Quality Metrics for Remote Patient Monitoring within Hospital at Home: Implementation, Barriers, and Motivations

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Introduction

The adoption of the hospital at home (HaH) care model has accelerated in recent years. Remote patient monitoring (RPM) of HaH patients holds potential in improving safety and quality of care, as well as enabling the care of higher acuity patients[1,2]. However, limited studies exist on the implementation of remote patient monitoring in HaH and how its impact is measured.

Table 1: Characteristics of Participating Institutions

Role of Interviewee (Self Reported)	Participating Institutions (N=9)
Clinical Leadership	11
Administrative Leadership	5
Geography	
United States	8 (89%)
International	1 (11%)
Provider Organization Type	
Academic Health System	3 (33%)
Community Health System	5 (56%)
Private HaH Vendor	1 (11%)
Setting	
Urban	6 (67%)
Suburban	3 (33%)
Rural	2 (22%)
De-centralized	3 (33%)
RPM for HaH Care Experience	
0-1 years	1 (11%)
1-2 years	2 (22%)
2-4 years	4 (44%)
5+ years	2 (22%)
Monitoring Modalities	
Vitals	9 (100%)
Continuous Single Lead EKG	3 (33%)
Falls	3 (33%)
Monitoring Frequencies	
q4hr	2 (22%)
q6hr	2 (22%)
q8hr	3 (33%)
Continuous	2 (22%)
Indications for RPM	
All Patients	8 (89%)
Condition-based	1 (11%)
Average Monthly HaH Patient Volume	
0-50	3 (33%)
50-100	2 (22%)
>100	3 (33%)

Objectives

As such, we sought to characterize ongoing quality monitoring programs among RPM programs for HaH, specifically:
- Quality domains in which metrics are used
- Motivation for quality measurement
- Barriers to quality measurement

Methods

We identified experienced leaders at existing HaH service lines through the published literature and professional networks. We developed and piloted an interview guide to assess RPM for HaH operational structure, quality metric implementation, as well as motivations and challenges around measuring quality. We then conducted semi-structured interviews with study participants about the approach to quality measurement in their respective HaH care model. We classified quality metrics monitored according to the National Quality Forum (NQF) Telehealth Measurement Framework. We developed a codebook from interview transcripts which we used to classify motivations for and barriers to quality measurement.

Results

We held 9 qualitative interviews with 16 HaH leaders representing 9 institutions with significant HaH experience. The majority of institutions operated a remote patient monitoring program within their HaH care model for greater than 2 years (6/9). All sites monitored patients' vital signs remotely; a minority of programs used continuous single lead EKG or fall detection monitoring. Sites primarily reported using quality metrics focused on effectiveness (5/9) and experience (4/9). Only 2 institutions tracked metrics related to access to care and 1 institution assessed the financial impact of RPM. Qualitative analysis revealed varied motivations for quality monitoring for RPM for HaH and found IT limitations, data fidelity and lack of benchmarks as the main barriers.

Table 2: RPM for HaH: Implemented Metrics Aggregated by NQF Domains of Quality Measurement

NQF Domain	Institutions Measuring Metric in Domain	NQF Subdomains	Institutions Measuring Metric in Subdomain
Access to Care	2 (22%)	Access for patient, family, and/or caregiver	2 (22%)
		Access for care team	0 (0%)
		Access to information	0 (0%)
Financial Impact/Cost	1 (0%)	Financial impact to patient, family, and/or caregiver	0 (0%)
		Financial impact to care team	0 (0%)
		Financial impact to health system/payer	1 (11%)
		Financial impact to society	0 (0%)
Experience	4 (44%)	Patient, family, and/or caregiver experience	4 (44%)
		Care team member experience	1 (11%)
		Community experience	0 (0%)
Effectiveness	5 (56%)	System effectiveness	0 (0%)
		Clinical effectiveness	0 (0%)
		Operational effectiveness	4 (44%)
		Technical effectiveness	3 (33%)

Table 3: Motivations for and Barriers to RPM for HaH Quality Measurement

Motivation for Quality Measurement	Examples
Patient Experience	• There is a patient expectation that if an alert is going off that someone is going to respond and they are going to be taken care of so we need to measure response times • Want to understand the experience of patients with RPM equipment and how we can best reach out to help troubleshoot
Quality Outcomes	• We want to prove the quality of our [RPM] system to the patients • Interested in understanding whether RPM can allow earlier intervention for deteriorating patients and prevent escalation in care
Stakeholder Buy-in	• Showing quality metrics and all the data to our institutional leaders is very important as they are skeptical about leveraging RPM and virtual care for HaH
Improve Access	• Want to understand impact of RPM on increasing census
Clinical Productivity	• Understanding operational metrics could help improve nursing team efficiency"
Device Measurement Accuracy	• I think as there is newer and newer products out there, the accuracy of the equipment is probably something that we want to know more about
Barriers to Quality Measurement	**Examples**
IT Limitations	• Current [RPM] software systems limit accurate tracking of time to resolution for RPM alert • Current RPM vendors require "active effort" to capture quality metrics. They have to allow for passive capture.
Data Fidelity	• Data reliability from RPM vendors is variable leading to some skepticism in metrics derived from this data • Connectivity issues can impact metrics
Lack of Benchmarks	• Difficult to make apples to apples comparison to in-hospital environment quality metrics

Limitations

The majority of institutions represented were based in the United States and therefore the ability to apply our findings to describe the state of quality measurement of RPM for HaH for international programs is limited. Furthermore, the majority of programs have been established for 2 or more years. Given the rapid rise of HaH programs, the findings from our study may not describe the use of quality metrics for many programs still in their nascency.

Conclusions

We identified variation in use and content of quality metrics assessing remote patient monitoring in HaH. Institutions primarily captured quality metrics related to operational effectiveness and patient/clinician experience of their remote patient monitoring systems. These findings may be valuable to support prioritization of institution-level quality metrics for development, as well as standardization of metrics to enable program benchmarking.

Resources
1. Conley J. Snyder GD, Whitehead D, Levine DM. Technology-enabled Hospital at Home: Innovation for Acute Care at Home. NEJM Catalyst. 2022
2. Whitehead D, Conley J. The Next Frontier of Remote Patient Monitoring: Hospital at Home. JMIR. 2023