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IN DEPTH

Huntsman at Home, an Oncology Hospital at Home Program

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Leaders at the University of Utah Health Huntsman Cancer Institute have developed a hospital at home model for oncology patients that features ongoing monitoring and rapid response for patients with unstable, acute illness. Nurse practitioners, home health registered nurses, and other staff provide hospital-level care in the patient's own home. Services are available within 2 hours of the patient arriving home and in response to emergent calls. Early results show reductions in hospitalizations, hospital length of stay, ED use, and cost of care.

Patients with cancer experience toxicities and complications related to their disease and treatments that result in ED visits and unplanned hospitalizations. Within a year of diagnosis, 75% of patients with advanced cancer are hospitalized, and more than 15% experience three or more unplanned hospitalizations.[1] This impacts quality of life, time at home with family, and health care costs. More recently, the Covid-19 pandemic has accelerated interest in models of care for preventable ED visits, hospitalizations, and infectious exposures.

Hospital at home models are one way to reduce acute care hospitalizations, shifting that care to a more cost-effective setting while keeping patients in the comfort of their homes and with their families. Hospital at home, as the name describes, provides acute, hospital-level care at home. Countries including Canada, Japan, Spain, Australia, and the United Kingdom have documented the benefits from shifting acute medical care services from the hospital to the home.[2,3] A variety of hospital at home models have been designed for specific chronic diseases, particularly congestive heart failure[4-6] and chronic obstructive pulmonary disease,[7,8] or have been tailored to geriatric care.[9] In the United States, several programs have been described that primarily focus on geriatric

care.[10-12] However, there are no reports in the literature of models designed specifically for adult oncology patients. Oncology patients commonly experience acute conditions such as pain, dehydration, neutropenic fever, or bowel obstruction that necessitate hospitalization for resolution. These acute episodes lend themselves to treatment in a hospital at home environment.

Hospital at home services are distinct from conventional forms of home care because they provide acute intervention with frequent monitoring and treatment visits in the patient's home for conditions that would otherwise require hospitalization. The goal of these programs is to substitute the home for inpatient care through admission avoidance or to reduce hospital length of stay (LOS) through early transfer to home to complete hospital-level care.[13,14]

Research over several decades from hospital at home programs and meta-analyses has demonstrated outcomes either equivalent to or better than hospitalization, including reduced mortality, increased care efficiency, reduced inpatient readmissions, and increased patient and family satisfaction.[2,15-18] Overall cost is reduced compared to traditional inpatient and ED models of acute care.[16,19,20]

Despite the clear benefit of these programs, treatment of oncology patients in hospital at home programs is uncommon. In a 2019 commentary, Handley and Bekelman[21] argued that oncology hospital at home programs could benefit patients, hospitals, and payers. We describe our initiative to develop and implement a hospital at home program exclusively for patients with cancer, Huntsman at Home (HH). The Huntsman Cancer Institute (HCI) is a National Cancer Institute–designated comprehensive cancer center located at the University of Utah in Salt Lake City. The HH initiative is a combined effort of HCI clinicians and health care delivery researchers.

Identifying a Gap in Cancer Care and the Need for a New Home-Based Model

As a quality initiative, we wanted to examine the patterns of health care utilization for patients receiving cancer treatment. The first component of the initiative was a retrospective chart review of patients' health care utilization. Patients and family members were also informally consulted about their care experiences. Results were then discussed in a gap analysis with HCI clinical leaders to determine how to address the findings.

> *"Operational design included planning for home pharmacy services, infusion supplies, durable medical equipment, laboratory services, in-home radiology, in-home nursing services, and respiratory, occupational, and physical therapy.*

Chart Review

Initially, we conducted a manual extraction chart review for 301 consecutive patients who were receiving active treatment at HCI from January to December 2016. We found that over a

6-month period, 172 patients (57%) used the ED, with a mean of 2.2 visits per patient (377 total visits); 200 of those visits (53%) resulted in unplanned hospitalizations. Institutional practice at HCI also includes assessing acutely ill patients in the ambulatory clinics or a Monday to Friday acute care clinic (ACC) with direct admission to the hospital as needed. We found that 277 of the 301 patients (92%) had unplanned hospitalizations during the 6-month period, with an average of 2.1 admissions (582 total admissions) and a mean LOS of 6.4 days for each admission.

Gap Analysis

We identified several themes from the data, discussion with patients and family members, and clinical leadership review of the data. First, Huntsman Cancer Hospital, as well as the University Health System ED, operate at capacity, creating a pressing need for expanding bed capacity. Second, patients were very engaged with receiving HCI care and did not like being referred to other agencies outside of HCI, such as home health companies; this patient preference often lengthened hospital stays. Finally, there were no alternate programs to ED or ACC use or to mitigate unplanned hospitalization for acute episodes.

Because the hospital at home model was developed to address acute needs at home, we saw a potential application to the oncology population even though we found no published evaluation of the model for adult oncology patients.

Formulating a Home-Based Oncology Acute Episode Care Model

We proposed a demonstration project, the HH initiative. While our primary purpose was to provide acute-level hospital at home services, we also included the institutional- and patient-identified need to provide other home services that carried the Huntsman brand, providing home-based palliative care and transition to hospice services when concordant with goals of care and creating seamless continuity of HCI home, clinic, and hospital care. We report in this article only the hospital at home acute-level HH program because it provided the innovative component of the home initiative. Our primary goals for the acute-level service were as follows: (1) to expand bed capacity by decreasing hospital LOS through early discharge with continued provision of acute, hospital-level care at home; (2) to reduce ED use and prevent hospital readmissions through ongoing monitoring and rapid response for patients with unstable, acute illness at home; and (3) to provide high-quality and safe in-home acute care, increasing time at home for patients and resulting in an improved patient and family experience.

Designing and Operationalizing the Program

Operational Setup

Operational design included planning for home pharmacy services, infusion supplies, durable medical equipment (DME), laboratory services, in-home radiology, in-home nursing services, and respiratory, occupational, and physical therapy. The in-home radiology was a new partnership for the university, but this worked very well, with no operational concerns. The other vendors were already known and used by the university, so it was easy to extend these services

to the HH program. All services met the required capability for a rapid response of 2 hours or less; we also identified resources for food delivery and social services when they were needed, which was provided as charity care through the home health agency.

Other logistics included hiring HCI nurse practitioners (NPs) to lead the care in the home and outfitting our clinical NP team with transportation, laptop computers, hot-spot Internet, telephone communications, clinical equipment bags, and first-dose pharmacy kits that were carried by each NP. We formed a clinical partnership through a memorandum of understanding with a nonprofit home health agency, Community Nursing Services, which provided the registered nurses (RNs), home health aides, therapists (for occupational, physical, and respiratory therapy), and social worker services. The home health agency also facilitated DME acquisition and delivery. This home health organization was already a long-standing affiliate with a strong reputation and experience working as a preferred provider with other programs at the University of Utah, but working with HH through a memorandum of understanding was its first partnered relationship at the university.

> *"It should be anticipated that there will be some turnover in NPs who try the program but find that the workflow or the independent home setting is not for them. In the first 15 months of clinical operations, about one-third of the NP staff turned over.*

Patient Selection and Referral

Programs can approach referral from a limited set of specific diagnoses or based on a clinical treatment plan. We chose the latter to provide greater flexibility in evaluating the home-based program for oncology. Using the admission criteria described in Table 1, patients who lived within the 20-mile HH service area radius were referred by their oncologist or inpatient hospitalist.

Electronic or telephone referrals were reviewed by the HH admission NP and accepted or declined based on the treatment plan and program capacity at the time. Previous HH patients could initiate a self-referral if acute episodes recurred, such as repeated vomiting and dehydration from ongoing chemotherapy cycles.

Clinical Team

The HH team model was centered on NPs leading the care for the patient in the home in partnership with the contracted home health agency's RNs to execute care. There was 24-hour coverage that included RNs on call for urgent after-hours visits, with NPs available 7 days a week during 12-hour shifts. For times when the NPs were not available, the medical director or hospitalist served as the overnight backup to the RN. The program is NP led, with an HH medical director who is board certified in oncology and palliative medicine providing guidance on clinical questions, complex patients, and those not responding to treatment. NPs also

Table 1. Criteria for Acute-Level Admission to the Huntsman at Home Program (HH)

Admission	Criterion
Inclusion	Huntsman Cancer Institute (HCI) inpatient or clinic oncology provider identifies hospital-level acute care needs that can be treated at home through Huntsman at Home (HH) services
	HH admission nurse practitioner agrees that proposed treatment plan is in HH scope
	Patient is aged 18 years or older
	Patient resides within HH service zip codes (20-mile radius of HCI)
	Social, home, and safety assessments demonstrate that the patient has or can be provided adequate resources in their home
	Patient agrees to referral
Exclusion	High risk that condition will deteriorate or may require inpatient intensive care or other hospital-based interventions such as surgery
	Patients who require active medical intervention during overnight hours
	Patients who are unable to self-care or mobilize alone or do not have a capable family or paid caregiver to provide activities of daily living and interact with the HH team
	Social, home, or safety issues that cannot be mitigated
	Patients who would be unable to engage in the treatment plan at home due to active substance misuse, mental health issues, or delirium states
	HH admission capacity has been reached

Source: The authors.

communicated directly with the patient's oncologist to coordinate the treatment plan. The NPs employed by the program had a mixed background of experience; some were experienced oncology NPs, others had acute inpatient experience, and some were experienced in palliative care. All completed the NP training program that emphasized oncology acute care skills.

Clinical staff needed to be comfortable as autonomous providers and able to cope with a work environment that is fast paced, requires flexible scheduling, and deals with multiple complex patients' competing needs. At any given time, there are 5 to 10 acute patients receiving the service. NPs without prior experience in the home or without experience with rapid response to emergent needs may find they prefer to work in a more predictable clinic or setting where there are other team members nearby to provide support. It should be anticipated that there will be some turnover in NPs who try the program but find that the workflow or the independent home setting is not for them. In the first 15 months of clinical operations, about one-third of the NP staff turned over. It is important to provide a supportive working environment where the clinical staff can debrief and attend staff wellness programs.

Staff Training

NPs had a comprehensive orientation that included didactic sessions and shadowing rotations through the inpatient units, oncology clinics, pain clinic, and supportive oncology service. This included cancer symptom management incorporating pharmacological and nonpharmacological interventions, pain management, acute oncology assessment and management of disease progression, and treatment of problems such as bowel obstruction, failure to thrive, and

neutropenic fever. NPs without an oncology background were required to complete the American Society of Clinical Oncology's Oncology 101 Training series. NPs without expertise in palliative care completed the Essential Practices in Hospice and Palliative Medicine learning modules from the American Academy of Hospice and Palliative Medicine. RNs from the contracted home health agency received a week-long training program. This program was provided by the HCI practice educator and assisted RNs in gaining the skills needed to provide acute-level services and meet HCI care expectations. Often, for example, home health RNs do not have sufficient experience with accessing and troubleshooting patients' venous access ports. Consistent training ensured that the expected HCI standard of care was provided for all patients.

> *"While most visits lasted less than 1 hour (after the longer initial assessment, often 90 minutes), occasionally the interventions required multiple same-day visits or extended visits lasting 3 to 4 hours — for example, when managing a pain crisis.*

A lead NP coordinates care in the HH clinical office, orchestrating the daily patient care workflow that begins each morning with virtual rounds. The lead NP also evaluates new referrals; addresses clinical questions from HCI providers, patients, and their caregivers; and coordinates with the home health partner and the NPs out on home rounds.

After intake, patients are seen by an NP for initial assessment and treatment within 2 hours of arriving home. The program protocol includes a first-dose medication kit with fluids and initial-dose intravenous (IV) or oral medications (excluding narcotic drugs), which permits prompt initiation of treatment (such as fluids, antibiotics, and antiemetics). The typical patient has multiple co-occurring symptoms, requiring a systematic approach to address their complex presenting issues. While most visits lasted less than 1 hour (after the longer initial assessment, often 90 minutes), occasionally the interventions required multiple same-day visits or extended visits lasting 3 to 4 hours — for example, when managing a pain crisis. Urgent visits were also provided with a rapid response of less than 2 hours, which is the standard in most hospital at home programs. Figure 1 summarizes the initial referral and acute episode care pathway, including our external partnerships.

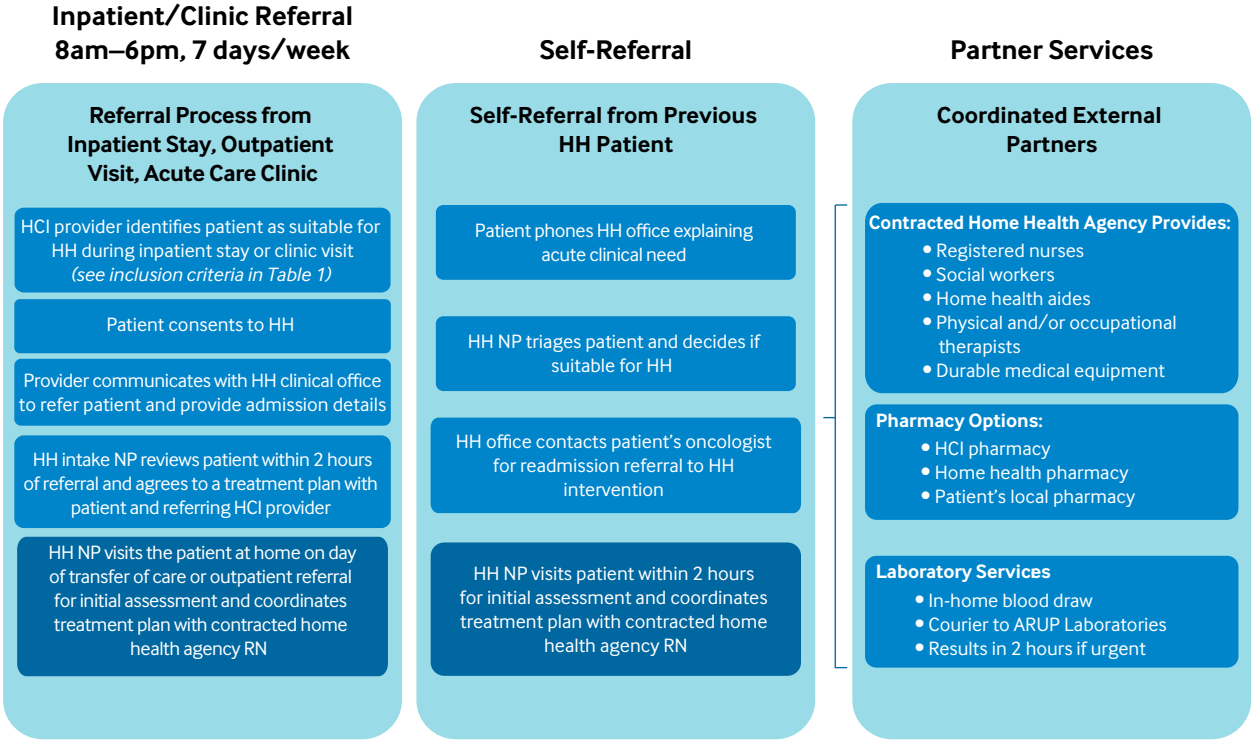
Referral Diagnoses and Care Pathway

In the first 15 months of service (August 2018–October 2019), we provided acute-level hospital at home service to 247 patients. The majority of these admissions were referred from an HCI inpatient admission (68%), and the remaining were outpatient referrals (32%). Patients were on average 62 years of age, 82% were white, 57% were women, and 73% had metastatic disease. Figure 2 presents the cancer diagnoses.

A variety of oncologists from several oncology specialties referred patients, with the majority of inpatient referrals coming from the medical oncology units. Figure 3 illustrates the presenting problems of the patients referred to the program.

FIGURE 1

Care Pathway for Referral and Initial Intake for Huntsman at Home Patients



This figure outlines the initial referral and acute episode care pathway for the hospital at home program for Huntsman Cancer Institute oncology patients, including the external partnerships. ARUP Laboratories = a national nonprofit and academic reference laboratory associated with University of Utah Hospital and Health System clinics, HCI = Huntsman Cancer Institute, HH = Huntsman at Home, NP = nurse practitioner, RN = registered nurse.
Source: The authors

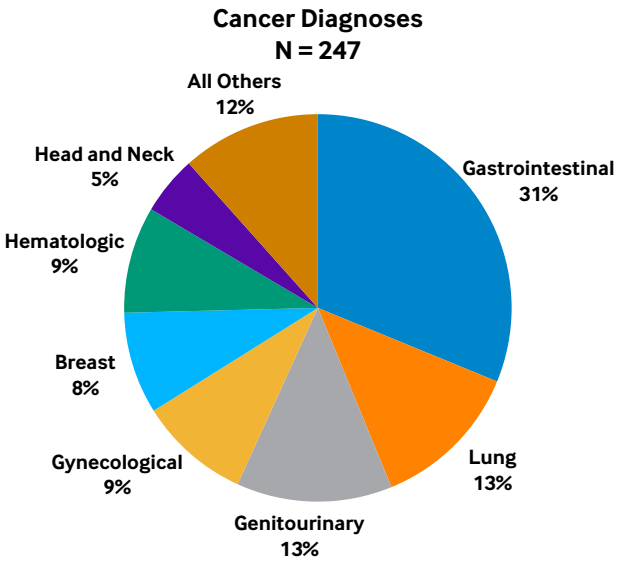
Our experience demonstrates that the common oncology toxicities (pain, nausea and vomiting, neutropenic fever, infections, etc.) can be safely handled with acute-level care in the home. An escalation protocol returned patients to the ED or ACC for evaluation if they could not be stabilized at home. Like other hospital at home programs, we found that the key features were (1) the high acuity, complexity, and frequency of care interventions, (2) the need for a rapid response, (3) the provision of acute-level monitoring and diagnostics, and (4) short-term intense interventions to resolve the acute episode.[12,22] We were able to provide acute-level care to patients with a variety of cancers and acute diagnoses who otherwise would require hospitalization.

> *"On average, patients received intensive acute care for the first 7–10 days, which was based on patient need, generally daily contact by the NP, and daily visits by the RN. Visits were tapered as the patient improved prior to discharge from acute HH.*

FIGURE 2

Cancer Diagnoses of the Initial Acute-Level Huntsman at Home Patients

The oncology hospital at home program served patients with a variety of cancers, primarily solid tumors.



Source: The authors

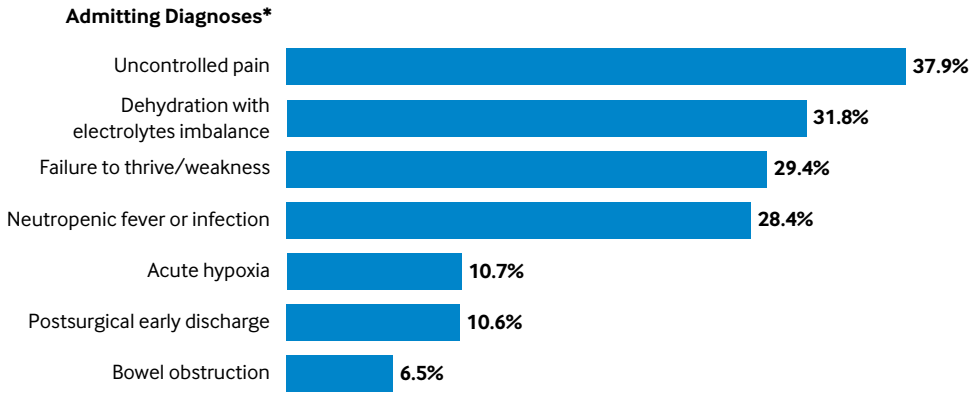
The number of in-person visits by our multidisciplinary team was tailored to patient condition. On average, patients received intensive acute care for the first 7–10 days, which was based on patient need, generally daily contact by the NP, and daily visits by the RN. Visits were tapered as the patient improved prior to discharge from acute HH. Visits were supplemented with telephone calls (back and forth) among patients and/or families, RNs, and NPs to address questions or provide follow-up. Telehealth video visits were available but were not heavily used prior to the Covid-19 pandemic. As the patient's condition improved, visits were tapered and patients were either discharged or transitioned to subacute care within the HH program, with less frequent visits for several weeks to monitor and address symptom exacerbations. We found that for oncology, as opposed to other conditions treated by hospital at home programs, continued subacute monitoring of patients at home after an acute episode was important so the cycle of symptom exacerbation, ED use, and repeat hospitalization did not occur. This was particularly important for those experiencing pain and disease progression.

Showing Early Success

Our health care utilization evaluation of the HH acute-level program was recently published.[23] Our results from this nonrandomized, real-world, propensity-weighted comparison demonstrated the benefit of HH in terms of significant reductions in hospitalizations

FIGURE 3

Admitting Diagnoses of the Initial 247 Acute-Level Huntsman at Home Patients



The primary admitting diagnoses for the oncology hospital at home program were in line with the common diagnoses found on oncology units or that bring people to the ED. *Patients were admitted with multiple acute diagnoses, resulting in a percentage greater than 100%.
Source: The authors

(55% lower), hospital LOS (1.1 days fewer), ED use (45% lower), and costs (47% lower) than the comparison.[23] In response to current health care challenges — including responding to unplanned acute episode needs with hospitals and EDs at capacity, the growing cost of care, and pressure to keep patients with cancer free from nosocomial infection exposure, particularly since the onset of the Covid-19 pandemic — the need for new care delivery innovations, such as hospital at home, has become clear and, furthermore, has the potential to transform care locations out of the brick-and-mortar hospital and clinic into the home.[24] Our initiative has improved our patients' experience, reduced unplanned hospitalizations, improved hospital bed capacity, and lowered ED use. The HH team managed acute oncology conditions that normally would be treated in the hospital. While hospital at home programs have previously reported feasibility and positive outcomes for a variety of conditions, to our knowledge, this is the first description of a program exclusively focused on oncology acute care.[14,19,25]

Hurdles and Lessons Learned

For many health care organizations and providers, hospital at home is a new philosophy of care and requires changes to traditional norms and usual practices; this creates many hurdles to navigate. An innovative spirit and willingness to work through barriers is essential. We discuss several of these hurdles.

Stakeholder Buy-In

Achieving buy-in and strategic support from key stakeholders is essential to the implementation of new approaches to care.[25] Initially, we had strong senior leadership support to establish a

hospital at home program in the greater University of Utah Health system, but a change in leadership required us to rebuild support to move forward and direct our efforts more narrowly to oncology. We built solid working relationships with each patient's primary oncologist and involved key forward-thinking oncologists who were willing to refer patients and collaborate in care. This then promoted good news stories of exceptional HH care that permeated HCI and brought more referrals and enthusiasm for the program. We also had exceptional support from the cancer center senior leadership who spoke about the importance of advancing new models of care and how HH fit within the broader cancer center goals, both scientific and clinical.

NP Recruitment and Retention

Hiring NPs into a new program can be a protracted process, with state licensing, institutional credentialing, and specialty training to ensure confidence in home-based care. It is also important to address, early on, the expectations of the NP role in providing care in the community rather than the usual, more controlled hospital setting. Clinicians who are involved in new programs like HH need to be flexible and adept with a variety of skills to address patient needs immediately (starting an IV or administering an antiemetic, for example), rather than waiting to delegate to the RN and thus delaying care.

Sustainable Reimbursement Models

Addressing the complex care needs of patients who otherwise would be hospitalized is not adequately reimbursed by fee-for-service or traditional home care. Thus, to start a program that is staffed and resourced to provide home-based acute care requires alternate funding resources. We are fortunate to have the support of our generous benefactor with a gift to the Huntsman Cancer Foundation from the Huntsman Family Foundation, plus other foundation support. This has allowed us the time to operationalize the program, gather data about the feasibility of the program, and evaluate the outcomes so we can now work with payers on new valued-based reimbursement models. Other hospital at home programs negotiate payment models with key private payers from the beginning.

> *"Our results from this nonrandomized, real-world, propensity-weighted comparison demonstrated the benefit of HH in terms of significant reductions in hospitalizations (55% lower), hospital LOS (1.1 days fewer), ED use (45% lower), and costs (47% lower) than the comparison.*

In addition, in response to the Covid-19 pandemic, the Centers for Medicare and Medicaid Services (CMS) has developed a Medicare temporary individual waiver for reimbursement of acute hospital at home episodes of care at the same diagnosis-related group rate as a hospitalization.[26] While this waiver expires when the pandemic recedes, this may signal a way forward for consideration of a permanent payment model, which will be necessary for

sustainability. It has resulted in the establishment of a number of hospital at home programs nationally, with more than 142 hospitals using the CMS waiver. Active discussion is underway with the Center for Medicaid and Medicare Innovation to determine a pathway for continuation. Congressional authorization to continue the program is also an avenue. There has been discussion of alternative payment models that might include a 30-day episode of care that extends to provide subacute care after the acute episode. This model may be particularly suited to oncology, in which exacerbations of the acute episode can recur unless symptoms, such as pain, are monitored for a sufficient period of time. A key factor in designing payment models is to examine costs in terms of the intensity of care needed to substitute for a hospitalization rather than begin payment design for modifying routine home health care services. Hospital at home is a modification of site of hospitalization, rather than viewed as frequent home care visits and, therefore, requires appropriate reimbursement.

Introducing a Home-Based Program in a Health System that Has Not Previously Provided Services in the Home

Adapting institutional processes that were designed for inpatient care or clinic visits to home-based care can be challenging. Visiting patients with acute-level needs at home is different from the inpatient setting in which resources are nearby. Not all inpatient processes work well in the home (such as ordering urgent laboratory tests, radiology services, or medication changes). Consideration of operational workflows and home processes must be assessed. Often, creative workarounds are needed. Working with external partners and vendors also adds complexity, with challenges such as incompatible electronic health records, timely communication models between external partners and the HH office and NPs in the field, or timely delivery of the necessary medical equipment.

Cultivating a strong relationship with external clinical partners is essential, with expectations clearly outlined during the contracting process and frequent check-ins to address issues as they arise. External partners often have no experience with the concept of hospital-level care at home or key elements such as 2-hour turnaround time, so it is critical to impart a clear understanding of the model. Clear reimbursement agreements are also needed; for example, when partnering with home health agencies, additional compensation is needed for visits that are beyond the traditional number of reimbursable home health RN visits.

Looking Ahead

Now that we have successfully established HH in our local, urban area, we plan to further expand and evaluate the hospital at home model for oncology. To date, we have not accepted admissions directly from the ED. This is a common, if not the primary, referral pathway for hospital at home programs. We plan to design an admission pathway directly from an ED visit.

Recently, we expanded the HH program to three rural and geographically distant underresourced communities in the southeastern part of Utah that are a 2- to 4-hour drive from HCI. This program includes telehealth, remote monitoring, and on-ground home health staff

with NP in-person visits weekly and telehealth visits otherwise. The program also uses a nurse care manager who helps to coordinate care among the local social resources, local ED, hospital, and primary care medical resources and with the HCI care team. Although the principles of hospital at home remain the same and the response time remains at 2 hours, there is a stronger emphasis on coordinating care and providing acute interventions in the home before the patient rebounds to the local hospital or back to HCI. As a comprehensive cancer center in the Mountain West, HCI serves a vast geographic footprint extending to five surrounding states (Idaho, Montana, Nevada, Wyoming, and parts of Colorado). A key strategic goal is to extend at-home support into geographically distant communities to better address the unique care needs of those with cancer living in rural and frontier communities. Finally, a key to HH sustainability, like other hospital at home programs in the United States, is alternate payment models that more appropriately address program costs. We continue to actively work on these payment policy issues.

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