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Overall patient experience with a virtual hybrid hospital at home program

Michael J Maniaci[1], Ricardo A Torres-Guzman[2], John P Garcia[2], Francisco R Avila[2], Karla C Maita[2], Antonio J Forte[2,3] and Margaret R Paulson[4]

Abstract

Objectives: Traditional hospital at home models often have high patient experience scores. The purpose of this study is to look at the patient experience of a new virtual hybrid model of hospital at home called Advanced Care at Home.

Methods: Patients in Mayo Clinic's Advanced Care at Home program received a survey via email from 1 January–31 May 2021. Each survey consisted of 20 questions divided into 18 multiple-choice and two open-ended questions.

Results: Ninety-nine surveys were sent and 41 partially or completely finished surveys were returned for a response rate of 41.4%. Patients responded positively, denoted by answering "strongly agree or somewhat agree," with regard to the ability to reach the team right away 100% of the time, being kept informed 92% of the time, the command center responding promptly to their needs 95% of the time, the team providing comfort and support 98% of the time, feeling comfortable with interacting with their provider by phone or tablet 95% of the time, the ease of use from the equipment 97% of the time, the virtual and in-person staff working well together 98% of the time, the staff treating patients with courtesy and respect 100% of the time, and the ease of understanding the discharge process and feeling ready to leave the program 100% of the time. All providers received positive responses on listening ⩾88% of the time. Patients gave a top rating in likelihood to recommend the program 100% of the time.

Conclusion: Overall, the Advanced Care at Home model of hospital at home was highly recommended by patients. Patients scored the program high on responsiveness, staff engagement and communication, ease of equipment use, and readiness for discharge, strengthening the overall confidence in this novel program.

Keywords

Virtual hybrid, telemedicine, patient satisfaction, health care surveys

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Introduction

Hospital at home (HaH) is a home-based healthcare delivery model developed over 25 years ago that serves as an alternative for delivery of high-acuity care traditionally offered in an inpatient hospital setting.[1] In the traditional HaH model, all required medical resources to provide inpatient care, such as physician rounding, bedside nursing, biometric monitoring, laboratory collection, and medication administration is brought to the patient in their home. Previous studies of this model of care have revealed that HaH can deliver high quality and safe inpatient-level care in the home setting while both reducing hospital costs as well as delivering a favorable patient experience.[2–7] When compared to care at a traditional brick-and-mortal hospital, HaH care is often associated with greater patient satisfaction scores.[5,6] Reasons for this better patient experience include a perception of more individualized medical care plan and a better therapeutic environment for faster recovery.[5]

In 2020, Mayo Clinic instituted two new models of virtual care for their patients, Advanced Care at Home (ACH) and

[1]Division of Hospital Internal Medicine, Mayo Clinic, Jacksonville, FL, USA
[2]Division of Plastic Surgery, Mayo Clinic, Jacksonville, FL, USA
[3]Department of Neurological Surgery, Mayo Clinic, Jacksonville, FL, USA
[4]Division of Hospital Internal Medicine, Mayo Clinic Health Systems, Eau Claire, WI, USA

Corresponding author:
Michael J Maniaci, Division of Hospital Internal Medicine, Mayo Clinic, 4500 San Pablo Road, Jacksonville, FL 32224, USA.
Email: Maniaci.Michael@mayo.edu

Care Hotel. In Care Hotel, post-procedural patients who would normally spend one night in the hospital as an outpatient in a bed are discharged from the post-anesthesia recovery unit and transported to our hotel on the Mayo Clinic Florida campus for overnight outpatient monitoring.[8] These discharged patients are monitored in Care Hotel by a combination of a daytime on-site registered nurse and our virtual bedside nurses in the command center, with the ability to escalate care to the procedural team or emergency department (ED) if problems arise. ACH is our virtual hybrid hospital at home program, where inpatient care is managed virtually by remote providers in a command center and executed through external vendors who are part of an integrated health care supply chain. ACH was built with the intention of overcoming some of the obstacles to rapid scalability and inability to cover large geographies seen in the previous traditional HaH models that only used in-person providers.[3] With this model, both the rounding physician and the bedside nursing assessment, management and treatment of the patient are completely virtual, completing their care via a telemedicine interaction, while in-person care is delivered by medical staff in the vendor supply chain only when needed.

While patient satisfaction with the traditional HaH models has been high, patient satisfaction with telemedicine visits, mostly studied in the outpatient clinic setting, has been variable. Many studies have shown patient satisfaction to be overall positive or at least non-inferior to in-office visits.[9,10] But these studies also show that there are many patient concerns with telemedicine, including the ability to reach their provider easily, establishing a trustful physician-patient relationship, establishing clear lines of communication with all providers virtually, and dealing with the technological difficulties of the model.[9–11] This leads to the question of whether the patient experience would be positive in this new ACH hospital at home model, where the physician and bedside registered nurse care is all virtual in nature, coming from a command center. We have previously looked at patient satisfaction in our Care Hotel program and patients had high satisfaction with this outpatient post-procedural monitoring program.[12] Care Hotel differs from ACH in that it is outpatient, short in timeframe, and extremely focused. We wanted to gauge the experience our patients would have in our inpatient, virtual hybrid hospital at home program. We hypothesize that patients will have an overall positive experience with the ACH virtual hybrid care model, finding comfort and confidence with both the provider team and the in-home technology. This study aims to describe the patient feedback obtained from a single survey regarding their ACH experience and overall satisfaction working with this novel virtual hybrid hospital at home program.

Methods

Population and setting

This study was approved by the Mayo Clinic Institutional Review Board as a retrospective review under protocol number 20-010753 and was independent from other ongoing ACH patient experience studies. The study was conducted between 1 January and 31 May 2021 at Mayo Clinic in Florida, a 306-bed community academic hospital. Written consent to participate in the ACH program and take part in any experiences surveys was collected at the time of admission. Patient participation was voluntary, and any responder could withdraw from the survey at any moment. The inclusion criteria for this study are the following: (1) patients that have been accepted to the ACH program in Florida and Wisconsin and (2) patients that completed the online survey. Patients were excluded if they did not have or list an email address to contact, if they refused to take part in the survey, or if the survey was returned fully unfilled. All surveys sent were done so after the patients were completely discharged from the ACH program. An email with a link to the anonymous survey was sent to each patient discharged completely from the ACH program.

ACH model of care

All patients admitted into the ACH program receive the virtual hybrid model of care. Patients are admitted to the acute phase of the ACH program either directly from the ED or from the hospital wards. Patients are screened for both clinical stability as well as demographic eligibility prior to admission to the program. A social stability screen is also done to ensure that the home setting is safe for both the patients and the in-home care providers. Patients must have functioning Internet access at home to participate in the program. If home Internet access is not available, the paramedic team delivers a cellular hub to the patient's home and tests it for connectivity to the virtual technology. Patients are then moved from the ED or hospital ward setting to their homes by institutional transport.

One home, the ACH program provides the in-home technology necessary for the hospital at home care. Patients are monitored from the comfort of their homes using a technology stack and a specially configured audio/video communication device to directly communicate with their clinical team in the command center. The in-home technology transmits biometric data such as blood pressure, heart rate, and oxygen saturation to the command center. Command center nursing staff monitor this information as well as conduct virtual assessments of patient symptom and care plan management every 3–6 h and as needed. Physicians round on the patients virtually each day of the acute phase. Twice daily in-person assessments are done by a combination of a traveling nurse, a visiting nurse practitioner, and/or a community paramedic. Based on both the data collected and input from the in-home services, the command center physician and nurse determine the individualized care plan for each patient. The command center activates a vendor-mediated supply chain to provide in-home rapid response services, phlebotomy, medication administration, nursing care, meals, and diagnostic images such as abdominal and chest radiographs.

When the acute phase patient reaches a clinical stability level equivalent to that of discharge from a bricks and mortar hospital, the patient enters the restorative phase, which lasts up to 30 days from the start of the acute phase. This phase focuses optimizing any medical and non-medical patient concerns as well as monitoring for early signs of clinical decompensation. Time is spent on patient and family education, medication adherence, advanced care planning, and physical and occupational therapy. Any recommended outpatient clinical appointments are coordinated and facilitated to optimize the patient's medical conditions. Near the end of the restorative phase, discharge from ACH is coordinated by the command center over the course of several days. The command center team spends the discharge days conducting any final education on the patient's medical condition, making sure they have all necessary prescriptions filled, ensuring that primary care and specialty follow-up appointments are set, and relating all care plans to the patient's primary care provider. Home technology and equipment are removed upon discharge, and the patient is given discharge instructions prepared by the ACH providers.

Survey design

The Mayo Clinic Department of Patient Experience developed the survey used in this study. Question themes of access, communication, emotional support, and care organization were based on a previously validated hospital at home patient survey questionnaire.[13] As the study focused on a new model of care involving technology, virtual providers, and in-person care, questions were created or adjusted to fit the needs of the study. The survey consisted of 18 multiple choice questions and 2 open questions which aimed to evaluate team responsiveness and communication, virtual and in-person provider engagement, experience with the technology and the discharge process, overall experience, and likelihood of recommending the ACH program to others. All the questions were Likert-type-like scale choices using the following answers: (1) strongly agree or extremely satisfied; (2) somewhat agree or satisfied; (3) neither agree nor disagree or satisfied nor dissatisfied; (4) somewhat disagree or dissatisfied; (5) strongly disagree or dissatisfied. The 2 open-ended questions asked the patients to describe one thing they enjoyed from the program and one thing that disappointed them.

Once the initial draft of the survey was created, it was distributed to the two lead physicians, the three ACH advanced practice providers, the command center operations manager, and the ACH nursing manager for review. These seven individuals reviewed the survey and provided both feedback on any problems with survey language or technical or descriptive aspects of the program as well as confirmed the relevance of each survey question and the patients' ability to provide an appropriate answer. The survey was then edited to the final draft that was distributed to patients (Figure 1). This process of survey review has been previously conducted and validated in previous hospital at home literature.[6,13]

Data collection and statistical analysis

As this study was a retrospective review of the patient experience surveys done over a fixed time period, no power analysis or sample size calculations were conducted; all returned surveys during the allotted time period were analyzed. In addition to the survey answers, we collected the patient age, sex, race, ethnicity, primary diagnosis, and severity of illness on 1–4 All-Patients Refined Diagnosis-Related Groups (APR-DRG) scale for all patients during the study interval. Patients would follow the email link to a secured survey and all study data was collected and managed using electronic data capture tools hosted at Mayo Clinic. All patient characteristics data was housed and protected on the Mayo Clinic electronic health record and internal servers. Returned surveys were uploaded through a secure link sent by email to the patients and the results were anonymous and de-identified to ensure patient anonymity.

Data analysis of the Likert-type questions used standard descriptive statistics for all of the data collected using frequency distribution and percentages. Further analysis was done by calculating the mean score of each answered question and confidence intervals were calculated using the mean confidence interval formula based of the sample standard deviation. The Shapiro–Wilk test was used to check if the normal distribution model fit the observed Likert-type scores and a p-value was generated, with a p-value of $\leqslant 0.05$ was considered statistically significant. No qualitative analysis or data saturation analysis was done on the freeform answers; common answers were grouped and reported in descriptive fashion.

Results

One hundred thirty-nine patients were admitted and discharged from Mayo Clinic's ACH program from 1 January–31 May 2021. Forty of those patients indicated that they did not want to be contacted with survey materials. Ninety-nine surveys were emailed to the remaining discharged patients. Forty-one of the 99 sent surveys (41.4%) were either partially or completely finished (Figure 2).

Patient characteristics and diagnosis can be seen in Table 1. As returned surveys were collected without identifiers in order to protect patient anonymity, patient characteristics and diagnosis were not matched to returned surveys, resulting in the demographic data being reported for all patients in the study interval. More patients were admitted in Florida when compared to Wisconsin (56.8% vs 43.2%), the average patient age was 71.1 years, and the majority of patients were white (87.1%), identified as not Hispanic or Latino (93.5%), and had Medicare insurance (74.8%). COVID-19 pneumonia was the primary diagnosis (23.7%) seen, although

As part of our effort to continuously improve our services, we ask that you please complete the following survey regarding the Advanced Care at Home program through Mayo Clinic.

Please rate your level of agreement with the following statements.

	Strongly disagree (1) (1)	Disagree (2) (2)	Neither agree nor disagree (3) (3)	Agree (4) (4)	Strongly agree (5) (5)
The equipment was easy to use (1)	○	○	○	○	○
I felt comfortable interacting with the care team by phone or tablet (2)	○	○	○	○	○

Please rate your level of agreement with the following statements about how well you have been treated by the Advanced Care at Home program staff.

	Strongly disagree (1) (1)	Disagree (2) (2)	Neither agree nor disagree (3) (3)	Agree (4) (4)	Strongly agree (5) (5)
The team kept me informed about my care plan (1)	○	○	○	○	○
The team promptly responded to my needs (2)	○	○	○	○	○
I was able to reach a team member right away for any questions or concerns (3)	○	○	○	○	○
The team made me feel comforted and supported (4)	○	○	○	○	○

Do you agree or disagree that the following team members LISTENED carefully to you?

	Strongly disagree (1) (1)	Disagree (2) (2)	Neither agree nor disagree (3) (3)	Agree (4) (4)	Strongly agree (5) (5)	Not applicable (6)
Doctors (1)	○	○	○	○	○	○
Nurse Practitioners or Physician Assistants (2)	○	○	○	○	○	○
Nurses (3)	○	○	○	○	○	○
Physical Therapists (4)	○	○	○	○	○	○
Occupational Therapists (5)	○	○	○	○	○	○
EMTs/Paramedics (6)	○	○	○	○	○	○
Home Health Aides (7)	○	○	○	○	○	○

Please rate your level of agreement with the following statements about discharge from the Advanced Care at Home program.

	Strongly disagree (1) (1)	Disagree (2) (2)	Neither agree nor disagree (3) (3)	Agree (4) (4)	Strongly agree (5) (5)
The discharge process was explained to me using language I could understand (1)	○	○	○	○	○
I felt ready to leave the Advanced Care at Home program (2)	○	○	○	○	○

Figure 1. *(Continued)*

Please rate your level of agreement with the following statements on how well the Advanced Care at Home program met your needs.

	Strongly disagree (1) (1)	Disagree (2) (2)	Neither agree nor disagree (3) (3)	Agree (4) (4)	Strongly agree (5) (5)
The team treated me with respect and courtesy (1)	○	○	○	○	○
The staff worked well together to care for me (2)	○	○	○	○	○

What is the likelihood of your recommending this service to others?

- ○ Very good (1)
- ○ Good (2)
- ○ Fair (3)
- ○ Poor (4)
- ○ Very poor (5)

Please tell us about anything that **impressed you** about your experience with the Advanced Care at Home program.

_____

_____

_____

Please tell us about anything that **disappointed you** about your experience with Advanced Care at Home program.

_____

_____

_____

Figure 1. ACH end of program survey.

over 35 distinct diagnoses were reported. Average severity of illness was 2.9 on the 1–4 APR-DRG scale (Table 1).

Percentages of each response can be seen in Table 2. Questions on the treatment from the team were completed by 38 patients. Regarding the ability to reach the team right away for questions or concerns, patients responded positively, denoted by answering "strongly agree or somewhat agree," 100% of the time. Patients responded positively to being kept informed about their care plan 92% of the time. Patients responded positively to the command center responding promptly to their needs 95% of the time. Patients responded positively to the team providing comfort and support 98% of the time.

Questions regarding staff carefully listening were completed by 37 patients and broken down into each service provider as follows. Regarding physicians listening carefully, patients responded positively, denoted by answering "strongly agree or somewhat agree," 94% of the time. Nurses had a 92% positive response rate, home health aides had a 95% positive response rate, paramedics had a 97% positive response rate, nurse practitioners and physician assistants had a 97% positive response rate, physical therapists had a 90% positive response rate, and occupational therapists had an 88% positive response rate.

Questions regarding the equipment use and the discharge process were completed by 38 patients. Regarding patients feeling comfortable with interacting with their provider by phone or tablet, patients responded positively, denoted by answering "strongly agree or somewhat agree," 95% of the time. Patients responded positively to the ease of use from the equipment 97% of the time. Patients responded positively to both questions on the discharge process being easy to understand and feeling ready to leave the program, with 99% strongly agreeing with both questions.

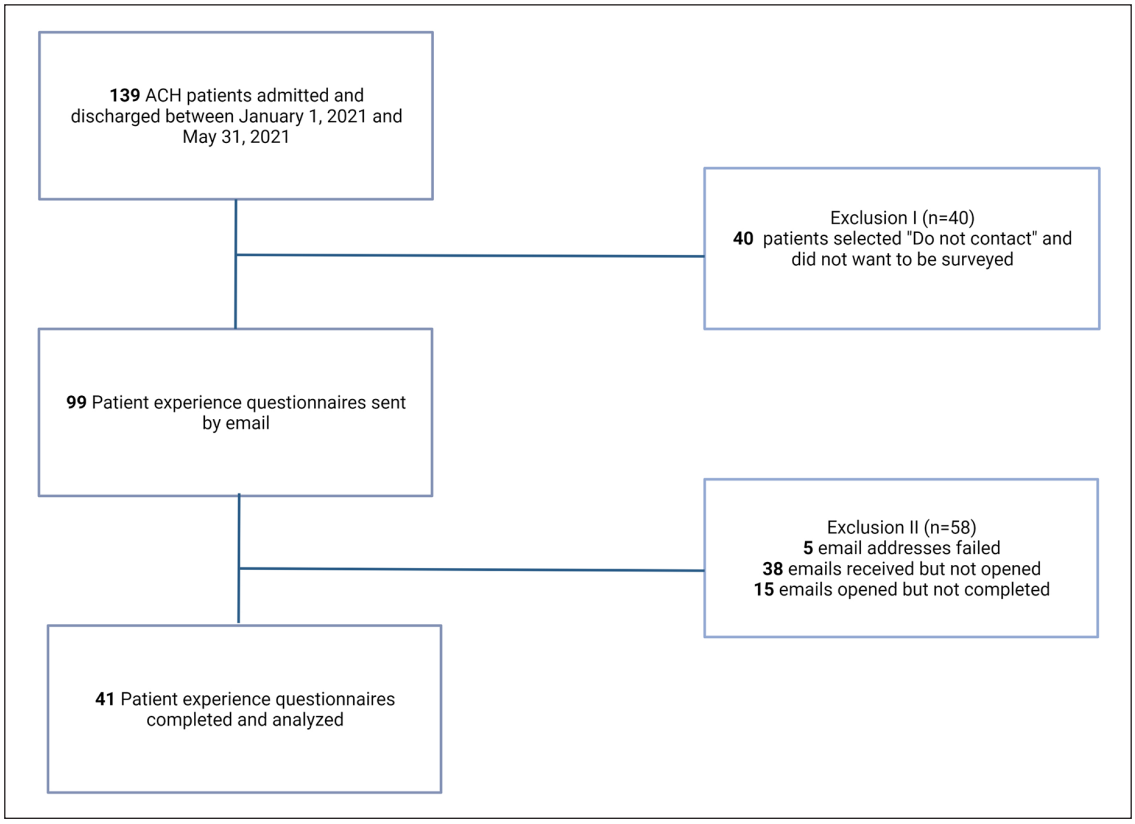

Figure 2. Patient inclusion pathway.

Questions regarding the overall program experience were completed by 37 patients. Regarding patients feeling that the virtual and in-person staff worked well together, patients responded positively, denoted by answering "strongly agree or somewhat agree," 98% of the time. Patients responded positively to the staff treating them with courtesy and respect 100% of the time.

Regarding the likelihood of patients recommending the ACH program to other patients, 22 patients responded, with a 100% rating it strongly. When asked to describe something the patient had enjoyed from the program in an open-end question, most answers emphatically praised the technology and setup in the house, the teamwork, and staff communicational skills, as well as the excellent care they received at their home (Table 3).

Patients were asked to describe an area in which they were disappointed in an open-ended question. Most responses were made toward a lack of continuity and communication between hospital personnel and ACH personnel. For example, some patients suggested that ACH staff remain in charge of the same patient instead of rotating personnel (Table 3).

Discussion

To our knowledge, this is one of the first studies to look at patient experience in a virtual hybrid hospital at home model. Our goal was to determine if patients receiving high-acuity care would have a high degree of satisfaction with a model where their primary physician and bedside nurse were both virtual in nature. The response rate to our voluntary patient experience survey was 41.4%; although this lower percentage is not ideal, it is consistent with the response rates of 14–47% seen in previously published hospital at home patient experience literature[5,6] as well as the response rate of 25%–33% seen in the last decade of reporting of Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) data.[14,15] It was reassuring that the responders rated all interactions very positively, with all mean Likert-type scores greater than 4.45 ($p < 0.0001$).

Overall, we found that patients at a very positive experience with our virtual hybrid model, with patients strongly agreeing with a positive experience in most question areas. This positive patient experience is similar to the patient experience seen in previous in-person only hospital at home models.[5,6,16] This would indicate that despite the core of the provider care (rounding physicians and bedside nursing staff) being virtual in nature, patients still could have a very satisfying experience through both the virtual interaction as well as the team interaction with the in-home care providers (advanced practice providers, paramedics, physical therapist, and occupational therapists). This finding is quite important as we believe the virtual hybrid model will become the predominant model of the future of hospital at home.

Table 1. Patient demographics and diagnosis.

Demographics	N = 139
Patients	
Florida	79 (56.8%)
Wisconsin	60 (43.2%)
Average age (years)	
Florida	71.5
Wisconsin	70.6
Sex	
Male	72 (51.8%)
Female	67 (48.2%)
Race	
African American	3
American born African	1
American Indian/Alaskan Native	1
Asian Filipino	4
Black or African American	7
Choose not to disclose	2
White	121
Ethnicity	
Central American	2
Choose not to disclose	3
Hispanic or Latino	2
Not Hispanic or Latino	130
Other Spanish Culture (except Spain)	1
Puerto Rican	1
Insurance (Primary)	
Aetna	2
Blue Cross Blue Shield	6
COVID-19 Uninsured Group	1
Medica	1
Medica Mayo Employee	15
Medicare	104
Security Health Plan	7
United Health Care	1
WEA Trust	2
Average severity of illness	
Florida	3.0
Wisconsin	2.7
Diagnosis (Primary)	
COVID-19 Infection/Pneumonia Due To COVID-19	33 (23.7%)
Congestive Heart Failure Exacerbation	8 (5.8%)
Cellulitis/Wound Infection	8 (5.8%)
Atrial Fibrillation/Cardiac Arrhythmia	8 (5.8%)
Colitis/Diverticulitis	7 (5.0%)
Failure Renal Acute/Acute Kidney Injury	7 (5.0%)
Acute Respiratory Failure	6 (4.3%)
Infection Urinary Tract/Pyelonephritis	6 (4.3%)
Electrolyte Disorder (Hyponatremia, Hyperkalemia, etc.)	5 (3.6%)
Bacteremia, not Sepsis	4 (2.9%)
Pneumonia, non-COVID	4 (2.9%)
Sepsis	3 (2.2%)
Diabetes Mellitus/Hyperglycemia/ Ketoacidosis	3 (2.2%)
Transplant-Related Complication	3 (2.2%)
Venothromboembolism/Embolus Pulmonary	3 (2.2%)
Abscess	3 (2.2%)
Chronic Obstructive Pulmonary Disease Exacerbation	2 (1.4%)
Acute Hepatitis/Cholangitis/Jaundice	2 (1.4%)
Chest Pain/Angina/Coronary Disease	2 (1.4%)
Anemia	2 (1.4%)
Fever of Unknown Origin	2 (1.4%)
Pain Control	2 (1.4%)
Osteomyelitis/Septic Arthritis/Discitis	2 (1.4%)
Neoplastic/Malignant Cancer Related Complication	2 (1.4%)
Other (1 case only)	12 (8.6%)

One main concern with telemedicine is the ability of providers to respond quickly to patient question, concerns, and needs.[17,18] We found that the perception of responsiveness was quite high in our virtual hybrid model, with 87% of patients strongly agreeing and 13% somewhat agreeing, giving an overall 100% positive rating. We attribute this perception to the instantaneous connectivity of our virtual model. In our model of care, when the patient wants to speak to a provider, they push one large button on the tablet device and their virtual bedside nurse answers their inquiry within seconds. The nurse can then connect the patient to a physician through the same technology instantaneously. This instantaneous connection to bedside providers through the video technology is much faster than leaving text or phone messages for providers to call patients back. Kashkoli et al.[19] found that the responsiveness of hospital staff strongly correlated with a high patient satisfaction score and suggested that hospital patient experience improvement teams should primarily focus on responsiveness in their strategic plans. We believe these findings also translate to the hospital at home environment and having a system of rapidly responding to patient needs is important for success.

Although 92% of our patients responded positively to being kept informed about the care plan, only 62% responded "strongly agree," which was our lowest "strongly agree" percentage out of all 18 questions. What's more, 5% of patients somewhat or strongly disagreed with this statement and when asked about their major disappointment in the open-ended question, suboptimal communication between hospital personnel and ACH staff was the patients' main concern. Proper communication plays a vital role in the provider-patient relationship, helping patients understand their care plan and leading to improved therapeutic recover and psychological satisfaction.[20,21] It has been noted that good communication with providers results in patients feeling a more personal connection with their providers, perhaps leading to

Table 2. Patients' experience with the ACH program.

Questions	Answers (%)					Mean [CI][a]	p-value[b]
	SA	SWA	NAoD	SWD	SD		
Treatment from team (n = 38)							
I am able to reach the team right away for questions/ concerns	86.8	13.2				4.8684, [4.7558, 4.981]	<0.0001
I was kept informed about my care plan	60.5	31.6	2.6	2.6	2.6	4.4474, [4.1544, 4.7403]	<0.0001
The command center team responded promptly to my needs	78.9	15.8	5.3			4.7368, [4.5546, 4.919]	<0.0001
My treatment team provided me with comfort and support	86.8	10.6		2.6		4.8158, [4.6309, 5.0007]	<0.0001
Staff listened carefully (n = 37)							
My physician listened carefully to me	83.8	10.8	5.4			4.7838, [4.6057, 4.9619]	<0.0001
My nurse listened carefully to me	83.8	8.1	2.7	5.4		4.7027, [4.4437, 4.9617]	<0.0001
My home health aide listened carefully to me	78.4	16.2	5.4			4.7297, [4.543, 4.9165]	<0.0001
My paramedic listened carefully to me	86.5	10.8	2.7			4.8378, [4.6905, 4.9851]	<0.0001
My nurse practitioner/physician assistant listened carefully to me	89.2	8.1	2.7			4.8649, [4.7251, 5.0046]	<0.0001
My physical therapist listened carefully to me	78.4	10.8	10.8			4.6757, [4.4526, 4.8987]	<0.0001
My occupational therapist listened carefully to me	75.7	13.5	5.4		5.4	4.5405, [4.2017, 4.8794]	<0.0001
Equipment and discharge (n = 38)							
I felt comfortable interacting with my provider by phone or tablet	81.6	13.2	2.6	2.6		4.7368, [4.525, 4.9487]	<0.0001
The equipment was easy to use	71.1	26.3	2.6			4.6842, [4.5115, 4.8569]	<0.0001
The discharge process was easy to understand	97.4	2.6				4.9737, [4.9204, 5.027]	<0.0001
I felt ready to leave the program	97.4	2.6				4.9737, [4.9204, 5.027]	<0.0001
Overall program (n = 37)							
The virtual and in-person staff worked well together	83.8	13.5			2.7	4.7568, [4.5157, 4.9978]	<0.0001
The staff treated me with courtesy and respect	89.2	10.8				4.8919, [4.7869, 4.9969]	<0.0001
Likelihood to recommend the ACH program to others (n = 22)	100					5, [5, 5]	NaN

NaoD: neither agree or disagree; SA: strongly agree; SD: strongly disagree; SWA: somewhat agree; SWD: somewhat disagree; CI: confidence interval; NaN: not a number.
[a]Calculated by confidence interval calculator
[b]Calculated by the Shapiro–Wilk test

Table 3. Written survey feedback.

Examples of Feedback Extracted from Open-Ended Questions	
What Impressed You:	*What disappointed You*:
1. Ability to be in the comfort of their own home	1. Getting use to using the home technology
2. Ability to be with family, friends, and pets during their treatment and recovery	2. Wanted more continuity with my nurse
3. Felt like they recovered faster in their own home (positive environment)	3. Hospital staff should know more about the program for better handoffs
4. ACH staff worked well together	

the greatest influence on patient satisfaction outcomes.[5] Despite the overall positive findings, as patients move into this novel virtual hybrid hospital home model, we need to continue to focus on strong communication by all providers, both virtual and in-person, in order to instill confidence in the model with our patients.

One significant finding of our study was that both physicians and nursing staff had listening response scores equivalent to the in-home staff. No matter if the staff was virtual or physical in presence, all individuals scored greater than 88% by patients. This fact is important as one major concern that both providers and patients had of the virtual hybrid model was that if the patient interaction with their main providers was only virtual in nature, it would take away from the provider-patient experience, making it less intimate and trustful. Patients associate providers who actively listen to their concerns as more trusted and high-valued, resulting in a better provider-patient relationship and overall experience.[22] This

strong relationship between providers and patients is achievable in the virtual hybrid model as long as time and effort is allocated to actively listened patient's concerns.

When it came to equipment use in the virtual hybrid model, 82% of responses strongly agreed being comfortable with interacting with staff via smartphones and/or tablets. Equipment ease did not have such a high percentage of strongly agree responses (71%), but overall positive experience responses in both areas was quite high at 95% and 97%. With an overall average agreement of 96%, this demonstrates that patients had a very pleasant experience with the equipment provided. This was also reflected in the open-ended questions, as a numerous response from areas enjoyed included the level of technology and setup at the patient's home. Technical difficulties often limit patient use of telemedicine equipment, interfering with care, and resulting in a subpar experience.[23] Therefore, it is important to have video and biometric monitoring equipment that is both easy to interact with and very reliable in its telemedicine connection. We are happy that our choice of equipment lives up to patient expectations as this also instills confidence in the virtual hybrid home hospital model.

A final important finding in our study was the extremely high positive patient responses to the questions on the ease of understanding the discharge process and feeling ready to be discharged from the program. Both received outstanding responses with 99% of patient responding that they strongly agreed, the highest percentage response of all questions survey. We attribute this to two properties of our discharge process. First our discharge process is highly organized, with the use of standardized discharge communication tools, printouts, and electronic resources, all of which are easy to interpret and repeatedly discussed with the patient by all providers. Studies have found that proper use of standardized discharge communication tools and practices improve discharge quality and satisfaction with the process.[24,25] Second, as opposed to a typical hospital discharge which is often rushed over several hours, our ACH discharge process happens over a number of days, ensuring proper patient education, medication reconciliation, and primary provider handoff and follow-up. We believe these two properties of our virtual hybrid model leave patients with confidence that they are ready for discharge as reflected in the high scores seen.

Limitations

This study has several limitations. First, although the total number of patients that have been treated at the ACH is high, only 41 patients answered the survey either partially or completely. This low response rate limits the significance of any results found. Future studies should look to include more patients in its analysis if the response rate remains low. Second, as this was a retrospective study, no power analysis or sample size calculations were conducted, thus limiting the significance of the results. Third, using the email to send surveys could prompt to errors or misunderstanding of the questions. Forth, as the returned surveys were done anonymously, we did not match patient characteristics or diagnosis to the survey results making correlation with patient physical or emotional state impossible. In addition, surveys were sent to all willing patients via email; although an Internet connection was required for treatment in the ACH program, those patients that had the cellular hub loaned to them during the treatment period and then removed at discharge may have not had the opportunity to take part of the survey, thus possibly excluding a small subset of patients of lower socioeconomic status. Fifth, outside variables such as the COVID-19 pandemic could have made the hospital at home model more attractive to patients, affecting survey results. All of the above could contribute to a selection bios in the final results reported. Finally, the subjective interpretation of the comments and results of the survey is also an inherent source of bias of these types of studies.

Conclusion

Patients in the ACH model of hospital at home had an overall positive experience. Patients scored the program high on responsiveness, staff engagement and communication, ease of equipment use, and readiness for discharge. Overall, the program was highly recommended by patients, strengthening the overall confidence in the virtual hybrid hospital at home model of care.

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Author contributions

Margaret Paulson, Antonio J. Forte, and Michael J. Maniaci contributed to the study design, data analysis, manuscript writing and preparation, and review process. Francisco R. Avila, Ricardo A. Torres-Guzman, Karla Maita, and John P. Garcia, contributed to the data collection and review, data analysis, manuscript writing, and manuscript editing. All authors have read and approved the final manuscript.

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ORCID iDs

Michael J Maniaci https://orcid.org/0000-0002-2731-1787
John P Garcia https://orcid.org/0000-0003-1401-2830
Antonio J Forte https://orcid.org/0000-0003-2004-7538

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