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Editorial

Remote monitoring of heart failure patients: To change by observation[☆]



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The concept that an object can be changed simply by the tools necessary to observe the object was described by Nobel Prize laureate Paul Dirac in *The Principles of Quantum Mechanics* [1]. Much like atoms and subatomic particles, outcomes in patients who are being carefully monitored may have different outcomes than those not as carefully observed. The field of remote monitoring (RM) of patients with heart failure arose from the theory that healthcare teams can improve the quality of care delivered to a patient regardless of their physical location in proximity to the healthcare system.

In this issue of American Heart Journal Plus: Cardiology Research and Practice, Dr. Johnson and colleagues present their intriguing report on outcomes in patients with heart failure enrolled in a remote monitoring program [2]. Patients were included in the RM program if they were admitted within 14 days with a heart failure hospitalization and met the program's rigorous inclusion criteria.

The results of this analysis found that patients in the RM group were significantly more likely to be admitted but less likely to die from any causes. This difference between groups seems particularly impressive in those who were identified as being low to medium risk of readmission. Due to the retrospective, observational nature of the study design results of the study should be primarily hypothesis generating. However, given the rigorous propensity matching performed and the discrepancy between hospitalization and mortality this study provides a unique insight into management of the heart failure patient after discharge. When averaged over an 18-month period 139 alerts were generated per patient who received RM. Each alert would then trigger an interaction with the healthcare team. This frequent focused interaction may have played a key role in why patients were admitted to the hospital at a higher rate but also could have played a role in the decrease in mortality.

Early efforts at RM of heart failure patients were primarily based on telephone-based strategies, relying on patient reported symptoms, with limited biometric input such as daily weights [3]. Meta-analysis of the

early smaller trials suggested an improvement in all-cause mortality and heart failure hospitalizations [4]. Larger randomised controlled trials such as the Tele-HF trial did not find a clear beneficial impact of RM on patients [5,6].

As the technology for remote monitoring and internet capabilities have evolved, RM technologies that incorporated greater degree of biometric data to aid in clinical decision making has been evaluated in several smaller trials which meta-analysis in 2015 suggested again there might be a benefit to all-cause mortality and heart failure hospitalizations, but not in terms of all cause hospitalizations [7]. The TIM-HF2 trial evaluated a more modern method of RM in patients with heart failure with a more robust degree of biometric data (pulse rate, blood pressure, weight, heart rhythm analysis, and oxygen saturation) as well as a health questionnaire delivered by electronic tablet [8]. This study found a significant improvement in the primary outcome of days lost due to unplanned cardiovascular admission or death from any cause, which was primarily driven by a decrease in mortality. The REVeAL-HF trial data was recently presented at the AHA 2021 meeting, which evaluated the role of an electronically generated alert sent to treating clinicians regarding a patient's risk of one year mortality on treatment decisions and outcomes [15]. Preliminary results found no significant difference in outcomes with this novel alert system, however this trial may provide unique insight to the role of electronic decision support in heart failure patients.

As initially demonstrated in the CHAMPION trial, RM strategies with invasive hemodynamic monitoring with the CardioMEMS (Abbot) sensor seems to be an effective method to reduce heart failure hospitalization for patients with NYHA class III symptoms and a hospitalization for heart failure within a year [9]. The recent GUIDE-HF trial aimed to determine if patients with higher or lower degree of heart failure symptoms and those with elevated natriuretic peptides without a recent heart failure admission would also benefit [10]. In this patient

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population invasive hemodynamic monitoring did not meet the primary endpoint of combined all-cause mortality, heart failure hospitalization or urgent heart failure visits. It should be noted that the authors found a significant impact on trial outcomes related to the COVID-19 pandemic, leading to uncertainty in the interpretation of the results.

The perfect modality of RM has not yet been identified by clinical trials. As technology has evolved it seems as though more data (biometrics, patient perceptions and in certain cases hemodynamics) provides the health care team with better tools to best assess and treat patients with heart failure. Does more data equate to better care? Certainly, at some point the burden on the patient or healthcare team to obtain and assess frequent measurements could become burdensome and become detrimental. Even in the setting of larger clinical trials a significant number of patients who are assigned RM do not always continue to engage in the program [6]. The importance of adherence to RM therapies is much like what is seen with other remote therapies such as the Life Vest (Zoll). The VEST trial failed to meet the primary endpoint of the study 90-day cardiac death or death from ventricular tachyarrhythmia with the Life Vest when compared to usual care [11]. In the study participants wore the device for an average of only 14 h per day, with some patients (2.8%) that never wore the device at all. Interestingly there may be an opportunity to maximize the use of therapies such as the life vest when active efforts are made to encourage use and troubleshoot issues [12]. Much like the Life Vest, RM cannot provide useful input to the clinical team if never or infrequently used, therefore patient selection and appropriate counseling becomes key if a therapy is going to have an impact on outcomes.

It is currently unclear what the most important endpoints should be to provide the highest quality of care to heart failure patients. Certainly, improvements in mortality are imperative, but do we provide lower quality of care when an increase in heart failure hospitalization is coupled with a decrease in mortality?

The authors make excellent points in regards to the quality of care that is delivered to heart failure patients in the United States. In 2010, the Hospital Readmission Reduction Program (HRRP) was implemented by the Centers for Medicare and Medicaid Services with the goal of reducing rehospitalization for acute myocardial infarction, pneumonia, and heart failure [13]. After the HRRP a rise in heart failure mortality over subsequent years was appreciated by evaluating the American Heart Association Get with the Guidelines – Heart failure registry, although a cause and effect relationship has not been established [14]. This has led some to question if the financial penalties imposed by HRRP promote treatment strategies that prioritize readmission reduction over quality of care.

New technologies for optimizing patient care is perpetually in development and all available technologies have limits. To determine which technologies benefit our patients further clinical trials are needed. Dr. Johnson and colleagues presented unique data that leads us to question not only how do we provide the highest quality care, but perhaps more importantly, what outcomes should we use to measure success?

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence

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