**Abstract to HFES Health Care Symposium 2020**

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**Proposal Title**: Developing a Framework for Telehealth Integration into Clinical Workflow

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**SUMMARY (up to 1,200 words):**

The practical and resource-efficient management of patients with chronic conditions has become a significant challenge in the United States.1 The management of chronically ill patients is more challenging on rural underserved communities, where limitations in infrastructure, resources, and access to trained healthcare professionals lead to barriers in healthcare access. Telehealth, a type of health information technology (HIT), has received special attention in the recent years for improving access to health care,2 and for supporting integrated care for chronic diseases by providing patient education and information transfer between patients and providers.3 Despite the demonstrated benefits of telehealth in the last decade, patients in rural underserved communities have shown lower adoption rates relative to the urban population.4 Survey studies soliciting healthcare providers’ perspectives about telehealth have identified that a significant barrier to buy-in and adoption of telehealth technologies is related to concerns regarding the integration of telehealth technologies into established workflow due to the potential impact in the clinical work.5,6 Therefore, understanding the impact of telehealth systems in clinical settings is vital since its integration can causes changes in health providers’ workflow. As we move towards the development of more efficient and scalable telehealth systems, it is essential to design telehealth systems that are efficiently integrated into healthcare providers’ workflow. Despite the growth of telehealth, few research efforts have been published regarding this issue.

To address this gap, this study applied a multi-project and mixed-methods approach with the following research objectives: (1) explore the reasons for low adoption and underutilization of telehealth platforms in clinical settings, (2) collect healthcare providers’ perspectives about challenges and barriers for telehealth to transform healthcare access and the impact on clinical workflow, and (3) understand the set of constraints that lead to inefficiencies and disruptions that may be imposed on the healthcare providers’ workflow by the integration of telehealth systems. Three separate projects aligned with the research objectives were held with the end objective of integrating the main findings towards the development of a framework for telehealth integration into clinical workflow. Aligned with objective (1), the first research project explored why live-video telemedicine platforms, a type of telehealth system, are underutilized in clinical settings. The study was conducted in the context of telemedicine in surgical specialties and what is necessary for broader postoperative utilization. A user-focused study was conducted in the Department of Surgery of an important healthcare system in Texas. The study is an exploratory, descriptive study based on data collected from a series of brief interviews with surgeons, the use of the Technology Readiness Index (TRI) as a pre-exposure survey, a mock patient interaction via telemedicine, and post-interaction survey using Van der Laan’s Technology Acceptance Questionnaire (TAQ), System Usability Scale (SUS), and Technology Acceptance Model (TAM), in addition to a brief post-exposure interview. The second research project, aligned with objective (2), involved the administration of a survey instrument designed to understand healthcare providers’ familiarity with remote patient monitoring (RPM) systems, a modality of telehealth, and to collect their perspectives about barriers and facilitators for telehealth to transform healthcare access in underserved communities. This survey-based and interview-based study elicited healthcare providers’ perspectives regarding their knowledge about the use of RPM to manage chronic diseases, ease of adoption and workflow disruption, the relationship between patients and physicians, costs and financial benefits, and relevant aspects to consider when developing protocols for the integration of RPM into clinical workflow. The third project, aligned with objective (3), involved visits to clinics located in underserved communities in south Texas that have adopted an RPM platform, to understand the context in which the system was being integrated and used by the healthcare providers. The study consisted of observation of clinic workflow, in addition to semi-structured interviews with physicians, medical assistants, and medical staff who directly or indirectly interact with the RPM system.

Results from the three research projects provided us a better understanding of healthcare providers’ perceptions about the challenges and barriers to the widespread integration of telehealth systems into clinical workflow. Findings from each project have been integrated towards the development of a framework for telehealth integration into clinical workflow. This framework based on literature and the data collected from the research projects provides a set of components, from the healthcare provider standpoint, that must be considered to achieve a successful integration of a telehealth system in a healthcare setting. The framework was developed to serve as a guide for clinics, hospitals, and other healthcare settings regarding the components that must be considered when developing and implementing a telehealth system and the relationship between those components. The resulting framework was divided into three main stages: (1) System Preparation, (2) Patient Enrollment, and (3) System Operationalization. The first stage, System Preparation, includes a set of components that must be in place to define the workflow for the telehealth encounters, such as the human and technological resources needed, the definition and sequence of the tasks, the decision-making hierarchy, and training and schedule considerations, among other components. The second stage, Patient Enrollment, includes components regarding the identification of the pool of patients eligible for telehealth enrollment, the regulations, and policies that govern their eligibility, and the definition of the internal enrollment procedures within the healthcare setting. The third and last stage, System Operationalization, includes components of data communication and representation, usability and integration, timing and frequency, and billing and reimbursement, among other components that must be defined for an efficient operationalization of a telehealth system. The connection between components within and across the three stages of the framework shows the complexity of the integration of telehealth systems into clinical workflow. This framework achieves the objective of providing a “big picture” showing the relevant components that must be considered and the interaction between those components. Despite the publication of models that includes aspects of the implementation of HIT into complex healthcare systems,7 to the best of our knowledge, this is one of the first efforts in establishing a framework in the context of the integration of telehealth systems into clinicians’ work.

**REFERENCES**

1. Paré G, Jaana M, Sicotte C. Systematic review of home telemonitoring for chronic diseases: the evidence base. *J Am Med Inform Assoc* 2007; 14: 269–277.

2. Hjelm NM. Benefits and drawbacks of telemedicine. *J Telemed Telecare* 2005; 11: 60–70.

3. Wootton R. Twenty years of telemedicine in chronic disease management – an evidence synthesis. *J Telemed Telecare* 2012; 18: 211–220.

4. Park J, Erikson C, Han X, et al. Are State Telehealth Policies Associated With The Use Of Telehealth Services Among Underserved Populations? *Health Affairs* 2018; 37: 2060–2068.

5. Koopman RJ, Wakefield BJ, Johanning JL, et al. Implementing home blood glucose and blood pressure telemonitoring in primary care practices for patients with diabetes: lessons learned. *Telemed J E Health* 2014; 20: 253–260.

6. Uscher-Pines L, Kahn JM. Barriers and Facilitators to Pediatric Emergency Telemedicine in the United States. *Telemed J E Health* 2014; 20: 990–996.

7. Sittig DF, Singh H. A New Socio-technical Model for Studying Health Information Technology in Complex Adaptive Healthcare Systems. In: Patel VL, Kannampallil TG, Kaufman DR (eds) *Cognitive Informatics for Biomedicine: Human Computer Interaction in Healthcare*. Cham: Springer International Publishing, pp. 59–80.

**KNOWLEDGE ADVANCEMENT & TARGET AUDIENCE (up to 800 words):**

Previous research work in this topic has provided a general understanding of telemedicine integration, providing insights about the challenges and barriers to telehealth adoption and telehealth integration into clinical workflow. The qualitative and mixed methods research findings of the challenges and barriers, such as disruption and inefficiencies in the integration of telehealth, are descriptive and informative. However, once the critical actual or potential challenges and contributors to disruption and inefficiencies are identified, there is a need to assess how to lead improvements in the efforts to achieve a more efficient integration of telehealth into clinical workflow. Achieving that requires the translation of those identified challenges and contributors to define a set of components that must be present to overcome and address those issues and achieve effective integration of the telehealth systems in healthcare providers’ work. Contributions in this area will be a step forward towards improving the acceptability, trust, and integration of a technology that seems to continue shifting healthcare delivery from hospitals or clinics into the patients’ home, becoming a vital component of the future of healthcare delivery.

This multi-project, mixed-methods research study has been conducted to develop a framework for the integration of telehealth into clinical workflow. This framework provides a "big picture" of the main components that must be considered to guide an efficient integration of telehealth into healthcare providers’ work. After the presentation of this framework, the audience will be able to: (1) describe challenges and barriers for telehealth adoption and integration into clinical workflow, (2) contrast different stages in the integration of telehealth into clinical workflow (3) list relevant components within the different stages in the integration of telehealth into clinical workflow, and (4) describe the relationship between the components within and across the three main stages in the integration of telehealth into clinical workflow.

Results from this research study will be of interest to the HFE research community working in macro ergonomics and systems engineering in health care, specifically to the research community interested in telehealth and technology integration. Additionally, this lecture will appeal to healthcare professionals (i.e. physicians, nurses, and medical staff, among others) interested in telehealth systems and the current challenges in this area. Results from this research study will motivate a discussion in the human factors and ergonomics in the healthcare community regarding the next step towards incorporating the developed framework to guide the integration of telehealth systems in healthcare settings in the United States. Additionally, new ideas and approaches to enhance the integration of telehealth technologies in healthcare providers’ work may result.