Executive Summary

The Empirical Foundations of Telemedicine Interventions for Chronic Disease Management

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Key words: Telemedicine, Telehealth, Telemonitoring, Chronic Disease, Telestroke, Telepulmonology,

Accepted for publication in Telemedicine and eHealth

Concern with issues of inequitable access, uneven distribution of quality, and cost inflation in healthcare has long historical roots. Yet, the various policies and programs aimed at redressing them since the beginning of the 20th Century have met with limited success, as manifest in their continuity and, in some instances, exacerbation. While there is no consensus on the most effective approaches to address these problems, there is universal agreement regarding their serious implications for the health, wellbeing and productivity of large segments of the population, as well as the threat to the public purse.

Advanced applications in information and communication technology in health care (referred to here as telemedicine) were developed and tested with an eye to improve healthcare access and quality while attempting to contain cost inflation. This technology has opened new vistas in connectivity, clinical and shared decision making, system integration, patient empowerment, as well as organizational and operational efficiency. Indeed, the need for the wider deployment of telemedicine systems (also referred to as telehealth, ehealth, mhealth and connected health) stems from a large and ever expanding body of empirical evidence, which attests to their merit in addressing the issues of healthcare access, quality and cost. This is particularly notable in the case of chronic diseases which are leading causes of death, illness, disability, and diminished quality of life. Together they also comprise the largest contributor to healthcare costs. It is estimated that over 50% of all adults have at least one chronic illness. Importantly, these diseases are amenable to telemedicine intervention.

A careful review of the published literature on telemedicine management of three chronic diseases (congestive heart failure, stroke and chronic obstructive pulmonary disease) reveals inconsistencies in methodologies employed and variations in outcomes measured. We tried to reduce such variations by selecting only randomized clinical trials (RCT) or designs approximating an RCT and a minimal sample of 150 cases (with few exceptions that are noted). A separate section is devoted to cost studies. Because the studies did not use a standard methodological protocol, their respective findings and conclusions must be viewed from the perspective of the design features that were employed, including research design, sample size, and the specific attributes of the intervention itself, such as technological configuration, provider mix, patient mix, program content, frequency and duration of the intervention. There were also variations in the measures of outcome. Findings are presented in terms of the reported empirical evidence on health outcomes, use of service, and cost.

Findings related to health outcomes: Among CHF patients, telemonitoring was significantly associated with reductions in mortality ranging from 15% to 56% compared to patients undergoing "usual" care. In only one study was mortality higher among the telemonitoring group. However, this exception may be accounted for by the fact that the study population was composed of very elderly and severely sick patient population and other methodological issues. Conclusions from several studies indicate: "noticeable change (improvement) in health outcomes"; "fewer episodes of health worsening"; "improved quality of life"; and "general improvement in clinical, functional, and quality of life status". In two studies, no significant differences were observed between the intervention and control groups in terms of mortality and morbidity. Telemonitoring offers lesser benefits for elderly patients with multiple health problems, especially when those in "usual care" have ready access to appropriate care.

Telestroke provides an inherent advantage for stroke patients who do not have ready access to stroke specialists. Prompt diagnosis, initiation of treatment, supervision and referral (when indicated) are critical for a successful outcome, given a potentially debilitating, if not fatal, disease. Except for the telephone-only intervention (with poor sensitivity as compared to video), the various modalities of telestroke have been demonstrated to reduce mortality in the range of 25% during the first year after the event.

Only three COPD studies measured mortality outcomes. Two RCT studies reported neutral findings, but one of these studies followed patients for only one week. An observational study found "some positive benefits vis-à-vis COPD mortality" 2 months after discharge from the hospital. Likely positive effects of telepulmonology include fewer exacerbations in the disease, and improvements in quality of life and exercise capacity.

Findings related to use of service. The majority of studies of telemonitoring for all three chronic diseases reported lower hospital admissions and readmissions, length of stay, and emergency department visits. There were notable exceptions, but in those instances the effects of telemonitoring were neutral. One study found telepulmonology to result in cost shifting in the outpatient setting, i.e., a decrease in demand for pulmonologists and an increase in demand for nurses.

Findings related to cost. The economic effects of telemonitoring have been measured or examined in two ways: (1) changes in rates or volumes of hospital admissions, readmissions, length of stay and/or emergency department visits; and (2) cost-benefit analysis (CBA) and cost-effectiveness analysis (CEA) of telemonitoring in terms of specified outcomes. In both instances

and with few exceptions, the evidence supports the economic benefits of telemonitoring as compared to usual care among patients with CHF, stroke and COPD.

Conclusions. There is an ever growing and complex body of empirical evidence that attests to the potential of telemedicine for addressing problems of access to care, quality of care, and health care costs in the management of the three chronic diseases chosen for this review. Despite some inconsistencies in methodologies, the preponderance of the evidence produced by telemonitoring studies points to significant trends in reducing hospitalization and emergency department visits, preventing and/or limiting illness severity and episodes resulting in improved health outcomes. It is hoped that this evidence would be useful for policymakers, researchers, program developers, provider, payers and the public at large.

Acknowledgement: The Alliance for Connected Care provided partial support for the work leading to this publication in the form of an unrestricted grant.