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Adult and pediatric pain management for burn injuries: A global survey of burn care providers

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ABSTRACT

Introduction: The practice of pain management for burn injuries may vary by region or socioeconomic status. This study aimed to assess current pain management practices in burn patients globally.
Methods: An online survey regarding the availability and use of drugs for burn pain management was sent to members of the International Society for Burn Injuries (ISBI) via email and shared in WhatsApp groups comprised of burn professionals. The primary outcome was to provide a cumulative representation of the current state of burn pain management globally.
Results: 113 surveys were completed, with half of respondents from high-income countries (HICs). Most respondents treat both adult and pediatric patients (65 %). The most used analgesic for background pain for all burn sizes is paracetamol, with HICs using it more often than other countries for large and small burn sizes ($p = 0.03$ and 0.02). Oral and intravenous (IV) opioids are more often used in HICs for all burn sizes in adult patients. Respondents having a protocol for pain management or being aware of pain guidelines reported better perceived pain control for their patients.
Conclusion: Pain management for burn injuries varies by country socioeconomic status and drug availability. Perception of adequate pain control is associated with socioeconomic status, availability of drugs, and having a pain protocol.

1. Introduction

Burns have been acknowledged as one of the most painful injuries, yet burn pain management guidelines often lack strong recommendations due to insufficient quality evidence [1]. Burn-related pain is exceptionally challenging to manage because it is multifaceted, starting with the initial traumatic injury, followed by debridement, frequent wound care, and other therapeutic interventions. Uncontrolled pain can have long-term sequelae, such as chronic pain and adverse psychological outcomes [2]. Inadequate pain control is unfortunately common among burn patients [3,4]. Improving burn pain management is a global priority to reduce burn-associated morbidity.

Currently, there is a dearth of high-quality evidence regarding pharmacologic pain management for burns [1,5]. Most opioid research focuses on morphine without adequate characterization of additional agents [6]. Experts promote multimodal pain management with both pharmacologic and non-pharmacologic options, but the literature has yet to define which specific agents in each class be included in the guidelines [1,7–9]. Practicing without clearly defined guidelines creates variability between regions and institutions, as well as between high-income countries (HICs), low-middle income countries (LMICs), and lower-income countries (LICs). Few randomized controlled trials on burn analgesia have been conducted in LMICs/LICs, reducing their generalizability to these settings [10,11]. Economic and geographic disadvantages have shown to reduce access to specialized burn care in LMICs/LICs [12,13]. Evidence has indicated that standardized protocols for pain management can lead to lower pain scores [14], indicating the importance of a standardized framework. Recent efforts have been made to design standardized protocols for resource-limited settings [15] but without a global consensus.

Like adult burn patients, there is a lack of strong evidence for a definitive treatment guideline in the pediatric population [16]. Pediatric patients represent most of the global burden of burn injuries [17]. A survey of United States (US) burn centers found a lack of consensus on

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analgesia for pediatric patients [18]. Studies in LMICs/LICs have similarly found inconsistencies in pediatric burn analgesia practices [19]. There is significant concern for the underestimation of pediatric burn pain and the connection between anxiety and increased pain [20]. Experts recommend specialized pediatric pain management teams as well as the use of virtual reality, both of which could be challenging to implement in resource-limited settings [20].

Surveys of burn providers have demonstrated a lack of consensus on burn analgesia for both adult and pediatric patients. A survey of US burn centers demonstrated high discordance in pain management practices between institutions [21]; similarly, high variability in clinical guidelines has been demonstrated between other HICs [22,23]. The same issues have been discussed in reviews based in LMICs [24]. The literature lacks a comparison of burn pain management practices in HICs, LMICs, and LICs. To date, no survey has been conducted on a global scale looking at clinical practice regarding burn pain management. This survey seeks to better understand current practices in burn pain management among burn providers globally, as understanding trends and preferences can lay the foundation for establishing standardized global burn analgesia guidelines. Our hypothesis is that global burn analgesia strategies will differ regionally and based on country income level, with differences which are enhanced by the variable availability of analgesic medications.

2. Methods

An online survey regarding the availability and use of drugs for burn pain management was sent to members of the International Society for Burn Injuries (ISBI) via email and shared in WhatsApp groups comprised of burn professionals. The survey was developed by an interdisciplinary team including providers and members of the care team with extensive experience providing burn analgesia to characterize availability and frequency of use of diverse analgesic methods. A copy of the survey is included as Supplement 1. The survey was disseminated by a link to an anonymous electronic survey. One link was provided for non-European Union (EU) providers with a standard consent and an additional link was provided for clinicians residing in the EU with a consent statement in compliance with the General Data Protection Regulation (GDPR). The study was granted exemption by the Colorado Multiple Institutional Review Board (COMIRB). Survey results were collected and stored in a Research Electronic Data Capture (RedCap) database. As the survey was distributed by anonymous link via messaging groups and ISBI email, the response rate is unable to be recorded.

The survey questions covered access to and use of several major drug classes (paracetamol/acetaminophen, NSAIDs, PO and IV opioids, benzodiazepines, ketamine, propofol, IV lidocaine, alpha-2 agonists, and neuropathic pain medications) in both adult and pediatric patients. Participants were asked to choose drug classes they had access to and quantify their frequency of use into percentage quartiles (0 %, 25 %, 50 %, 75 %, 100 %). Additionally, the survey differentiates background pain and pain associated with wound care as well as small wounds versus big wounds with a cutoff of 10 % TBSA. We chose 10 % TBSA as the cutoff because anything 10 % or greater generally involves more than one area of the body and wound care quickly becomes more complicated and involved for the patient, thus increasing time and pain from wound care. Participants were asked to respond separately in each circumstance (big vs. small, background vs. wound care pain). There was an inclusion of nonpharmacologic options with an associated text answer. The primary outcome was to provide a cumulative data representation to increase knowledge regarding the state of global burn pain management.

Responses from completed surveys were aggregated into binomials for the primary comparative analysis indicating a drug/drug class being used in > 50 % of cases per a specific scenario to reflect very common use. For example, if a survey response indicated using paracetamol for pain in > 50 % of patients for background analgesia in large burns, that response would be coded as a 1 and any response of 0–50 % would be coded as a 0. If the respondent indicated that they did not have access to the drug/drug class, then the survey automatically excluded that drug class for all subsequent questions. All were surveyed regarding knowledge of pain guidelines, use of protocols and perception of pain control at their institutions. Aggregate binomials of "well" or "very well" versus "neutral" or "less" were used to compare perception of how well pain is managed at that institution. Respondent country and city was recorded and categorized into high-income country (HIC), upper-middle-income country (UMIC), lower-middle-income country (LMIC), and lower-income country (LIC) based on the WHO World Economic Situation and Prospects 2022 report [25]. Due to the low number of completed surveys by those practicing in LICs, LMICs and LICs countries were combined for data analysis. Fisher's Exact test was used for comparative analysis across the three socioeconomic groups overall with statistical significance set at $p < 0.05$. Where that threshold of significance was met overall, the groups with the greatest and lowest proportions were each tested against the combined group by Fisher's Exact to identify which of the groups was significantly different from the rest. We report p-values at < 0.05, < 0.025, and < 0.0167 for ease of interpretation against a Bonferroni corrected alpha for multiple comparisons of one, two, or three, respectively. Statistical analysis was performed using JMP®, Version Pro 17 (SAA Institute Inc., Cary, NC).

3. Results

A total of 113 surveys were completed by respondents from 44 different countries (Fig. 1). Based on socioeconomic status, there were 56 responses from HICs, 25 from UMICs, 29 from LMICs and 3 from LICs.

3.1. Demographics

Demographic data are available in Table 1. Most respondents were physicians (80 %), followed by nurses (15 %) and other medical professionals (5 %). Most respondents have been practicing for over 15 years ($n = 60$) and work either in an academic ($n = 46$) or government ($n = 49$) health facility. Nearly all (92 %) report having a burn unit at their health facility. Almost half of respondents say they admit > 300 burn patients yearly, with the remainder spread from < 50–300 admissions. Most respondents care for both adult and pediatric patients at their facility ($n = 73$), with the remainder split evenly between adults or pediatric only ($n = 20$ each).

3.2. Drugs/therapeutics

Table 2 shows the number of respondents reporting access to each specific drug. Most respondents (75 %+) reported having access to all classes of analgesics, apart from IV lidocaine (48 %). 94 % of respondents report premedicating patients at least sometimes before wound care, but only 48 % premedicate most of the time. 65 % say they have a pain protocol at their facility and the majority report > 50 % adherence.

3.3. Background pain – adults

Table 3 shows the percentage of respondents who reported using a specific drug for background pain in adults > 50 % of the time. The most used analgesic for background pain for all burn sizes globally is paracetamol, however respondents in UMICs reported significantly lower use compared to HIC and LMIC respondents (29 %, 77 % and 55 % for big burns, $p = 0.004$; 43 %, 79 % and 69 % for small burns, $p = 0.04$). Oral and IV opioids are very commonly used for burns > 10 % TBSA per HIC respondents (70 % and 65 %), compared to both UMIC (36 % and 62 %) and LMIC (40 % and 27 %, $p = 0.01$ and 0.006) respondents. A Cochran Armitage Trend Test revealed a significant effect of socioeconomic group on neuropathic pain medication use ($p = 0.01$).

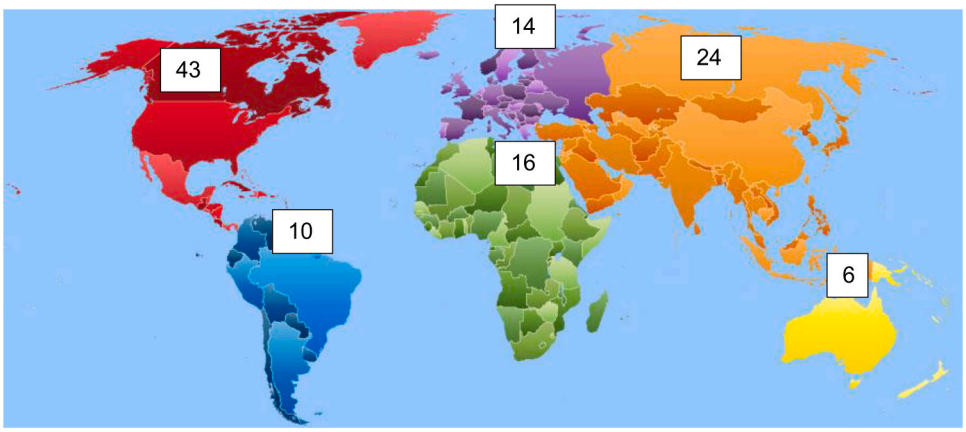

Fig. 1. Distribution of completed surveys. A total of 113 completed surveys were received from 44 different countries.

Table 1
Demographics. Demographic data from each respondent, including role/profession, number of years in practice, geographic region, type of medical facility, number of admissions and patient population.

		Number	Percent
Profession	Physician	90	80
	Nurse	17	15
	Other	6	5
Years in Practice	0–5 years	9	8
	6–10 years	17	15
	11–15 years	27	24
	> 15 years	60	53
Type of facility	Academic	46	41
	Governmental	49	43
	Private	10	9
	Charity/Non-Profit	8	7
Region	Europe	13	12
	Africa	16	14
	Asia	24	21
	South America	10	9
	North America	43	38
	Oceania	6	5
Burn unit	Yes	104	92
	No	9	8
Annual admission	0–50	10	9
	51–100	18	16
	101–200	16	14
	201–300	18	16
	> 300	51	45
Population	Adult	20	18
	Pediatric	20	18
	Both	73	64

3.4. Wound care – adults

Table 3 shows the percentage of respondents who reported using a specific drug for wound care pain management in adults > 50 % of the time. The most used drug in HICs is PO and IV opioids and are used significantly more compared to the other two groups. UMIC respondents report higher use of benzodiazepines and ketamine compared to HICs and LMICs, although this does not reach statistical significance. The most used drug in LMICs for both small and big burns is paracetamol. A Cochran Armitage Trend Test revealed a significant effect of socioeconomic group on PO opioid use for both big and small burns as well as IV opioid use in big burns ($p < 0.05$ in all cases).

3.5. Background pain – pediatrics

Table 4 shows the percentage of respondents who reported using a specific drug for background pain in children > 50 % of the time. The most used analgesic for background pain for all burn sizes is paracetamol, with HICs using it more often than other groups ($p = 0.03$ and 0.02). The second most frequently used drug in small burns globally is NSAIDs, however in big burns the second most common drug differs: HICs use NSAIDs and PO opioids equally (59 %), UMICs use IV opioids (57 %), and LMICs use NSAIDs (43 %). UMICs use NSAIDs significantly less compared to the other groups (big burns: 22 % vs. 59 % and 43 %, $p = 0.03$; small burns: 33 % vs. 62 % and 39 %, $p = 0.07$). Compared to HICs and UMICs, LICs report less use of IV opioids for pain control in big burns (62 %, 57 %, and 23 %, respectively, $p = 0.005$). Non-pharmacological techniques were used more often in big burns by HICs compared to UMICs and LMICs (21 %, 4 %, and 3 %, $p = 0.05$). A Cochran Armitage Trend Test revealed a significant effect of socioeconomic group on PO and IV opioid use for background pain in big burns ($p = 0.04$ and 0.003).

Table 2
Drug availability. Number of respondents (percentage) reporting access to specific drug classes.

Drug	Overall n = 113	HIC n = 56	UMIC n = 25	LMIC + LIC n = 32	p-values
Paracetamol/ Acetaminophen	108 (96)	54 (96)	24 (96)	30 (94)	0.84
NSAIDs	105 (93)	56 (100)	20 (80)	29 (91)	0.001
Oral opioids	95 (84)	52 (93)	17 (68)	26 (81)	0.014
IV opioids	103 (92)	53 (95)	23 (92)	27 (84)	0.256
Benzodiazepines	97 (86)	55 (98)	20 (80)	22 (69)	< 0.001
Ketamine	89 (79)	50 (89)	13 (52)	26 (81)	0.001
Propofol	88 (78)	51 (91)	19 (76)	18 (56)	< 0.001
IV lidocaine	54 (48)	29 (52)	12 (48)	13 (41)	0.59
Alpha−2 agonists	76 (67)	50 (89)	17 (68)	9 (28)	< 0.001
Neuropathic pain medications	93 (82)	52 (93)	20 (80)	21 (66)	0.005

NSAIDs: non-steroidal anti-inflammatory drug; IV: intravenous; HIC: high income country; UMIC: upper-middle income; LMIC: low middle-income country; LIC: low-income country

3.6. Wound care – pediatrics

Table 4 shows the percentage of respondents who reported using a specific drug for wound care pain management in children > 50 % of the time. The most common drug used is paracetamol, except in the case of big burns in UMICs, where IV opioids is more common. The second most common drug in HICs is IV opioids for big burns (65 %) and PO opioids/NSAIDs for small burns (51 %); in UMICs is IV opioids for small burns (43 %) and paracetamol for big burns (55 %); in LMICs it is NSAIDs for both small and big burns (46 % and 43 %). Non-pharmacological interventions are used more often in HICs ($p = 0.02$ and 0.001) for all

Table 3
Adult background pain and wound care. Percent of respondents with access to the medication who reported using the medication for adults > 50 % of the time.

	HIC	UMIC	LMIC+LIC	Overall p-value
Background Pain - Adult Big Burns (>10 % TBSA)				
Paracetamol	**77**[a]	**29**[a]	55	**0.004**
NSAIDs	48	39	39	0.73
PO opioids	**70**[a]	36	40	**0.01**
IV opioids	65	62	**27**[a]	**0.006**
Benzodiazepines	31	15	14	0.26
Ketamine	18	17	8	0.45
IV lidocaine	7	0	8	> 0.99
Alpha−2 agonist	18	25	0	0.41
Neuropathic pain medication	**48**[a]	30	**14**[b]	**0.02**
Non-pharmacologic medication	6	0	3	1
Background Pain - Adult Small Burns (<10 % TBSA)				
Paracetamol	79	**43**[c]	69	**0.04**
NSAIDs	52	38	43	0.64
PO opioids	**53**[a]	36	**20**[a]	**0.02**
IV opioids	20	23	15	0.81
Benzodiazepines	10	15	0	0.22
Ketamine	7	17	4	0.44
IV lidocaine	10	0	0	0.7
Alpha−2 agonist	4	0	0	> 0.99
Neuropathic pain medication	30	10	19	0.36
Non-pharmacologic medication	8	0	3	0.56
Wound Care - Adult Big Burns (>10 % TBSA)				
Paracetamol	53	29	52	0.3
NSAIDs	33	15	39	0.31
PO opioids	**62**[a]	36	32	**0.03**
IV opioids	**74**[a]	54	**38**[a]	**0.01**
Benzodiazepines	29	46	19	0.27
Ketamine	34	67	23	0.13
Propofol	30	36	29	0.93
IV lidocaine	3	17	8	0.32
Alpha−2 agonist	9	25	0	0.15
Neuropathic pain medication	20	0	14	0.4
Non-pharmacologic medication	6	0	0	0.4
Wound Care - Adult Small Burns (<10 % TBSA)				
Paracetamol	57	29	52	0.16
NSAIDs	38	23	46	0.35
PO opioids	**55**[a]	18	28	**0.02**
IV opioids	52	31	27	0.08
Benzodiazepines	21	23	5	0.22
Ketamine	18	50	0	0.17
Propofol	14	36	12	0.16
IV lidocaine	3	17	8	0.32
Alpha−2 agonist	11	8	0	0.82
Neuropathic pain medication	13	0	10	0.76
Non-pharmacologic medication	8	0	0	0.21

TBSA: total body surface area; NSAIDs: non-steroidal anti-inflammatory drug; PO: per oral; IV: intravenous; HIC: high income country; UMIC: upper-middle income; LMIC: low middle-income country; LIC: low-income country
[a] $p < 0.0167$ vs others combined
[b] $p < 0.025$ vs others combined
[c] $p < 0.05$ vs others combined

Table 4
Pediatric background pain and wound care. Percent of respondents with access to the medication who reported using a specific drug for children > 50 % of the time.

Background Pain - Pediatric Big Burns (>10 % TBSA)	HIC	UMIC	LMIC+LIC	p-value
Paracetamol	**84**[b]	55	62	**0.03**
NSAIDs	**59**[c]	**22**[c]	43	**0.03**
PO opioids	59	43	32	0.09
IV opioids	62	57	**23**[a]	**0.005**
Benzodiazepines	21	**44**[b]	**5**[c]	**0.01**
Ketamine	20	0	12	0.27
IV lidocaine	5	10	0	0.71
Alpha−2 agonist	12	33	0	0.09
Neuropathic pain medication	16	41	10	0.057
Non-pharmacologic medication	**21**[a]	4	3	**0.05**
Background Pain - Pediatric Small Burns (<10 % TBSA)				
Paracetamol	**89**[a]	59	69	**0.02**
NSAIDs	62	33	39	0.07
PO opioids	27	29	20	0.78
IV opioids	14	24	19	0.59
Benzodiazepines	8	17	5	0.51
Ketamine	9	0	12	0.74
IV lidocaine	5	10	0	0.71
Alpha−2 agonist	6	13	0	0.6
Neuropathic pain medication	14	24	10	0.53
Non-pharmacologic medication	18	0	6	0.058
Wound Care - Pediatric Big Burns (>10 % TBSA)				
Paracetamol	70	55	52	0.25
NSAIDs	46	28	46	0.38
PO opioids	59	36	32	0.08
IV opioids	65	67	**31**[a]	**0.01**
Benzodiazepines	29	33	10	0.13
Ketamine	26	9	24	0.64
Propofol	25	35	18	0.52
IV lidocaine	5	0	8	> 0.99
Alpha−2 agonist	12	33	0	0.1
Neuropathic pain medication	11	18	0	0.16
Non-pharmacologic medication	**18**[a]	4	0	**0.02**
Wound Care - Pediatric Small Burns (<10 % TBSA)				
Paracetamol	73	55	59	0.29
NSAIDs	51	28	43	0.24
PO opioids	51	36	32	0.31
IV opioids	32	43	23	0.38
Benzodiazepines	18	28	10	0.34
Ketamine	26	9	20	0.53
Propofol	17	24	18	0.92
IV lidocaine	5	10	8	> 0.99
Alpha−2 agonist	6	27	0	0.08
Neuropathic pain medication	11	18	0	0.16
Non-pharmacologic medication	**31**[a]	4	3	**0.001**

TBSA: total body surface area; NSAIDs: non-steroidal anti-inflammatory drug; PO: per oral; IV: intravenous; HIC: high income country; UMIC: upper-middle income; LMIC: low middle-income country; LIC: low-income country
[a] $p < 0.0167$ vs others combined
[b] $p < 0.025$ vs others combined
[c] $p < 0.05$ vs others combined

wound care, while IV opioids are used significantly less in LICs compared to UMICs and HICs in both big ($p = 0.003$) and small burns ($p = 0.01$).

3.7. Non-pharmacologic pain management

While non-pharmacologic approaches to wound care were not used commonly, they notably are used more often with pediatric patients and there was a statistically significant difference use in HICs compared to other countries ($p = 0.02$). Additionally, 14 % of respondents reported wanting non-pharmacologic options available at their centers to improve pain management.

4. Outpatient

Most respondents send patients home with pain medication. The most common prescribed medication is paracetamol, followed by NSAIDs. Only a small minority of respondents prescribe PO opioids for outpatient pain management (11 %, 12 %, and 4 %, respectively).

4.1. Perceptions

When asked how well they manage pain, 69 % of respondents from HICs reported "well" to "very well", compared to only 50 % of respondents from UMICs and LMICs ($p = 0.21$). At the end of the survey respondents were asked the following open question: "If there was one aspect of pain management that you would improve, what would it be?". Responses were sorted into the following overarching categories: non-pharmacology availability, availability of alternative drugs, pain specialist, conscious sedation, improved assessment/training, and pain protocol. The 2 most common categories were "non-pharmacology availability" and "availability of alternative drugs" (14 % and 15 %).

5. Discussion

This study was conducted to address the critical need for a better understanding of burn pain management practices worldwide, particularly highlighting the disparities between countries of varying socioeconomic status. The insights from this study are essential in developing more equitable and effective global guidelines, as inadequately managed burn pain can lead to significant long-term physical and psychological consequences [2]. Our results highlight both similarities and differences in pain management practices across multiple domains (i.e. background pain control vs. wound care, adults vs. pediatrics).

In 2020 the American Burn Association (ABA) published guidelines on the management of acute pain in the adult burn patient [1]. This is the most comprehensive guideline published to date for burn patients and provides some basic principles that can be applied universally, such as:

1. Attempts should be made to use as few opiate equivalents as needed to achieve the desired level of pain control
2. Acetaminophen should be utilized on all burn patients
3. Agents for the treatment of neuropathic pain (e.g. gabapentin or pregabalin) should be considered as adjuncts to opioid therapy
4. Every patient should be offered non-pharmacological pain control technique as an adjunct to traditional pharmacological pain control methods

While the ABA guidelines did not include a review of pediatric pain management, these principles are in line with previously published studies [16,18,20]. Our survey was designed to assess the level of adoption globally of these principles of pain management.

While prior studies have noted variability in burn pain management practices, this study offers a more detailed comparison across diverse socioeconomic contexts, offering new insights into the global landscape [26]. The results show that paracetamol is the cornerstone of global burn pain management, with this being the most commonly used medication almost universally across each group [1]. However, our findings did identify some differences in the use of paracetamol, especially in UMICs, where regular use was reported to be less than 50 % in adults and just barely above 50 % in children. Additionally, our data reveals more pronounced differences in opioid use and the adoption of non-pharmacologic interventions than previously documented. The widespread reliance on paracetamol, despite the availability of other analgesics, is likely driven by its accessibility, cost-effectiveness, and safety profile [27]. Conversely, the reduced use of opioids in LMICs, especially for pediatric patients with larger burns, contrasts with the more frequent use observed in HICs. One might intuitively attribute this difference to availability of the medication, however over 80 % of LMIC/LIC respondents said that oral and IV opioids were available at their facility. This disparity may instead reflect broader challenges such as drug availability, regulatory constraints, and concerns about opioid misuse in LMICs [28]. Opioids are a mainstay of appropriate pain management in burns, therefore this disparity is something worth exploring further in future studies to elucidate potential barriers to opioid use for burn pain management.

One aspect of burn pain care that has been studied extensively in high-income countries is non-pharmacologic interventions [29]. Current guidelines include a strong recommendation that patients be offered a non-pharmacologic intervention such as cognitive behavioral therapy or virtual reality [1,29]. Virtual reality has been shown in multiple studies to decrease pain scores for burn patients [30,31]. Challenges associated with VR for burn analgesia on a global scale are cost, availability, and consistent electricity. Low-cost VR has been studied in LMICs and LICs, but the scalability of the intervention has not yet been determined [32]. More readily available non-pharmacologic interventions such as music, spiritual care, and relaxation techniques have been studied with success in LMICs/LICs [33–35].

Despite guideline recommendations, our data shows overall adoption of non-pharmacologic interventions to be low, ranging from 0 % to 31 %. Qualitatively, respondents expressed interest in this modality by identifying "non-pharmacology availability" as one of the most common areas for improvement in pain management. Given previous suggestions that non-pharmacologic tools like virtual reality could offer considerable benefits in low-income settings, this emphasizes the need for more inclusive strategies that integrate both pharmacologic and non-pharmacologic approaches to enhance burn pain management worldwide [32]. The lack of availability and/or implementation of these interventions, as reported in our study, may contribute to suboptimal burn pain management.

The global scope of this study, coupled with its diverse respondent base, offers a comprehensive perspective on burn pain management practices. Our results highlight disparities in certain drug availability and usage between socioeconomic groups. The identification of these disparities highlights the need for standardized guidelines that are applicable and practical to different socioeconomic groups to improve burn pain management universally, especially in LMICs, where the implementation of such protocols remains inconsistent and can be difficult [26]. By elucidating these differences, this study provides a foundation for future initiatives aimed at better understanding pain management practices and developing more equitable and evidence-based guidelines.

There are several limitations to this study. First, we were unable to record a response rate as the survey was distributed by link to burn care professionals using both online forums (i.e. WhatsApp) and an email listserv, with potential overlap of participants between the two. While there was the potential for duplication of data (i.e. the same person responding to the email request and the WhatsApp request), an internal review of responses did not identify any that appeared duplicative. Also, the exact demographic breakdown of the WhatsApp groups, including countries of origin, was unable to be quantified. The study's reliance on self-reported data introduces potential response bias and may not accurately reflect observed clinical practice. Additionally, our data and subsequent analysis and p-values are based on a yes/no cutoff if someone reported using a medication > 50 % of the time on the Likert scale. By using a Likert scale rather than a simple yes/no we could be dismissing respondents who may use a specific drug a plurality of the time, just not the majority. We designed the survey using a Likert scale to encourage respondents to think more critically about both if they use a drug *at all* and, if so, how often they use it. This allowed us to have a more granular view of drug use than a simple yes/no response and prevented grouping respondents with significant drug use differences together (e.g. respondent X using drug A 1–25 % of the time vs. respondent Y using drug A >75 % of the time). Regardless, this decision for a yes/no cutoff at 50 % use could introduce bias into the data that our analysis does not account for.

The lower number of responses from low-income countries limits the generalizability of the findings to the most resource-constrained settings. It is not known whether LIC providers represent a smaller proportion of the group members to which the survey was disseminated, or if for another unknown reason they were less likely to respond. The

study also may not fully capture geographic and resource-based disparities or provide detailed insights into the specific barriers affecting the adoption of non-pharmacologic methods in various contexts.

Future research should prioritize the development and assessment of standardized burn pain management protocols that can be tailored to different socioeconomic contexts. It is essential to investigate low-cost, non-pharmacologic interventions that are feasible for LMICs and explore alternative analgesics that are accessible in resource-limited settings. Additionally, further studies should evaluate the efficacy of non-opioid medications, such as alpha-2 agonists, neuropathic pain medications, and oral ketamine, in burn pain management.

6. Conclusion

This study offers an overview of current global burn pain management practices, highlighting universal practices (i.e. universal use of paracetamol) as well as significant regional disparities. Addressing these disparities through targeted interventions and improved access to resources will be vital in ensuring more equitable care and reducing burn-related morbidity worldwide. This study also demonstrates an opportunity to standardize burn pain management globally with comprehensive guidelines and protocols.

CRediT authorship contribution statement

MD contributed to the planning of the study, IRB approval process, and writing of the manuscript. KB contributed to the planning of the study, IRB approval process, and writing of the manuscript. SM contributed to the planning of the study, writing the survey, data analysis, and writing of the manuscript. AW contributed to the data analysis and editing of the manuscript. CG contributed to the planning of the study, writing the survey, disseminating the survey to providers, data analysis, and writing of the manuscript.

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Declaration of Competing Interest

None of the above authors have conflicting interests to declare.

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MD contributed to the planning of the study, IRB approval process, and writing of the manuscript. KB contributed to the planning of the study, IRB approval process, and writing of the manuscript. SM contributed to the planning of the study, writing the survey, data analysis, and writing of the manuscript. AW contributed to the data analysis and editing of the manuscript. CG contributed to the planning of the study, writing the survey, disseminating the survey to providers, data analysis, and writing of the manuscript.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.burns.2025.107570.

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