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# Urban Telemedicine: The Applicability of Teleburns in the Rehabilitative Phase

**Yuk Ming Liu, MD, MPH**[*], **Katie Mathews, BA**[*,†], **Andrew Vardanian, MD**[*], **Taylan Bozkurt, MBA**[*], **Jeffrey C. Schneider, MD**[†], **Jaye Hefner, MD**[†], **John T. Schulz, MD, PhD**[*], **Shawn P. Fagan, MD**[‡], **Jeremy Goverman, MD**[*]

[*]Department of Surgery, Massachusetts General Hospital, Sumner Redstone Burn Center, Boston;

[†]Spaulding Rehabilitation Hospital, Charlestown, Massachusetts;

[‡]Still Burn Center, Augusta, Georgia.

## Abstract

Telemedicine has been successfully used in many areas of medicine, including triage and evaluation of the acute burn patient. The utility of telemedicine during the rehabilitative phase of burn care has yet to be evaluated; therefore, we expanded our telemedicine program to link our burn center with a rehabilitation facility. The goal of this project was to demonstrate cost–effective improvements in the transition and quality of care. A retrospective review was performed on all patients enrolled in our telemedicine/rehabilitation program between March 2013 and March 2014. Data collected included total number of encounters, visits, type of visit, physician time, and readmissions. Transportation costs were based on local ambulance rates between the two facilities. The impact of telemedicine was evaluated with respect to the time saved for the physician, burn center, and burn clinic, as well as rehabilitative days saved. A patient satisfaction survey was also administered. A total of 29 patients participated in 73 virtual visits through the telemedicine project. Virtual visits included new consults, preoperative evaluations, and postoperative follow-ups. A total of 146 ambulance transports were averted during the study period, totaling $101,110. Virtual visits saved 6.8 outpatient burn clinic days, or 73 clinic appointments of 30-min duration. The ability to perform more outpatient surgery resulted in 80 inpatient bed days saved at the burn hospital. The rehabilitation hospital saved an average of 2 to 3 patient days secondary to unnecessary travel. Satisfaction surveys demonstrated patient satisfaction with the encounters, primarily related to time saved. The decrease in travel time for the patient from the rehabilitation hospital to outpatient burn clinic improved adherence to the rehabilitation care plan and resulted in increased throughput at the rehabilitation facility. Videoconferencing between a burn center and rehabilitation hospital streamlined patient care and reduced health care costs, while maintaining quality of care and patient satisfaction. This program has improved inpatient burn rehabilitation by maximizing time spent in therapy and avoiding unnecessary patient travel to offsite appointments.

Address correspondence to Jeremy Goverman, MD, Department of Surgery, Massachusetts General Hospital, Sumner Redstone Burn Center, Boston, Massachusetts. jgoverman@partners.org.

Telemedicine is defined as the use of information technology to deliver health care at a distance. Historically, the telephone was the earliest example of telemedicine. The ability to store digital images that could later be retrieved from a remote location led to the early days of teleradiology. Electronic mail, electronic medical records, and the internet have been crucial in the evolution of telemedicine. Real-time conferencing via videocamera and webcamera devices are becoming widely used between patients and practitioners to facilitate and enhance communications. Telemedicine has now been incorporated into many settings, such as radiology, neurology, cardiology, diabetes, critical care, and trauma.[1–9] The utility of telemedicine is further expanding in many other arenas of medicine, including burn care.[10–12]

The benefits of telemedicine have been discussed and evaluated by various fields of health care and these characteristics include improved access to information, improved access to limited resources and services, improved delivery of care, and reduced health care costs. Saffle et al.[11] have shown the impact and potential benefits of telemedicine on the care of acute burn patients. They reported improvements in the triage of acute burns using telemedicine, which resulted in enhanced resource utilization. Reiband et al.[13] also drew similar conclusions regarding the utility of telemedicine in their retrospective review of burn referrals and the benefit of reducing undue referrals which they termed as overtriage. The importance of these findings is underscored when one considers the 30% decrease in the number of verified burn centers during the past 50 years.[14] The inherent effect is that each burn center now has a larger referral region and therefore a larger patient load which, in turn, affects capacity and resource funding. Furthermore, advances in acute burn care have resulted in decreased mortality from burns and a shift toward the treatment and prevention of burn-related morbidity. This has led to an increased need for highly specialized rehabilitation services. The same conclusion can be made with regard to post burn care, the availability of resources for rehabilitation, and the resources required of both patients and caregivers, which includes travel time and travel costs.

Traditionally telemedicine has been utilized and evaluated as a way to facilitate and enable specialized medical services for those in rural and/or remote regions.[7,9–11,15] In this project, we utilized telemedicine in an urban setting between a burn center and rehabilitation hospital, but with similar implications—given the intense rehabilitation program in which our patients participate on a daily basis on discharge to inpatient rehabilitation. The utility of telemedicine during the rehabilitative phase of burn care management has not been previously studied. At our ABA-verified burn center, the majority of large burn survivors requiring inpatient rehabilitation are discharged to a nearby comprehensive, multispecialty, rehabilitation hospital. As a result of a hospital network-wide initiative to facilitate referral management for community providers and patients, and a department-wide quality initiative to reduce unplanned readmissions, a collaborative program was initiated between our burn center and the rehabilitation hospital. Initially, this required the burn surgeon to travel to the rehabilitation hospital for weekly rounds. Soon thereafter, in an effort to improve efficiency for the practitioners, and as an extension of a hospital-wide telehealth initiative, in-person physician rounding was replaced by virtual real-time patient rounds via synchronous video. The goals of this partnership remained unchanged: to facilitate a seamless transition between the acute and rehabilitative phase of burn care, to improve the overall quality of care and

patient experience, to reduce unplanned readmissions, and to lower global costs. We report our initial experience with video-conferencing between an ABA-verified burn center and a nearby urban rehabilitation hospital.

## METHODS

An IRB-approved retrospective review was performed on all patients enrolled in the telemedicine/rehabilitation program between March 2013 and March 2014. All patients transferred to the rehabilitation hospital were given the option of utilizing the telemedicine service or traveling back to the acute burn hospital outpatient clinic for their follow-up care. Written consent was obtained from patients involved in all telehealth encounters. All telemedicine visits were performed consecutively on one day a week and at the same time each week. At the acute hospital, telemedicine visits involved a burn surgeon, the burn clinic practice manager, and a surgical administrator. At the rehabilitation hospital, the telemedicine visit included the telehealth computer engineer, a nurse that was specifically assigned to perform all telemedicine visits, an occupational therapist, and a wound care nurse. The weekly schedule and consultation times were established with a specific outline that included a preround huddle, patient evaluation, debriefing, and quality evaluation with a patient satisfaction questionnaire. The preround huddle was used to identify scheduling, staffing, or equipment issues before starting the telemedicine session with the patient. Each patient encounter typically lasted between 10 and 20 min. The wound care nurse, or occasionally the nurse practitioner, would perform all dressing changes or primary bolster removal. At the conclusion of all telemedicine visits for a specific day, the telemedicine nurse from the rehabilitation hospital would send an email to all involved practitioners, including the attending rehabilitation physicians. The email would summarize the visit and include the assessment and plan.

Each facility purchased and maintained its own telemedicine equipment. The burn surgeons' office computers were equipped with ClearOne Chat® 50 Personal USB Conference Phones ($90.00) and Logitech® HD Pro Webcam C920 ($80.00). The rehabilitation hospital team outfitted a Rubbermaid® Telemedicine Video Cart with a VidyoRoom™ HD50 Hardware Codec, a Sony® EVI-HD7V 1080p Pan/Tilt/Zoom Camera and Yamaha® PJP-20UR USB Conference Speakerphone ($15,000.00 for entire cart). The Video Cart connected wirelessly through a Cisco Aironet 1142 Access Point that linked to the burn clinic (hospital) secure network, which is HIPAA-compliant, protected by firewalls, and maintained by hospital information systems. The rehabilitation hospital typically performed all visits in one room which was dedicated, weekly, for telemedicine. Patients were transported from their rehabilitation beds to this room by the nurse or occupational therapist. Infrequently, the cart would be wheeled into the patient's room, and the visit would be performed at bedside.

Data collected included total number of encounters, type of visit, physician time, and readmissions. Transportation costs were calculated based on local ambulance rates between the two facilities. With each telehealth encounter, patient surveys were distributed to document satisfaction assessment of the visit. The impact of telemedicine was evaluated with respect to the time saved for the physician, burn center, burn clinic, and rehabilitation hospital.

## RESULTS

During the study period, all patients chose to use the telemedicine service for follow-up care, rather than being transported back to the acute burn hospital outpatient clinic. Telemedicine visits lasted an average of 10 to 20 min, with approximately 10 min of preround huddle before starting the day, and 10 min of debriefing time on completion of all visits for that day. A total of 29 patients participated in 73 virtual post burn weekly follow-up visits through the telemedicine project. Visits were calculated to be the equivalent of saving 6.8 burn clinic days, or 73 clinic appointments of 30-min duration. Sixteen same-day surgeries were scheduled at the time of the virtual visits. Previously, due to the complexity of the patients and the size of the grafts, each of these surgeries would have resulted in a 5-day-inpatient hospital stay (until the time of primary dressing removal). With the telemedicine program and closer relations with the rehabilitation hospital, however, burn surgeons felt more comfortable discharging these patients directly back to the rehabilitation hospital and performing the primary dressing removal via telemedicine. Ultimately this resulted in approximately 80 bed days gained at the burn hospital, many of these occurring at times when the hospital was at 100% capacity.

At the rehabilitation hospital, 146 ambulance transports were averted during the study period, resulting in a cost savings of $101,110. In addition, assuming a weekly 3-hour visit to the burn center, which includes travel and prep time on both ends, the rehabilitation hospital saved an average of 2 to 3 days per hospital admission secondary to unnecessary travel and improved throughput. Throughout the study period, the rehabilitation hospital estimated an average of three rehab days saved per patient, totaling 87 bed days gained. During the study period, there were no unplanned acute transfers to the emergency department and no unplanned readmissions to the burn hospital.

Satisfaction surveys were completed by all patients after each televisit with a 100% response rate. Surveys demonstrated patients to be satisfied with the encounters (Table 1). Examples of patient comments on the satisfaction surveys include the following:

“Instead of needing a whole day of transport back to the burn hospital to see my doctor, the virtual visit took 20 min;” and “the convenience of being able to stay at the rehabilitation hospital and still be in contact with my burn doctors was huge.” In addition, one of the features of the telemedicine software allows for the provider to share their screen with the patient, ie, the patient and rehabilitation hospital can see the same view as the burn surgeon. This allows patients to view their own wounds/grafts/scars close up and in high definition, regardless of their location. It was not uncommon for patients to remark on the usefulness of this feature. Comments included: “Now I’m able to look at my injury and talk to the doctor at the same time;” and “for the first time, I wasn’t a bystander in my care and I was actually able to see my wounds.”

## DISCUSSION

The next level in the evolution of telemedicine and telehealth programming is recognizing its impact in “our own backyard,” from a more locoregional approach. The rehabilitative

phase of burn care can be equally as intensive and as highly specialized as the acute care period. The burn patient's post hospital care requires a continuation of the multidisciplinary efforts, which include the burn surgeon, occupational and/or physical therapist, nursing/wound care, nutritionist, psychologist/psychiatrist, social worker, and others. This prolonged care necessitates numerous clinic visits for evaluation of wounds with respect to healing, contractures, pigmentation, and psychosocial factors that include return to work, school, and the community. For patients with large burns, this period can last for several months to years. Missed outpatient clinic sessions can create a domino effect in which a wound that was previously considered worrisome could require skin grafting, subsequent immobilization, and thereby prolong the rehabilitation phase of therapy, scar treatment, and ultimately reintegration into society.

This experience with our local, urban, rehabilitation hospital demonstrates the utility of telemedicine during the rehabilitation phase of burn care. We also found that the telehealth program has greatly strengthened and enhanced our relationship between the acute burn care team and the rehabilitation team. Our typical telemedicine session brings together more than the patient and the burn surgeon as is typical in the clinic setting; the patient's nurse and therapist are also present for the session, and each session includes the entire team with the patient playing an active role in the evaluation.

The use of telemedicine between the rehabilitation hospital and the acute burn center opens a direct line of communication between the two hospitals and involves more of the care team in this communication. This has created an environment in which members of the care team are more likely to call each other with questions concerning the patient. In addition, with both nurses and therapists present for the televisits, both are more inclined to ask questions and discuss progress or lack thereof with the burn surgeons. This increase in discussion leads to improved professional education.

In the current model, the travel distance between hospitals of just greater than two miles may appear insignificant. However, many positives were gained from this Teleburns program. Not only were there cost savings with the decrease in ambulance use but also by decreasing the travel time for the patient from the rehabilitation hospital to the outpatient burn clinic, adherence to the rehabilitation care plan improved and the effectiveness of the time spent in therapy was maximized. Time was saved for both patients and providers, allowing for greater efficiency at both healthcare locations. Throughput at both locations also improved, allowing for open beds when they were needed.

While telemedicine has the ability to improve patient throughput, it requires an appropriate initiation strategy to realize this time saving potential. Before the start of this pilot study, a number of tactics were specifically employed to reduce downtime and maximize efficiency. First, we chose a single day and time of the week for which we dedicated to these televisits. We performed all visits in the same dedicated physical space each week, such that the patients were transported to the telemedicine room before the visit and we did not typically have to move the telemedicine cart from room to room. We also attempted to have all dressings removed before the visit, such that wounds could be evaluated quickly. Redressing of wounds was performed back in the patients' room and after the telemedicine visit.

Similarly we chose a dedicated, consistent team at the rehabilitation hospital to perform all visits which afforded easier communication and the development of trust between the burn team and the rehabilitation team over time.

Limitations to this study include the small sample size as well as the fact that the satisfaction survey utilized was not previously validated. While much of the telemedicine literature examining patient satisfaction suffers from this problem,[16] future studies will require a questionnaire that has been validated and is specific for use in burn telemedicine. Currently no such surveys exist. Additional limitations included a few logistical issues that existed with using the camera to look at certain body parts, as video quality is still not as high as that of still photos; however, with telemedicine on the rise and technology constantly improving, the quality and experience will only get better. On occasion, we would request a still photograph of a specific area in question. The photo would be securely emailed to the burn provider and could often be reviewed during the televisit such that real-time feedback could be given to the rehabilitation providers and patient.

## CONCLUSIONS

Videoconferencing between a burn center and rehabilitation hospital streamlined patient care and reduced health care costs, while maintaining quality of care and patient satisfaction.

This program has changed the paradigm of traditional inpatient burn rehabilitation by maximizing the time spent in therapy and avoiding unnecessary patient travel to offsite appointments.

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**Table 1.**

Patient satisfaction questionairre

| As it Relates to This Visit | Agree | Neutral | Disagree | Strongly Disagree | Do not Know |
|---|---|---|---|---|---|
| I could HEAR the specialist clearly | 100% | 0% | 0% | 0% | 0% |
| I could SEE the specialist clearly | 100% | 0% | 0% | 0% | 0% |
| I could ASK the specialist questions | 100% | 0% | 0% | 0% | 0% |
| I felt I could DISCUSS a problem | 100% | 0% | 0% | 0% | 0% |
| I was WORRIED others were listening | 5% | 0% | 70% | 24% | 0% |
| The specialist ASKED me questions | 97% | 3% | 0% | 0% | 0% |
| The specialist EXPLAINED what to expect with my problem | 97% | 3% | 0% | 0% | 0% |
| The specialist spent enough TIME with me | 100% | 0% | 0% | 0% | 0% |
| I felt comfortable with the TV camera | 100% | 0% | 0% | 0% | 0% |
| I was confident that my condition could be sorted out via videoconference | 95% | 5% | 0% | 0% | 0% |
| Compared with Seeing a Specialist in Person | Easier | Agree | Same | Difficult | More Difficult |
| …talking to a specialist on TV was | 32% | 32% | 68% | 0% | 0% |
| …asking the specialist questions on TV was | 27% | 27% | 73% | 0% | 0% |
| …this visit was as good as a face-to-face visit | 73% | 69% | 14% | 11% | 3% |