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## The value of WhatsApp communication in paediatric burn care

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### ABSTRACT

**Background:** Telemedicine is increasingly applied in developed settings to facilitate transfer of information to and from burn surgeons across vast geographic areas. WhatsApp is a widely available and extremely user-friendly encrypted smartphone application that does not require the expensive physical and personnel infrastructure that characterizes many of these telemedicine systems. The aim of this study was to review the use of WhatsApp to facilitate paediatric burn injury consultations to a regional burn centre in a developing country, where burn care continues to be thwarted by administrative apathy, poor resource allocation and lack of attention to medical and nursing education at all levels.

**Methods:** A retrospective review was undertaken of all consultations using WhatsApp over an 18-month period, received by the burn centre's two senior medical practitioners. The specific origin and nature of the telemedicine requests for advice, transfer or follow-up were collected, as were data relating to the demographics of the patients, the aetiology, mechanism and extent of the burn injury. The impact of the system of communication in terms of reductions in admissions and clinic visits was assessed, and a cost analysis was undertaken. Feedback was also obtained from those health practitioners regularly using the service.

**Results:** 838 communications occurred during the study period, which included 1562 distinct clinical queries. 486 interactions (58%) originated from within the hospital, the majority of which were initiated by surgeons in training or burn nurse practitioners. 352 (42%) consultations were from outside the hospital. Queries related to the full spectrum of burn care, including emergency management and stabilization, triage and transfer, the need for escharotomy, fluid resuscitation, wound care, the timing and nature of surgical intervention, as well as follow-up and rehabilitation.

While no significant changes in the number of surgical interventions or admissions were observed when compared to the five years prior to the intervention, outpatient visits reduced significantly during the study period. It was estimated that over 150 unnecessary admissions were also avoided as a result of the triage made possible by WhatsApp, which translated into considerable cost saving for the institution.

**Discussion:** Incorporating WhatsApp technology into the daily processes of burn care has significantly improved the quality of paediatric burn care referrals to specialist burn services.

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Specifically, WhatsApp has contributed to reductions in unnecessary referrals and outpatient visits, facilitated opportunities for continuing medical education, improved the care of major burn injuries through more effective prehospital communication, and enabled greater allocation of scarce specialist resources at the burn centre. This study motivates for the wider application of WhatsApp for burn care referrals, especially in developing countries.

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## 1. Background

One of the major challenges in meeting the needs of under resourced communities is access to sustainable and equitable healthcare. The World Health Organization has identified telemedicine as one of the potential solutions to address disparities in the distribution of healthcare, and to facilitate and enhance clinical management, education and research [1-5].

There is now considerable evidence for the successful application of telemedicine technology in general across the spectrum of medical specialties, not least in the context of surgical trauma and burn care [6-15]. A variety of formats have been utilized, including real-time video conferences, mobile or cellular telemedicine, hybrid systems and integrated models. Common to all of these technologies has been the ability to, at the very least, capture an image, store it temporarily, transmit it to or from a remote location, and facilitate the viewing of this image, ideally with minimal loss of resolution. Several of these methods have required a fixed, secure physical and personnel infrastructure, and have proved to be quite costly [11,16-21].

Rapid technological advances in terms of processing speeds, ease-of-use and unit mobility, as well as very aggressive marketing campaigns, have now enabled over 85% of the world's population to have access to telecommunication, most commonly via cellular networks. It stands to reason, therefore, that medical professionals have made increasing use of their mobile cellular telephones to facilitate professional communication to improve clinical decision-making and patient care. Clinical scenarios amenable to imaging, photography and radiology, for example, lend themselves best to the transmission of such information, often facilitating rapid and convenient decision-making within medical facilities, but also across vast continents. A recent systematic review has demonstrated the cost-effectiveness of telemedicine in the context of emergency triage and acute management, as well as remote outpatient follow-up care. In the context of burn care the use of this technology has obviated the need for a significant proportion of unnecessary admissions, as well as long commutes for follow-up visits [21-25].

Owing to its low cost, ease-of-use, and availability, WhatsApp (WhatsApp Inc., Mountain View, California) is often the preferred mode of communication between healthcare workers [24]. This study sought to evaluate the application of WhatsApp to facilitate optimal burn care and resource allocation at the Red Cross War Memorial Children's Hospital (RXH) in Cape Town, South Africa, a regional, national and international referral centre for paediatric burn injury. The

institutional research ethics board of the University of Cape Town granted permission for this study to be taken undertaken (HREC Ref 501/2016).

## 2. Methods

The Red Cross War Memorial Children's Hospital in Cape Town houses the paediatric regional burn centre for the Western Cape Province of South Africa, which has a population of 6 million. All major burn injuries in children up to the age of 13 years are referred to this multidisciplinary facility.

A retrospective review of all mobile telephone consultations using WhatsApp received by the burn centre's two senior medical practitioners was undertaken over an 18 month period, from April 2015 to October 2016. Communications from both within the hospital and from outside were included in the study and evaluated. The specific origin and nature of the telemedicine requests for advice, transfer or follow-up were collected, as were data relating to the demographics of the patients, the aetiology, mechanism and extent of the burn injury, the content of the communication itself, as well as patient disposition and outcomes.

All images were received on a proprietary WhatsApp cross-platform (can be used on any device) mobile messaging system and secured with end-to-end encryption following the processing of visual clinical information. Verbal informed consent was obtained by the referring healthcare worker. Telephonic communication from the referring healthcare worker usually preceded the transfer of images, and advice was given either electronically or telephonically in more urgent cases. The responsibility for medical care and decision-making remained with the referring healthcare worker.

Formal encryption of the system was undertaken in July 2016, and this has seen a rapid increase in the use of this means of communication to the point that it is now the favoured method of information and image transfer in the context of burn injury in our setting. Educational modules and video clips have recently also been incorporated with, for example, advice and indications for intubation in the context of smoke inhalation. The Signal Protocol, designed by Open Whisper Systems, is the basis for WhatsApp's end-to-end encryption. This end-to-end encryption protocol is designed to prevent third parties and WhatsApp from having plaintext access to messages or calls. What's more, even if encryption keys from a user's device are ever physically compromised, they cannot be used to go back in time to decrypt previously transmitted messages.

A random selection of 300 cases was analysed to determine the mean number of interactions and the time required to

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