periphery everybody think burns is complicated and burns patients are a liability. That attitude has to change, there have to be some center, maybe not in every district, but in like, like in Southern or Eastern part of state if we could have a center which was totally developed as a burn center, then not all patients will have to be referred to state capital. Because we see patients coming to us from district also.” (R-16, public hospital)</p> <p>“We have national programs, but again, national programs are only concentrated at hospitals in urban areas. There is need to expand it beyond urban medical centres” (R-13, public hospital)</p> <p>“I think is collecting the epidemiological data is extremely important. There is the type of burns, where they come from, then where they come from means, I mean, whether they're burns at home or the industrial burns or any other, which type of burns and then based on this epidemiological data, then only just concerned authorities will be able to take very useful action in order to prevent burns and in order to take care for those burn patients. Because unless you know what it is, you can't stop it.” (R-11, private hospital)</p>
Measures to ensure continuum of care	<p>“We can link up those patients and provide them follow-up care through tele-medicine. Tele-medicine is important and can help in providing experts services to higher number of patients, but it has long way to go” (R-8, public hospital)</p> <p>“I think telemedicine is a good thing, but WhatsApp is definitely not less good because what we see everybody got WhatsApp nowadays. Everybody got video calling so we can definitely advise them how to do physiotherapy and we can see what type of contracture developing around, whether the wound is healing, I can tell you that time even fresh burn showed me the photographs or send me the photographs, this is the burn what to do? So, I had to advice on that. So those things can be definitely systematised.” (R-17, private hospital)</p> <p>“Tele-consultation is good and perfect for minor burns up to 10–15%, which can be guided by tele or video call and these patients can be managed at home or local health facility or any other place of convenience, so people can simply buy consumables and medicine from local pharmacy and can I do home treatment as guided by consultant via Tele or video consultation for such minor cases” (R-5, public hospital)</p> <p>“We cannot justify, we cannot replace the physical treatment of a patient with online presentation. The government has also put in some restrictions that you can prescribe certain amount of medication, which are safe without seeing the patient, we cannot encourage, and it cannot happen that online treatment is better than physical examination.” (R-18, private hospital)</p>



measures, and reduced patient load provided the opportunity for better attention. A few respondents did, however, suggest a decline in quality of care. Views on the impact of recovery outcome were also differing, as some respondents noted improved recovery outcome and decreased mortality while other respondents had contrary opinions.

### 3.2.3. *Lessons and reflections for practice and policy reform*

The participants reflected on practice and policy reforms for burn care based on lessons from the pandemic and their own long experience in the field. These are described below and selected quotes reflecting these suggestions are mentioned in Table 4.

3.2.3.1. *Robust and resilient emergency services and preparedness.* The predominant call was a need for robust and resilient emergency care systems within the hospital including burn services. Three important measures were suggested for this: a parallel and segregated emergency system for pandemic or disaster response; a robust hospital disaster preparedness plan; and infrastructure to ensure physical distancing. Ensuring proper ventilation, crowd management, and compliance to protocol by the people were deemed necessary to reduce cross-infection in hospitals. Another important message was that resources and HR for essential services like burns should not be diverted.

3.2.3.2. *Strengthening burn care services and improving epidemiological understanding of burns.* Burn care should be entirely a public responsibility. Treatment for burn patients should either be free or adequately covered by a publicly financed health insurance scheme. Strengthening burn care in the public sector was preferred. There was perceived lack of burn care in peripheral health facilities. Decentralising burn care and rehabilitation service by making appropriate burn services available in peripheral health facilities were suggested by almost all respondents. Hospitalised burns care should ideally be available at district hospitals, and first aid and primary care should be available at all primary care centres. Staff working at these facilities should be trained in burn management appropriate for their service level. The national program should be expanded beyond medical colleges (see Table 4).

Respondents emphasised the need for a better understanding of burn epidemiology in India and recommended implementing burn registry at all burn care centres. The pandemic also reiterated the need for rigorous compliance to standards and protocols, and the importance of implementing standard treatment guidelines. Higher priority on preventive aspects and the need for the national program to focus on prevention also emerged as one of the important recommendations. The approach for strengthening the preventive aspect should involve intersectoral coordination for more effective implementation.

3.2.3.3. *Measures to ensure continuum of care.* Telemedicine emerged as an alternative system for ensuring continuum of care, especially for minor acute burns, guiding the patient or carer for follow-up care and rehabilitation. Many respondents

shared experiences of direct teleconsultation using personal mobile phones through WhatsApp and multimedia message or via video calling. Such consultations were largely limited to personal rapport between patients and doctors. Organised teleconsultation services were established and started in few hospitals, but it focused more on general medicine than burns care. Administrative, financial, and technical challenges in setting an organised telemedicine service at the institutional level were also discussed. Lack of information about the availability of teleconsultation services to the masses, difficulty in proper diagnosis without physical examination or investigation, knowledge level of recipients, and connectivity issues were opined as major limitations for telemedicine. A few participants said that teleconsultation could not replace physical consultation and it only has very limited benefit in burns care. In an important policy decision during the national lockdown, the Government of India allowed teleconsultation for minor ailments, which gave confidence to the medical fraternity to use telemedicine for care delivery. Many respondents mentioned this policy and how the guideline helped in freely practicing online teleconsultation. Burn practitioners did not share the experience of using national telemedicine services for burn care. Home-based care and provider training also emerged as an alternative measure to ensure the continuum of care in the rural area.

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## 4. Discussion

The ongoing COVID-19 pandemic and containment measures have affected some of the risk factors, patient characteristics, and access to care, as well as caused significant disruption in facility-based burns care in India. This unparalleled crisis has also provided many lessons for improving burn care in India such as developing robust and resilient emergency services, decentralised burn care, improved epidemiological understanding, need to focus on prevention, and harnessing technological innovation to ensure the continuum of care. Evidence describing the COVID-19 impact on burn centres has noted changes in the pattern and inflow of burns patients, quality of care, and recovery outcome [9–11]. The existing burn care systems in India is already grappled with an inadequate number and skewed distribution of facilities, limited human resources, inadequate infrastructure, financial burden, neglect of preventive aspects, and lack of integrated rehabilitation services [2]. To our knowledge, this investigation is the first attempt to qualitatively explore and understand the challenges faced at specialised burn units in India during the ongoing COVID-19 pandemic. The findings have relevant policy implications which may also be applicable for other similar low and middle-income countries (LMIC) contexts.

The findings suggest a change in the risk factors, reduction in major burns, decrease in industrial and chemical burns, and reduction in suicidal, homicidal, or burns due to violence during the pandemic. The decline in patient load, a probable decline in incidence, and a marked increase in the proportion of paediatric burn cases were also reported. Cases of self-immolation by women and bride burning were

reportedly fewer, possibly due to family members spending time together at home, and lower access to harmful substances. This finding is in contrast to the evidence of increased domestic violence and quarrels within family, both globally as well as in India.[\[16,17\]](#) Overall, these findings reiterate the need to focus on minimising the risk for burns by a targeted prevention approach. The role of targeted prevention in the reduction of incidence, the severity of burns, and the requirement of hospitalisation in India is also documented previously [\[18\]](#). These lessons also underline the importance of community-based prevention and the need for the national burns program to focus on preventive aspects with an inter-sectoral approach.

Limited availability of emergency transport, interrupted access, and fear of COVID-19 infection also deterred patients to visit the hospital, causing delay in presentation and resulting complications. Existing evidence on emergency referral transport from India suggests better outcomes if burn patients are transported timely to an appropriate facility [\[19\]](#). India has an established network of national ambulance services for transporting critical care, trauma, and accident victims [\[20\]](#). Available evidence suggests challenges regarding awareness about emergency transport services in India and recommended the need to create awareness.

Reorganisation of burn unit was necessitated to improve ventilation, ensure spacing, and isolation. Improved infection control practices created a conducive environment for health workers and improved quality of care. Infection prevention contributes significantly to the recovery outcome of burn patients [\[21\]](#). Recent findings from burn centres during the pandemic also concurred on improved infection prevention [\[10,22\]](#). Improved quality of care was also reported probably due to reduced patient load, better provider-patient ratio, better adherence to the treatment protocol. Views regarding reduction in mortality and improved recovery outcome were not uniform, as few respondents also reported worsened recovery outcome. Other published work also reported shorter duration of stay for burn patients during the pandemic resulting in post-discharge complications [\[23\]](#). Reorganisation of health facilities due to COVID-19 protocols led to the prolonged care-seeking pathway for admission to burn ward or ICU. Similar findings were also reported from burn centres in other LMIC during the pandemic [\[11\]](#). Surgical services, follow-up care, and rehabilitation services were most adversely affected. Similar disruption in burn care services is also described in a paper describing experiences of multiple burn centres from different settings during the pandemic [\[24\]](#).

The study findings suggest multiple HR challenges, including scarcity of personnel due to digression towards COVID-19 response, positivity for COVID-19, and fear of getting infected. Short-term strategies such as assigning front-line work to young health workers, rotational posting to reduce exposure time, and ensuring adequate personal protective measures were adopted to combat these challenges. A systemic review on protective measures for burn care professionals during the pandemic echoed the need for strict adherence to the protocol [\[25,26\]](#). Burnout among staff due to low motivation, fear of infection, and stress during the pandemic is also reported in other studies [\[27\]](#). Low motivation

among support staff due to few incentives is recognised as a threat. Performance-based monetary incentives have been demonstrated to motivate health workers for maternal health services in India [\[28\]](#). Similar incentives can also be explored to motivate burn care providers, considering the challenges of burn care. For longer-term solution, priority should be given to increasing the number of skilled burn professionals and training general health care providers in burn care.

The high cost of burn management was recognised as a significant barrier to adequate care. A limited network of burn centres in the public sector, co-payment causing high out-of-pocket expenditure (OOPE), and inadequate coverage under public health insurance schemes contribute to the high cost of care. Ensuring completely free treatment in the public sector and expanding the width, breadth, and depth for burn care packages under publicly financed health insurance schemes were some impending suggestions. High OOPE for burn patients in public hospitals in India has been reported earlier [\[29\]](#). Pradhan Mantri Jan Arogya Yojana (PMJAY) is a major publicly financed health insurance program in India which started in 2018. The program covers hospitalisation costs for around 40% of country's population and cost of burns management is covered under the scheme [\[30\]](#). But, the early evidence on the implementation of PMJAY indicates skewed distribution of empanelled hospitals and limited results in reducing financial risk protection for hospitalised patients [\[31,32\]](#). Decentralised burn care service with a three-tiered structure, first aid at primary health facilities, hospitalised treatment of minor non-complicated at district hospitals, and referral linkage to specialised tertiary level burn centres emerged as preferred long-term solution to improve health systems responsiveness to burns. Such arrangement should be coupled with appropriate training of HR and compliance to a standard treatment guideline. Rehabilitation services should be integrated at all levels to ensure holistic care from the first day of starting treatment. These findings also indicate a perceived lack of awareness on decentralisation in burns care. As per directives of Nation Program for Prevention and Management of Burn Injury (NPPMBI), secondary level hospital in each district needs to earmark 6 beds for burns care and fund is also provided for setting and equipping these burn units [\[33\]](#). Similarly, a new initiative for comprehensive primary health care through a network of Health and Wellness Centres (HWC) across the country was started in 2018. The framework of HWC includes the provision of stabilisation, triaging, and referral of emergency patients including burns [\[34\]](#). Decentralised and integrated three-tier structure for burns care in LMICs have been demonstrated to improve the quality of care [\[35\]](#). However, several implementation challenges have been documented. A systematic review on burn management capacity in LMICs documented infrastructure and skilled staff as the most significant challenges for burn care [\[36\]](#).

Burn patients require frequent follow-up visits, which were severely challenged during the pandemic. Poor understanding, ignorance, financial constraints, and unawareness about consequences were compounding factors for non-compliance. Burn centres reported adopting many measures to mitigate these challenges, the most common being

telemedicine. Direct personal telecommunication between doctors and patients was almost universal during the lockdown. Institutionalised telemedicine face limitations owing to resource constraints, lack of administrative and technical support, inadequate information about telemedicine, difficulty in diagnosis, understanding level of patients or caregivers, and connectivity challenges. Despite challenges, telemedicine was recognised to have strong potential in treating minor burns, triaging and referral, and follow-up care. Telemedicine was supported through a policy guideline in India released in March 2020 after the national lockdown, allowing registered medical practitioners to provide limited medical consultation via telemedicine [37]. Later, a dedicated national web platform was also started to facilitate the use of teleconsultation [38]. The implementation of this platform and decision regarding the range of services were responsibilities of the state government. In most of the states, services were limited to general out-patient consultation services with minimal linkage with specialised services [39]. The use of this platform for burn care did not feature in our findings, probably a reflection of its limited penetration for burn care. The role of telemedicine for burns has been discussed and evaluated in many settings. A recent study evaluating telemedicine at a burn unit demonstrated its usefulness in triaging, reducing the burden on tertiary care burn centre, and optimising resources in terms of time and cost [40]. Other evidence demonstrated very high sensitivity for diagnosing and triaging burn patients via teleconsultation as compared to face-to-face consultation [41]. The use of telemedicine during the COVID-19 restriction helped in managing 44% of burns patients remotely at peripheral networked hospitals in the United Kingdom. Such a strategy was found to be useful for resource optimisation as well as in mitigating infection [42]. The role of telemedicine in optimising home-based follow-up care and rehabilitation is also documented in urban settings in high-income country [43,44]. But, majority of the evidence is observational, and robust experimental evidence based on the comparative outcome is limited. Some documented limitations for telemedicine are cultural concerns, equity and data protection, technical, and administrative challenges [45]. The evidence for use of telemedicine for burn-in LMICs is very limited [46]. Many challenges of operationalising telemedicine for general health services in India are previously noted [47].

Improving epidemiological understanding of burns in India is recommended as an essential step for proper planning. Initiation of burn registry at tertiary care burn centres should be starting point for this. Under the national program, the burn registry is identified as one of the critical components for future planning [48]. The documented challenges for burn registry in India are heterogeneity of burn providers and facility, and a weak health information system [2].

#### 4.1. Strengths and limitations

This study had a number of strengths. The inclusive representation of burn experts in terms of geographical location, range of experience, public-private mix is an important strength of the study. Most of the respondents were involved in administrative and clinical management at their

respective centres, thus providing holistic viewpoints. All respondents were actively involved in burn management during the COVID-19 pandemic. The study also has a few limitations. The first limitation is all respondents being either plastic or general surgeons, which may not necessarily reflect the views of other cadres of the multidisciplinary team, such as nurses, social workers, rehabilitation practitioners and support staffs. However, the respondents participated in the study as representative of the unit and were asked to reflect on the functioning of the entire burn unit. The second limitation can be subjectivity, as the results are dependent on the experiences and opinions of the respondents. The research team employed an inductive approach for coding, and discussion on interpreting the qualitative data was regularly held to combat subjectivity. The third limitation can be social desirability bias and guarded response. As the response was reflective of the functioning of the burn unit, the respondent may have been influenced by desirability while explaining few points. The interviewer tried to negate this by probe questions and reiterating neutrality and confidentiality.

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## 5. Conclusions

The ongoing COVID-19 pandemic has overwhelmed health systems and affected essential burn care in India. These challenges have been exaggerated by already limited health systems capacity for burn care. However, many useful lessons for improving and strengthening burn care in India have emerged. Based on these lessons, the emerging policy recommendations are:

- Focus on targeted prevention approaches for the prevention of burn.
- Ensuring emergency and essential services like burn care are not affected by the pandemic response or disaster.
- Deploy adequate skilled human resources for burn care, and they should not be diverted to other services. Ensure proper training, safety, and incentive.
- Make burn services free in public facilities and broaden the width, breadth, and depth of publicly financed health insurance schemes for burn treatment.
- Improving burn care in community settings, and integrate with the peripheral primary health care system.
- Harness use of technology and innovative methods for ensuring continuum of care for burn injury.

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## CRedit authorship contribution statement

Vikash Ranjan Keshri and Jagnoor Jagnoor conceptualised the study with inputs from , Maneesh Singhal, Tanu Jain,

Margaret Peden, Bontha V. Babu, Shivangi Saha, and Robyn Norton. Vikash Ranjan Keshri collected and analysed the data and drafted the manuscript with inputs from JJ and Margaret Peden. Robyn Norton, Maneesh Singhal, Shivangi Saha, Bontha V. Babu, and Tanu Jain critically reviewed and helped in revising the manuscript. All authors reviewed and approved the final draft of the manuscript.

### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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### Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.burns.2021.11.011](https://doi.org/10.1016/j.burns.2021.11.011).

#### REFERENCES

- [1] James SL, Lucchesi LR, Bisignano C, Castle CD, Dingels ZV, Fox JT, et al. Epidemiology of injuries from fire, heat and hot substances: global, regional and national morbidity and mortality estimates from the Global Burden of Disease 2017 study. *Inj Prev* 2019;26(Supp 1):i36–45. <https://doi.org/10.1136/injuryprev-2019-043299>
- [2] Singh A. Burns management in India – the way ahead. *Indian J Burns* 2018;26:3–5. [https://doi.org/10.4103/ijb.ijb\\_2\\_19](https://doi.org/10.4103/ijb.ijb_2_19)
- [3] Ranganathan K, Mouch CA, Chung M, Mathews IB, Cederna PS, Sabapathy RR, et al. “Geospatial mapping as a guide for resource allocation among burn centers in India”. *J Burn Care Res* 2019;41(4):853–8. <https://doi.org/10.1093/jbcr/irz210>
- [4] Brigham PA, Dimick AR. The evolution of burn care facilities in the United States. *J Burn Care Res* 2008;29:248–56. <https://doi.org/10.1097/BCR.0b013e31815f366c>
- [5] Jagnoor J, Bekker S, Chamania S, Potokar T, Ivers R. Identifying priority policy issues and health system research questions associated with recovery outcomes for burns survivors in India: a qualitative inquiry. *BMJ Open* 2018;8(3):e020045 <https://doi.org/10.1136/bmjopen-2017-020045>
- [6] Gupta I. Relying on serendipity is not enough: Building a resilient health sector in India. *Indian Econ Rev* 2020:1–23. <https://doi.org/10.1007/s41775-020-00091-5>
- [7] Acharya R, Porwal A. A vulnerability index for the management of and response to the COVID-19 epidemic in India: an ecological study. *Lancet Glob Health* 2020;8:e1142–51. [https://doi.org/10.1016/S2214-109X\(20\)30300-4](https://doi.org/10.1016/S2214-109X(20)30300-4)
- [8] Nischwitz SP, Popp D, Sawetz I, Smolle C, Tuca A-C, Luze H, et al. Burns in pandemic times – The Graz way towards COVID-19 and back. *Burns* 2021;47:234–9. <https://doi.org/10.1016/j.burns.2020.06.010>
- [9] Rogers AD, Cartotto R. The impact of COVID-19 on burn care at a major regional burn centre. *J Burn Care Res* 2020;42(1):110–1. <https://doi.org/10.1093/jbcr/iraa181>
- [10] Kumar S, Kain R, More A, Sheth S, Arumugam PK. Burns and COVID-19—Initial Experience and Challenges. *J Burn Care Res*. 2021;42(4):794–800. <https://doi.org/10.1093/jbcr/iraa217>
- [11] Fouadi FE, Ababou K, Belkouch A, El Khatib K, Siah S. Burn patients' management during the COVID-19 pandemic: An institutional report from the Mohammed Vth Teaching Armed Forces Hospital in Morocco. *Burns* 2020;46(7):1718–9. <https://doi.org/10.1016/j.burns.2020.06.025>
- [12] Greenhalgh DG. Not All Burn Centers Are Quiet During the COVID-19 Crisis: “Trends in Burn Injuries in Northern Israel During the COVID-19 Lockdown”. *J Burn Care Res* 2020;42(1):2. <https://doi.org/10.1093/jbcr/iraa164>
- [13] Ma S, Yuan Z, Peng Y, Chen J, Li H, Luo Q, et al. Experience and suggestion of medical practices for burns during the outbreak of COVID-19. *Burns* 2020;46(4):749–55. <https://doi.org/10.1016/j.burns.2020.03.014>
- [14] QSR International Pty Ltd., NVivo (Version 12), 2018. (<https://www.qsrinternational.com/nvivo-qualitative-data-analysis-software/home>).
- [15] Patton M. *Qualitative evaluation and research methods*. 2nd ed., Sage Publication, Inc.; 1990.
- [16] Krishnakumar A, Verma S. Understanding domestic violence in India during COVID-19: a routine activity approach. *Asian J Criminol* 2021:1–17. <https://doi.org/10.1007/s11417-020-09340-1>
- [17] Sacco MA, Caputo F, Ricci P, Sicilia F, De Aloe L, Bonetta CF, et al. The impact of the Covid-19 pandemic on domestic violence: The dark side of home isolation during quarantine. *Med Leg J* 2020;88:71–3. <https://doi.org/10.1177/0025817220930553>
- [18] Sarma BP. Prevention of burns: 13 years' experience in Northeastern India. *Burns* 2011;37:265–72. <https://doi.org/10.1016/j.burns.2010.08.003>
- [19] Newberry JA, Bills CB, Pirrotta EA, Barry M, Ramana Rao GV, Mahadevan SV, et al. Timely access to care for patients with critical burns in India: a prehospital prospective observational study. *Emerg Med J* 2019;36:176–82. <https://doi.org/10.1136/emermed-2018-207900>
- [20] National Health Mission, ERS Patient transport service, 2021. (<http://nhm.gov.in/index1.php?lang=1&level=2&sublinkid=1217&lid=189>) [accessed 11 June 2021].
- [21] Bloemsma GC, Dokter J, Boxma H, Oen IM. Mortality and causes of death in a burn centre. *Burns* 2008;34:1103–7. <https://doi.org/10.1016/j.burns.2008.02.010>
- [22] Li N, Liu T, Chen H, Liao J, Li H, Luo Q, et al. Management strategies for the burn ward during COVID-19 pandemic. *Burns* 2020;46:756–61. <https://doi.org/10.1016/j.burns.2020.03.013>
- [23] Farroha A. Reduction in length of stay of patients admitted to a regional burn centre during COVID-19 pandemic. *Burns* 2020;46:1715. <https://doi.org/10.1016/j.burns.2020.05.028>
- [24] Barret JP, Chong SJ, Depetris N, Fisher MD, Luo G, Moiem N, et al. Burn center function during the COVID-19 pandemic: An international multi-center report of strategy and experience. *Burns* 2020;46:1021–35. <https://doi.org/10.1016/j.burns.2020.04.003>
- [25] Al-Benna S. Protective measures for burn care professionals during the coronavirus disease 2019 pandemic: systematic review. *Ann Burns Fire Disasters* 2020;33:182–90. PMID: 33304207.
- [26] Saha S, Kumar A, Dash S, Singhal M. Managing burns during COVID-19 outbreak. *J Burn Care Res* 2020;41:1033–6. <https://doi.org/10.1093/jbcr/iraa086>
- [27] Aljunmeeyn A, El-Dahiyat F, Altakhineh MM, Azab M, Babar Z-U-D. Understanding the factors influencing healthcare providers' burnout during the outbreak of COVID-19 in Jordanian hospitals. *J of Pharm Policy and Pract* 2020;13:53. <https://doi.org/10.1186/s40545-020-00262-y>

- [28] Padmanaban P, Raman PS, Mavalankar DV. Innovations and challenges in reducing maternal mortality in Tamil Nadu, India. *J Health Popul Nutr* 2009;27:202–19. <https://doi.org/10.3329/jhpn.v27i2.3364>
- [29] Prinja S, Jagnoor J, Sharma D, Aggarwal S, Katoch S, Lakshmi PVM, et al. Out-of-pocket expenditure and catastrophic health expenditure for hospitalization due to injuries in public sector hospitals in North India. *PloS One* 2019;14. <https://doi.org/10.1371/journal.pone.0224721>
- [30] National Health Authority, About Pradhan Mantri Jan Arogya Yojana (PM-JAY), 2021. <https://pmjay.gov.in/about/pmjay> [accessed 13 June 2021].
- [31] Joseph J, Sankar DH, Nambiar D. Empanelment of health care facilities under Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (AB PM-JAY) in India. *PloS one* 2021;16:e0251814 <https://doi.org/10.1371/journal.pone.0251814>
- [32] Garg S, Bebartha KK, Tripathi N. Performance of India's national publicly funded health insurance scheme, Pradhan Mantri Jan Arogya Yojana (PMJAY), in improving access and financial protection for hospital care: findings from household surveys in Chhattisgarh state. *BMC Public Health* 2020;20:949. <https://doi.org/10.1186/s12889-020-09107-4>
- [33] National Health Mission, National Programme for Prevention and Management of Burns Injury (NPPMBI), 2021. <https://nhm.gov.in/index1.php?lang=1&level=2&sublinkid=1050&lid=610> [accessed 13 June 2021].
- [34] National Health Systems Resource Centre, Ayushman Bharat Comprehensive Primary Health Care through Health and Wellness Centre: An Operational Guidelines. New Delhi, 2018. Available from: <https://ab-hwc.nhp.gov.in/download/document/45a4ab64b74ab124cfd853ec9a0127e4.pdf> [accessed 17 June 2021].
- [35] Potokar T, Bendell R, Chamania S, Falder S, Nnabuko R, Price PE. A comprehensive, integrated approach to quality improvement and capacity building in burn care and prevention in low and middle-income countries: An overview. *Burns* 2020;46:1756–67. <https://doi.org/10.1016/j.burns.2020.05.029>
- [36] Gupta S, Wong EG, Mahmood U, Charles AG, Nwomeh BC, Kushner AL. Burn management capacity in low and middle-income countries: a systematic review of 458 hospitals across 14 countries. *Int J Surg* 2014;12:1070–3. <https://doi.org/10.1016/j.ijssu.2014.08.353>
- [37] Board of Governors in super session of the Medical Council of India, Telemedicine Practice Guidelines: Enabling Registered Medical Practitioners to Provide Healthcare Using Telemedicine. New Delhi, 2020. Available from: <https://www.mohfw.gov.in/pdf/Telemedicine.pdf> [accessed 17 June 2021].
- [38] Ministry of Health and Family Welfare. A Big Win for Digital India: Health Ministry's 'eSanjeevani' Telemedicine Service Records 2 Lakh Tele-consultations. New Delhi: Press Information Bureau; 2020 (Available from). (<https://pib.gov.in/PressReleasePage.aspx?PRID=1646913>).
- [39] Ministry of Health and Family Welfare, National Teleconsultation Service, 2021. <https://esanjeevaniopd.in/FAQS> [accessed 14 September 2021].
- [40] Monte Soldado A, López-Masramon B, Aguilera-Sáez J, Serracanta Domenech J, Collado Delfa JM, Moreno Ramos C, et al. Implementation and evaluation of telemedicine in burn care: Study of clinical safety and technical feasibility in a single burn center. *Burns* 2020;46:1668–73. <https://doi.org/10.1016/j.burns.2020.04.027>
- [41] Gacto-Sánchez P, Molina-Morales J, Rodríguez-Vela F, Moreno-Conde J, Sendin-Martin M, Parra-Calderon C, et al. Diagnostic accuracy of a telemedicine tool for acute burns diagnosis. *Burns* 2020;46:1799–804. <https://doi.org/10.1016/j.burns.2020.05.020>
- [42] Jones J, Cubitt JJ. Optimising burns referrals in response to COVID-19. *JPRAS Open* 2021;28:1–3. <https://doi.org/10.1016/j.jpura.2021.01.004>
- [43] Hickey S, Gomez J, Meller B, Schneider JC, Cheney M, Nejad S, et al. Interactive home telehealth and burns: A pilot study. *Burns* 2017;43:1318–21. <https://doi.org/10.1016/j.burns.2016>
- [44] Liu YM, Mathews K, Vardanian A, Bozkurt T, Schneider JC, Hefner J, et al. Urban Telemedicine: The Applicability of Teleburns in the Rehabilitative Phase. *J Burn Care Res* 2017;38:e235–9. <https://doi.org/10.1097/BCR.0000000000000360>
- [45] Wallace DL, Hussain A, Khan N, Wilson YT. A systematic review of the evidence for telemedicine in burn care: with a UK perspective. *Burns* 2012;38:465–80. <https://doi.org/10.1016/j.burns.2011.09.024>
- [46] Atiyeh B, Dibo SA, Janom HH. Telemedicine and burns: an overview. *Annals Burns Fire Disasters* 2014;27:87–93. PMID:26170782.
- [47] Agarwal D, Roy N, Panwar V, Basil A, Agarwal PM. Bringing health care closer to people - a review of various telemedicine models under the National Health Mission in India. *Indian J Community Med* 2020;45:274–7. [https://doi.org/10.4103/ijcm.IJCM\\_334\\_19](https://doi.org/10.4103/ijcm.IJCM_334_19)
- [48] Gupta JL, Makhija LK, Bajaj SP. National programme for prevention of burn injuries. *Indian J Plast Surg* 2010;43:S6–10. <https://doi.org/10.4103/0970-0358.70716>