Editorial Commentary

Telemedicine for infectious disease care—how do we measure the true value?

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Telemedicine technologies are increasingly being used to deliver healthcare services because of their potential to eliminate distance barriers and improve access to care. Additionally, telemedicine has led to the improved clinical outcomes and cost-savings as demonstrated by multiple studies in different disease populations (1-4). Findings from these studies include reduction in hospitalizations and use of other acute healthcare services, as well as improvement in the quality of life, clinical outcomes and patient satisfaction particularly in patients with chronic diseases (1-4).

Further, the potential of telemedicine in addressing the needs of patients with acute infectious diseases (ID) such as hepatitis C virus (HCV), human immunodeficiency virus (HIV), and tuberculosis has been well described in the literature (5-8). Telemedicine consults effectively bridge the gap between patients in remote areas and ID specialists' who typically practice in large academic medical centers. Implementing telemedicine to provide care to patients with mild to moderate infections has been shown to improve clinical outcomes and reduce health care costs (6,7). In addition, telemedicine can also facilitate continuing medical education for several providers working in remote areas (7,8).

Previously published studies by Eron *et al.* and Assimacopoulos *et al.* have demonstrated both a decrease in length of hospital stay and antibiotic therapy in patients with ID (4,5). Other studies have proven that telemedicine consults are equivalent to in-person consultations in terms of quality of care provided to patients with ID (5,6). This study conducted by Monkowski *et al.* is a retrospective analysis of patients who have undergone inpatient ID consultation using real-time interactive telemedicine assessment. The findings of this study add to the existing literature on the clinical and cost effectiveness of telemedicine for ID.

Researchers evaluating the effect of telemedicine technologies for ID management should better define and weigh the pros and cons of telemedicine. While most studies focus on the clinical and cost-related value, there are several other metrics to consider while evaluating digital health interventions (9). Some of these relevant to evaluating telemedicine for ID consultations and management are described below:

(I) Operational and technical feasibility. This includes an assessment of additional resources required to implement the technology (e.g., additional time, financial support, personnel support), suitability for everyday use as part of the clinical workflow and assessment of any additional burden on care team to use the technology;

(II) Acceptability. Acceptability of the technology should be evaluated through extensive user feedback on various aspects of the technology (e.g., complexity or ease of use, mode of delivery, and credibility), users' intention to use, perceived barriers and facilitators for uptake of technology in regular clinical practice;

(III) User satisfaction. This includes gathering feedback on the overall satisfaction from using telemedicine

technology. This includes feedback from all users and those that may directly or indirectly benefit from the technology including the clinicians, patients and other support staff;

(IV) Clinical and patient-reported outcomes. These outcomes may be specific to the therapeutic area in focus and should be compared with the gold standard treatments impact of an intervention.

Furthermore, this type of quasi-experimental study design has several limitations. Monkowski *et al.* rightly note the heterogeneity in the study population as one of the limitations. The lack of randomization makes it difficult to control for important confounding variables (severity and type of infections, knowledge, and experience of the technology users, changes in clinical workflow or hospital policy) that may have varied in the pre-intervention and post-intervention periods. It is also unclear if the patients in the TeleID group received any auxiliary interventions or treatments that may have contributed to improved outcomes in this group. Researchers looking for alternatives to the more expensive randomized controlled trials should explore other robust quasi-experimental designs to evaluate telemedicine technologies. The interrupted time-series (ITS) design is one such quasi-experimental design that requires a continuous sequence of observations in a population, taken repeatedly at equal intervals over time (10). This type of design can help researchers control better for confounding and regression to the mean that may wrongly attribute improvements to the intervention when the improvements were in fact due to chance (10). After careful consideration of resources available, researchers must make every effort to use the most effective study design to establish the true value of a telemedicine intervention.

The wave of telemedicine will continue to rise in the field of ID. The dearth of specialists especially in remote areas, the shift from volume-based to value-based care, and the current reimbursement models will push the health care community to adopt telemedicine for ID consultations and management (6). However, successful and sustainable integration of telemedicine in clinical settings largely depends on the periodic evaluation of these technologies using robust study designs and measuring the true value of a technology through an appropriate outcomes framework.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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