A new tool to measure acuity in the community: a case study

Edward Baker, Jose Loreto Facultad, Harriet Slade, Geraldine Lee

Edward Baker, Lecturer in Applied Technology for Clinical Care, King's College London, King's College Hospital NHS Foundation Trust

Jose Loreto Facultad, Associate Chief Nurse— Workforce Transformation and Professional Practice, Buckinghamshire Healthcare NHS Trust

Harriet Slade, Clinical Development Matron, @home service, Guy's and St Thomas' NHS Foundation Trust

Geraldine Lee, Reader in Applied Technology for Clinical Care, King's College London

edward.e.baker@kcl.ac.uk

ABSTRACT

The provision of acute healthcare within patients own home (i.e. hospital in the home) is an important method of providing individualised patient-centred care that reduces the need for acute hospital admissions and enables early hospital discharge for appropriate patient groups. The Hospital in the Home (HitH) model of care ensures that this approach maximises patient safety and limits potential risk for patients. As HitH services have seen record numbers of patient referrals in the past 2 years, there is now a greater need to measure and understand the acuity and dependency levels of the caseload. Through an expert clinician development process at one NHS trust, aspects of procedural complexity, interdisciplinary working, risk stratification and comorbidities were used to quantify acuity and dependency. This paper uses a case study approach to present a new method of measuring this important concept.

KEY WORDS

◆ Hospital in the home ◆ Hospital avoidance ◆ Acuity measure
◆ Dependency ◆ Acute care ◆ Community

Accurate measurement of acuity and dependency within all areas of healthcare is an important component of clinical governance and is directly linked with patient safety (Griffiths et al, 2020). There are validated approaches to the measurement of acuity and dependence, which have been developed within the acute inpatient hospital setting and have enabled individual units to describe their patient population more accurately and provided evidence for the workforce requirements within specific areas (e.g. acute medical wards, emergency departments and critical care units) (Vranas et al, 2018; Yiadom et al, 2018; Griffiths et al, 2020). In the community setting, there are unique challenges in understanding and accurately measuring acuity and dependency. This is mainly due to patient complexity owing to the environment and varied patient populations requiring community healthcare (David and Saunders, 2018). Previous studies have attempted to predict hospital readmission using validated tools, but these are not routinely used (Lee et al, 2016; Armitage et al, 2021). Some patients are eligible for management in their own homes rather than having to go to hospital. For these patients, the assessment of acuity and dependency is an extremely difficult but integral component of assessing and managing risk to patient safety (Abrashkin et al, 2019).

The Hospital-in-the-Home (HitH) care model has been piloted internationally in response to the increasing pressures on acute and emergency services across high-income countries. These pressures are measurable through overcrowding in emergency departments, with increased acute and emergency admissions for inpatient management (Lee et al, 2017). This has been associated with an expanding ageing population and the significant contribution of multimorbidity and polypharmacy. The primary aims of the HitH model are to reduce hospital admissions, failed discharge and readmission and the overall hospital length of stay, which has been demonstrated to result in positive health and economic outcomes (Caplan et al, 2012; Gonçalves-Bradley et al, 2017; Dowell et al, 2018). By effectively managing acute illness within the community setting for vulnerable populations, the risk of nosocomial infections (those originating from within the hospital setting) and complications, such as delirium, can be minimised (Dowell et al, 2018), although HitH should not be used purely to reduce emergency department attendances (Pickstone and Lee, 2019).

Since the COVID-19 pandemic, there has been increased awareness of hospital admission avoidance for these patient groups. This, alongside an exponential increase in HitH management of acutely unwell COVID-19-positive patients, has resulted in a surge in the use of HitH and an improved understanding of the importance of acute care provision in the community setting among clinicians in both primary and secondary care setting (Lee and Titchener, 2017; Pericàs et al, 2021). This article will use a case study to present a novel approach for measuring patient acuity in the community, which was developed the at Guy's and St Thomas' NHS

Foundation Trust in London. This measure is employed within the clinical setting within the organisation, and this article will provided an overview of the content and potential benefits to both staff and patients.

Case study: part 1

A referral was made by a patient's GP after virtual review. The patient is a 79-year-old woman, whose case is presented below.

Presenting complaints and history

A 79-year-old woman was referred to the @home service with increased shortness of breath which the GP considered likely to be secondary to an exacerbation of decompensated heart failure. During the virtual GP consultation, the patient was completing full sentences, but had increased respiratory workload. Her past medical history included:

- Left ventricular diastolic dysfunction
- Hypertension
- Dementia
- Chronic obstructive pulmonary disease (COPD)
- Chronic kidney disease (CKD) (stage 3)
- Type 2 diabetes.

She had no previous surgical history. Her drug history was as follows:

- Ramipril 2.5 mg (once daily)
- Bisoprolol 5 mg (once daily)
- Salbutamol inhaler (PRN)
- Tiotropium inhaler (x2 puffs, once daily)
- Carbocisteine 375 mg (Four times daily)
- Gliclazide 60 mg (Once Daily)

She had been fully vaccinated against COVID-19 in March 2021 and had no known drug allergies. In terms of her social circumstances, the patient lives alone and has no social services or private care support. The patient's family is local and is actively involved in her social care. Despite this, there was a potential need for equipment assessment during the care episode.

The patient's GP discussed the potential need for hospital admission with the patient, who was continuing to self-isolate with her family bubble at home and remained very concerned about the potential risk of contracting COVID-19 if admitted to hospital. The GP believed that the patient was suitable for @home management and requested an urgent assessment.

Guy's and St Thomas' @home service

The HitH model has develop substantially since its early conception in the UK, where it was first trialled by Guy's and St Thomas' NHS Foundation Trust in 2013. There have been misconceptions among clinicians regarding the aim and scope of the HitH model, where it was believed that the service primarily facilitated hospital admission avoidance among older adults. The service has the potential to support any patient over the age of 18 years living within specific geographical boundaries in south London. These patients, who often have a potential need for acute hospital admission or ongoing acute medical needs after discharge from hospital, can be referred to the @home service for assessment and review. The service keeps acute patients out of hospital or allows for rapid hospital discharge by treating them in their residence (Lee et al, 2015; Lee and Titchener, 2017; Lee et al, 2017).

The service provides short-term intensive episodes of care within the patient's home environment, and eligibility is broad, including a wide range of complex and acute conditions, including heart failure, deep vein thrombosis, urinary tract infections, falls, COPD, unstable diabetes, hyperemesis gravidum, post-operative surgery and dehydration (Lee et al, 2015; Lee and Titchener, 2017; Lee et al, 2017). It also enables acute hospital treatment for patients who may be unable to leave their home due to emotional or mental health problems (e.g. agoraphobia or acute/chronic mental illness) or because they are isolating due to COVID-19 (Baker and Clark, 2020).

Patients are referred to the @home service through primary care, community nursing teams, secondary care hospitals and from the social care setting (Lee and Titchener, 2017). The audited target response time from referral to urgent assessment is 2 hours. During this rapid response assessment, the clinician (normally, a nurse with advanced physical assessment skills) will collect assessment data, formulate a diagnosis and plan, initiate treatment and evaluate the care episode. There are nuances between this advanced clinical practice (ACP) role and other advanced community nursing roles like the community matron model, particularly in the autonomous management of complexity. The key difference between these roles is the need for practitioners to autonomously manage acute illness within the patient's own home.

Through the integrated model, the @home team response can include nursing, physiotherapy, occupational therapy and medical care provided by specialist consultants and @home GPs. The care pattern can be maintained over a 3–7-day period, with up to four visits a day depending on the acuity and dependency needs of the patient. This approach enables technical aspects of acute care, including medication titration with monitoring at home, administration of intravenous and subcutaneous fluids and medications, provision of nebulisers and home oxygen therapy, physiotherapy and occupational therapies, as well as environmental and safeguarding checks, including social care assessments. The service runs over a rolling 24-hour period 365 days a year, which enables clinicians to provide proactive care of complex and acute conditions outside the hospital setting using methods that maximise patient autonomy while mitigating potential risks to individual safety (Lee and Titchener, 2017). It also promotes a shared decision-making approach to patient care, involving patients and their families, which is an important aspect of the programme (Hendriks and Lee, 2020).

Workforce organisation and leadership

The @home service is primarily led by senior nurses with acute care experience who are educated to a master's degree level in ACP or who are undertaking this programme of study. The ACP programme requires clinicians to have training in physical assessment, clinical decision making and independent and supplementary prescribing (Dover et al, 2019). These core skills enable the team to support patients with complex needs, comorbidities and polypharmacy (Lee et al, 2017;

Raleigh and Allan, 2017). A previously published integrative review of the literature underpinning the HitH care model highlighted the importance of advanced practice skills with experience of acute care provision to enable assessment, decision making, evaluation and escalation for potentially critically unwell patients (Gray et al, 2018). The @home team is interdisciplinary, and nurses work alongside physiotherapists, occupational therapists, ambulatory services, doctors and social services to provide holistic care. The service is distinct although complementary to district nursing in its focus on episodic acute care (Lee et al, 2015).

Case study: part 2

The referral was accepted from the patient's GP, which initiated a cascade for assessment and treatment processes for this patient while she remained in her own home environment. As part of this process, the patient received assessment within 2 hours of referral by a registered nurse with advanced practice skills who was able to assess her, make a diagnosis and formulate a management plan.

Brief overview of physical examination findings

The patient weighed 84 kg (she had been last weighed by her GP 3 months previously, when she weighed 76 kg). The patient was found at home, sitting in an upright padded chair. She reported having slept in the chair for the past two nights due to dyspnoea, which was worse on exercise and when lying flat. Her hands and arms at the peripheries were cool and slightly clammy, consistent with hypoperfusion. No cyanosis, finger clubbing or nicotine staining was found.

She had no jaundice to the sclera and normal pallor to the conjunctiva. No xanthoma was observed. The patient wears dentures. Her oral mucosa was healthy, and she had no halitosis. Her jugular venous pressure was raised (around 8 cm), and she had no lymphadenopathy. She had no haematoma, wounds, scars, deformity, erythema or lesions on the thorax. The shape of the thorax was normal (estimated anterior/transverse diameter). However, the patient had an increased rate and workload of breathing.

On palpation, equal bilateral expansion (posterior and anterior surface) was noted. No tenderness, crepitus or deformity was detected on gentle palpation, and no heaves or thrills were noted. On percussion, normal resonance was detected throughout. On auscultation, equal bilateral air entry was noted, but crackles were heard in the bilateral bases. Her heart sounds were S1+S2+0.

The patient's abdomen was soft but non-tender, and bowel sounds were present. Her bowels had opened as normal that day. She reported normal oral liquid intake but reduced food intake over the past 5 days.

In terms of the neurological examination, the patient was alert and oriented to time and place. She had normal power in all four limbs; her pupils were equally reactive to light and were 3 mm bilaterally.

Bilateral ankle oedema to the level 10 cm above the medial malleolus was found bilaterally. The patient was fully mobile. Her observations were as follows:

- Respiratory rate: 26 breaths per minute
- SpO_2: 94% in room air
- Pulse: 93 beats per minute
- Blood pressure: 146/103 mmHg
- Temperature: 36.2°C
- National Early Warning Score 2 (NEWS2): 5
- Clinical Frailty Scale (CFS) score: 6

Care plan

On the basis of the assessment, the following care plan was devised by the nurse. Initially, the patient would three visits daily for monitoring and evaluation of clinical care and progress. An intravenous cannula would be inserted for collection of blood samples for haematology and biochemistry. A 12-lead ECG would be recorded with continuing physiological monitoring during visits. Intravenous diuretics were prescribed to be supplied by the pharmacy. The patient was started on intravenous diuretics twice daily with twice daily patient review, with a plan in place to switch to oral diuretics when clinically appropriate. She was referred to the local community heart failure specialist service, and the nurse liaised with the patient's primary care provider for continuing care management.

Fluid overload is a commonly seen symptom of decompensated chronic heart failure. In the past 10 years, there has been a growing evidence base to demonstrate the likely benefits of intravenous diuretic management in the patient's own home (Ahmed et al, 2021; Halatchev et al, 2021). Evidence suggests that diuretic therapies have a beneficial effect on mortality, morbidity and determinants of health-related quality of life (Faris et al, 2016). The key symptoms for these patients include breathlessness, weight gain, and oedema (Banerjee et al, 2012). Management of the symptoms of exacerbated chronic heart failure within the community setting reduces hospital admissions while providing improved patient experiences in many cases. Acute exacerbations of chronic heart failure are routinely managed within the HitH care model with closely monitored pathways to ensure that evidence-based treatments are provided and risks to patient safety are recognised and managed (Lee and Titchener, 2017).

Development of the acuity and dependence measure

A working group was established to coordinate this quality improvement project, and local approvals were obtained to complete this work from Guy's and St Thomas' NHS Foundation Trust. The final completed acuity and dependency measure is presented in *Tables 1* and *2*.

A brief review of the existing literature and evidence base identified a paucity in both empirical and opinion-based data pertaining to acuity and dependency tools in both the community setting and specifically relating to the HitH model of care. Despite this, there was evidence to suggest that there were potential economic benefits associated with a greater understanding of patient acuity and, ultimately, the workload of the interdisciplinary team (Shepperd et al, 2021). The literature highlights the importance of enabling the workforce to assess their own workload and suggested that involving experienced members of the workforce in developing the

Table 1. The acuity and dependency measure

Care acuity scale	Considerations
Tier 1 Patients require acute clinical care and intervention wherein their needs are met through routine @ home care of once daily visit, that is, clinical reviews, pressure area care, phlebotomy and once-daily patient observations	• NEWS2=0 or within normal threshold • CFS score=5 (mildly frail) • Confused patients not at risk. CAM negative • Patient waiting for review and ready for discharge • Blood assays monitoring • Analgesia and pain management • ECG monitoring to establish cardiac stability • Pharmacist[s] review not requiring a visit • Uncomplicated post-operative procedure care, such as daily review of wound site to include dressing • Administration of a single type of IV antibiotic on once-a-day frequency • Administration of once-daily IV diuretics • Waterlow score=<15 (low risk of developing a pressure ulcer) • Once-daily support/assistance or prompting in taking medications • Patients who are fully independent in performing activities of daily living or require minimal assistance/one person to mobilise, who experience occasional incontinence that can be supported during the routine once a day visit • With or without existing package of care provided by external agency
Tier 2 Patients requiring interventions that are more than the routine at-home care and up to twice daily visits. Clinically stable condition, with a potential to deteriorate	• NEWS2=1–4 (low risk level with potential for escalation if required) • CFS score=6 (moderately frail) • Mild dementia • Increased level of observations and therapeutic interventions necessitating twice daily visits from registered clinicians • Pharmacist review and visit required, taking actions to help resolve complex medicines management issues • Waterlow score=16–22 (high risk, with or without grade 1 pressure ulcer up to grade 2) • Administration of multiple types of IV antibiotics up to twice-a-day frequency • Nebulisation regime weaned down to twice daily • Administration of twice-daily IV diuretics • Twice-daily intermittent IV fluid boluses with or without an overnight subcutaneous fluid infusion • Increase in dependency to perform most ADLs, needing assistance up to twice daily, single-handed package of care initiated by @home service • Twice-daily medication support/assistance or prompting • At risk of falls—mobility, transfer and/or repositioning difficulties requiring the assistance of one person for up to twice daily • Home exercise programme (HEP) to optimise physical rehabilitation • Provision of basic transfers and mobility aids • Facilitating a complex discharge • Requires mental health review with or without onward follow-up

NEWS=National Early Warning Score; CFS=Clinical Frailty Scale; ADLs=activities of daily living; IV=intravenous; CAM=Confusion Assessment Method

measure would result in the tool with great potential for effective implementation and acceptance in clinical practice (Kidd et al, 2014).

The acuity and dependence measure was developed by one of the authors (JF) with support clinicians within the service, who combined aspects of previous validated measurement tools from within the acute sector, including the CFS (Rockwood et al, 2005) and the Safer Nursing Care tool (The Shelford Group) (Griffiths et al, 2020). The content of these measures is summarised in *Table 3* to demonstrate how each contributes to the final acuity and dependency measure. The components of these tools were integrated with experiential learning from 3 years of activity undertaken by the @home service, focusing on the complexities in care provision, patients' psychosocial needs, home adaptations required in acute care provision and the multiple layers of interprofessional working required to co-ordinate medical and nursing care in the patient's own home (Kidd et al, 2014). The final measure was reviewed internally and approved for use in clinical practice after a process of internal validation on a sample of 173 patients managed by the @home service. This internal review concluded that the acuity and dependency measure appropriately identified the complexity and acuity levels of patients requiring care within the HitH care model. The findings impact the wider workforce planning, workload allocation and scheduling of additional clinical reviews for patients with higher or escalating acuity scores. Overall, having a greater understanding of the evolving workload enables improved and more effective care provision across the service.

The acuity and dependency measure

Table 1 presents the acuity and dependency measure that has been developed and implemented in clinical practice at Guy's and St Thomas' NHS Foundation Trust. The measure grades acuity and dependency based on four tiers, with tier 4 being the highest level of acuity and dependency within each category. There are four categories included:

Table 1 (contd). The acuity and dependency measure

Care acuity scale	Considerations
Tier 3 More frequent clinical reviews and/or interventions with visits up to three times daily Acutely unwell patients with increased dependency in care who are clinically unstable with a greater potential to deteriorate	• NEWS=≥5 or a score of 3 in one or more parameters (medium risk level requiring senior clinician review and/or escalation of care to hospital admission) • CFS score=7 (severely frail) • Moderate dementia • Out-of-hospital referrals (ambulance service, GP and other community services) requiring urgent response and/or immediate therapeutic intervention within 2 hours • Acute fluctuating confusion state who are at risk. CAM positive • Management of severe infection and potential for sepsis • Intermittent IV fluid infusion to a maximum of 4 hourly, i.e. hyperemesis and hypercalcaemia • Complex IV antibiotics regime including multiple types of IV antibiotics, those requiring more time to prepare, longer administration period and/or administration of up to three times per day • Patients on oxygen weaning regime/protocol • Nebulisations four times per day or weaned down to three times daily • Waterlow score=>23 (very high risk of pressure damage with pressure ulcer of grade 3 and above) • Daily chest physiotherapy review to include sputum clearance and on-going pulmonary rehab • Provision of three times daily single-handed package of care with or without some elements of a micro-environment set-up • Provision of advanced transfers and mobility aids, i.e. gutter frames, two-wheel walkers, bariatric equipment, rota stand • At risk of falls requiring daily functional and mobility physiotherapy with or without occupational therapy inputs • Three times daily medication support/assistance or prompting
Tier 4 May be managed within the existing resources, clinical expertise and staffing level. Patient with advanced care plan/ceiling of care to be provided in usual place of residence. May require hospital admission for further escalation of care	• NEWS2=7 or more (trigger point reached, high risk requiring further escalation—hospital admission) • Deteriorating • CFS score=8 (severely frail) • Severe dementia • Fluctuating mental capacity refusing hospital admission • Clinical co-ordination will take up to at least 2 hours to consolidate a multi-professional care plan to keep the patient safe in their usual place of residence • Treating reversible causes for EoL patients progressively deteriorating • Increased care support in performing ADLs up to four times a day, single-handed package of care that can potentially increase to double handed • Mobility, transfer and/or repositioning difficulties requiring the assistance of two persons for up to four times a day • Provision of highly advanced transfers and mobility aids, i.e. hoists • Micro-environment set-up in place or needed • Ongoing input from specialist services (palliative care team and/or community EoL regarding priorities of care)

NEWS=National Early Warning Score; CFS=Clinical Frailty Scale; EoL=end of life; ADLs=activities of daily living; IV=intravenous; CAM=Confusion Assessment Method

1. Procedural complexity
2. Interdisciplinary team involvement
3. Risk stratification
4. Presenting complaints and comorbidities.

There is a clear inter-relationship between these factors, whereby each has an impact on the other three. The @home service identified how, in combination, these four variables comprehensively described the acuity and dependency of this patient population. *Table 2* presents the completed measure broken down using categories and tiers. The following section briefly provides an overview of the key components of each category.

Procedural complexity

Some patients require multiple daily visits to maintain the required treatment and evaluate and identify the risk of clinical deterioration. Examples of procedural complexity include administration of intravenous (IV) medications and fluids up to four times daily, trial without catheter after the removal of a urinary catheter and multiple therapy sessions among others. Changes to the patient's clinical condition or social situation could trigger additional unplanned visits, which would impact the workload and availability of staff within a shift.

Interdisciplinary team involvement (workforce and workload)

In the HitH service, daily allocation of patient caseloads to clinicians is determined by the clinical condition and complexity of patients' medical and social needs (Lee and Titchener, 2017). The workload is distributed in equal numbers among clinicians working 11-hour shifts throughout the day (08:00–23:00), with no overnight service. The service has the capacity to manage up to 60 patients per day, and this is allocated evenly to eight clinicians working across at 11.5-hour shift pattern over 365 day per year.

As well as the existing and established patient workload, there are other factors that impact the interdisciplinary team composition and service capacity. These include:

Table 2. The acuity and dependency measure divided by components

	Tier 1	Tier 2	Tier 3	Tier 4
Procedural complexity	• 12-lead ECG • Antibiotic administration (one daily) • Collection and review of blood test results • Virtual/telephone patient care review	• Complex wound/ pressure area care • Nebulised medication (up to twice daily) • Antibiotic administration (prescription for twice daily administration) • Social help/package of care or medication prompting (twice daily) • HEP • Complex discharge • Shared care	• IV antibiotic administration (three times per day) • Increased falls risk with advanced transfers • Nebulisers (three or four times per day) • Complex antibiotic therapies (more than one agent) • IV fluid administration • Management of infection with increased risk of developing sepsis	• ACP • Potential requirement for hospital admission/ escalation of care • Medication administration (four times daily) • Requires two persons for safe transfer • Requires a hoist for transfer • Microenvironment set-up/organisation
Interdisciplinary team involvement (workforce and workload)	• Single clinical support worker visit • Single registered professional visit • Virtual pharmacy review	• More than one professional visiting each day • Face-to-face pharmacy visit • Mental health review during care/follow-up	Ambulance/GP 2-hour response requested Therapies review (three times daily) Respiratory physiotherapist review required	Ongoing specialist input (e.g. palliative care, community respiratory care team)
Risk stratification	NEWS2=0 CFS score=≤5	NEWS2=1–4 Waterlow score=10–22 Falls risk assessed and identified CFS score=≤6	NEWS2=5–6 or 3 in any one parameter Waterlow score=>22 Acute delirium/CAMS positive CFS score=≤7	NEWS2=>7 CFS score=≤8
Presenting complaints and comorbidities	Patient presentation within scope of the @home team	Immunocompromised patient	• Exacerbation of heart failure with two or more comorbidities • Exacerbation of COPD with two or more comorbidities • Positive for COVID-19	Clinical deterioration at home Fluctuating mental capacity EoL care

NEWS2=National Early Warning Score 2; CFS=Clinical Frailty Scale; CAMS=HEP=home exercise programme; ACP=advance care planning; EoL=end of life

- New patient referrals received throughout the day with a the required 2–4-hour initial consultation benchmark
- Complexity introduced from a combination of medical, mental health, therapy-related and social care problems
- Acuity in a patient's clinical presentations (including but not limited to cognition, level of functional therapy required and the increasing demand from early hospital discharges and admission avoidance referrals).

These factors result in daily workforce challenges, particularly around fair caseload allocation, whereby the acuity and dependency of the workload is matched between clinicians and considers the knowledge, clinical skills and experience of the practitioners working on a shift (Kidd et al, 2014). There are potential negative impacts when allocation of acuity and dependency is not done using these methods, including:

- Reduced quality of care provided to patients
- Poor time keeping and untimely patient visits
- Poor staff morale and increased worker sickness.

Risk stratification

The broad variety of acute medical presentations and the varying levels of complexity in patients makes managing the clinical caseload within the HitH model of care extremely challenging (Facultad and Lee, 2019). The @home team will normally take complete responsibility for the medical care of patients requiring acute care within their own home, which means that evidence-based decision making is key to managing the potential risk for patient deterioration. In the hospital setting, clinicians use the validated National Early Warning Score 2 (NEWS2) to monitor acutely ill patients.

Table 3. Influential tools in the development of the acuity and dependency measure

Tool	Key components
Safer Nursing Care Tool (Griffiths et al, 2020)	This tool is based on the critical care patient classification (Comprehensive Critical Care; Department of Health and Social Care, 2000) and has been adapted to support acuity measurement across a wide range of acute ward-based care areas. The specified levels of care include: • Level 0: patient care needs are met through normal ward-based care (e.g. patient awaiting discharge) • Level 1a: patients are acutely unwell requiring intervention or unstable with a greater potential to deteriorate (post-operative care provision) • Level 1b: in a stable condition but dependent on nursing care to perform most/all ADLs • Level 2: managed within specialist care areas with specialist nursing care in a critical care unit or designated area for high-dependency care (e.g. coronary care unit or high-dependency unit) • Level 3: needing advanced multi-organ support in a critical care setting (e.g. respiratory support with or without monitoring for multi-organ support requirements)
NEWS2 (Brangan et al, 2018; Inada-Kim et al, 2020; Pullyblank et al, 2020)	This tool is a systematic method for risk stratification for patient deterioration advocated by the Royal College of Physicians. The score converts the patient's vital signs to a physiological score, which equates to their risk of deterioration considering factors including normal oxygen saturation level and current oxygen requirement. NEWS2 has also standardised the required frequency of patient monitoring and the expected clinical response to abnormal physiological status. • NEWS2 0: monitoring every 12 hours at a minimum; continue to monitor • NEWS2 1–4: 4–6 hourly monitoring at a minimum; registered nurse to assess and decide on the need for escalation • NEWS2≥5: 1 hour monitoring at a minimum; registered nurses to escalate to medical team responsible for the patient • NEWS2≥7: continuous monitoring of vital signs; registered nurses to escalate to medical team and critical care outreach
Clinical Frailty Scale (Rockwood et al, 2005; David and Saunders, 2018; Cubitt et al, 2019)	This score was designed to briefly summarise the results of the Comprehensive Geriatric Assessment. The measure is based on a 9-point scale. The following summarises the scoring levels: • 1 – very fit: people who are active, energetic, and motivated • 2 – well with symptoms: people who have no active disease but are less fit • 3 – managing well: people whose medical problems are well controlled but have limitations in more vigorous exercise • 4 – vulnerable: symptoms from disease processes may limit activities, but the person is not dependent on others • 5 – mildly frail: people with more evident slowing requiring greater support with higher-functioning ADLs • 6 – moderately frail: people who need help with all outside activities and with keeping hours, bathing and climbing stairs • 7 – severely frail: completely dependent for personal care but not at risk of dying within 6 months • 8 – very severely frail: completely dependent, approaching the end of life • 9 – terminally ill: people approaching the end of life (life expectancy<6 months)

NEWS2=National Early Warning Score 2; ADLs=activities of daily living

The purpose of this risk stratification score is to achieve a standardised approach to the identification, escalation and management of clinical deterioration in acutely unwell adults within the community setting (Brangan et al, 2018). The score aims to enable global improvements in patient safety and improve measurable patient outcomes and is used across the NHS in the UK (Inada-Kim et al, 2020). At present, within the HitH model, no equivalent risk stratification score has been identified to support the management of risk within the community setting, but there is evidence to support use of the NEWS2 risk stratification score within the community setting (Pullybank et al, 2020). The score has been integrated into the measurement of acuity and dependency and is associated with an escalation policy which meets the needs of acutely unwell patients being managed within their own homes. The score in the context of the acuity and dependency score enables decision making and allocation of patient care, with evidence of the patient's risk of deterioration, within the HitH model (Pullyblank et al, 2020). Additional risk stratification scores have been embedded within the measure, including a CFS score (Rockwood et al, 2005), falls assessment and Waterlow pressure area scoring (Charalambous et al, 2018).

Presenting complaints and comorbidities

In HitH care, several important risk factors were identified related to patients presenting conditions and associated comorbidities in patients (Federman et al, 2018). During the development process, this factor was deemed to be important by the expert development group. Specific presenting complaints—COPD and heart failure—were identified, which carried an increased risk of rapid and significant deterioration over a relatively short period of time; this, in turn, adds further risk when these patients are managed at home (Ural et al, 2015; Shin et al, 2019). For both conditions, the presence of multimorbidity has been evidenced to increase the complexity of care required, and this has been recognised within the final acuity and dependence measure (Ploeg et al, 2017). Additional sources of complexity and risk were identified, including immune compromisation and the associated risk of complications from infection, end of life (EoL), intermittent mental capacity and COVID-19 infection (Butler et al, 2018; Pericàs et al, 2021).

Case study: part 3

The acuity and dependency measure was used to assess the patient described in this case study, and she was classified as being in tier 3 based on the score. The scoring was conducted by the nurse in charge of the shift in collaboration with the clinicians directly responsible for the patient's care. The rationale for this decision is presented below.

- The patient was acutely unwell with increased dependency on care. She had the potential to be clinically unstable and deteriorate further
- The patient had an acute-on-chronic exacerbation of heart failure with two or more associated comorbidities (COPD, type 2 diabetes, hypertension and CKD)
- The patient was reviewed and re-scored using the measure over the course of 3 consecutive days, but remained in tier 3 due to the complexity of an acute-on-chronic condition, the twice daily administration of IV medications and the potential for clinical deterioration.

On day 4, there was a marked improvement in the patient's physiological signs and blood work. Her observations were as follows:

Respiratory rate: 17 breaths per minute
SpO_2: 98% in room air
Pulse: 78 beats per minute
Blood pressure: 128/72 mmHg
Temperature: 36.0°C
NEWS2: 0
CFS score: 3

The patient's rate and work of breathing was substantially reduced and back to baseline. Similarly, her weight had returned to near baseline (78 kg), and the lower limb oedema had reduced. The patient was switched to oral diuretics after additional investigations (repeat routine blood tests focusing on electrolytes and renal function and 12-lead ECG recording). At this point, the patient was deemed suitable for referral back to their primary care provider with follow-up with the community heart failure team.

Informal internal evaluation

The acuity and dependency measure underwent a process of information internal evaluation within the @home service, and the overall feedback was positive. The tool has been effectively implemented in routine clinical practice and accepted by staff as an appropriate method of quantifying their workload. Staff involved in the internal evaluation highlighted the benefits of prospectively monitoring acuity and dependency using the measure on a shift-by-shift basis. Furthermore, from an organisational point of view, managers in the team identified the benefits associated with retrospectively looking at the past month's workload in modelling the likely profile of future patients being managed by the team. Initially, there was some resistance to the frequency of scoring patients from shift leaders, as this was felt to be a time-consuming process. However, with time and experience, these clinicians became comfortable in applying the tier content to patients, particularly as these scores proved useful in justifying staffing requirements for the service. The @home team recognised the need to further validate the measure using quantitative methods. Now, there is a plan to firmly embed a regular audit of the measure in clinical practice as part of a wider analysis of healthcare provision by the @home service.

Conclusion

The paucity of evidence on the impact and evaluation of acuity and dependency within the community setting—and, more specifically, within the HitH care model—highlights the importance of developing and integrating a quantitative measurement tool into clinical practice. Previously, HitH services relied on measuring patient volume, numbers of direct and indirect patients contacts and the types of clinical activities required to determine the appropriate staffing and caseload allocation. The acuity and dependency measure presented in this article has been shown to appropriately measure complexity and acuity of patients requiring care within the HitH care model in one clinical organisation in the UK. Use of the measure has been found to positively impact staff support, workload allocation, scheduling of additional clinical reviews for patients with higher acuity levels and the effectiveness of care delivery. It is recommended that adjustments in staffing as a result of the tool will improve both patient and staff satisfaction, as well as result in measurable improvements in the quality of care provided by the service. **BJCN**

Accepted for publication: September 2021

Declaration of interest: none

Abrashkin KA, Poku A, Ramjit A et al. Community paramedics treat high acuity conditions in the home: a prospective observational study. BMJ Support Palliat Care. 2019. https://doi.org/10.1136/bmjspcare-2018-001746

Ahmed FZ, Taylor JK, John AV et al. Ambulatory intravenous furosemide for decompensated heart failure: safe, feasible, and effective. ESC Heart Fail. 2021. https://doi.org/10.1002/ehf2.13368

Armitage MN, Srivastava V, Allison BK, Williams MV, Brandt-Sarif M, Lee G. A prospective cohort study of two predictor models for 30-day emergency readmission in older patients. Int J Clin Pract. 2021; 75(9):e14478. https://doi.org/10.1111/ijcp.14478

Baker E, Clark LL. Biopsychopharmacosocial approach to assess impact of social distancing and isolation on mental health in older adults. Br J Community Nurs. 2020; 25(5):231–238. https://doi.org/10.12968/bjcn.2020.25.5.231

KEY POINTS

- Assessing acuity and dependency is an important component of understanding the workload and managing risk in the hospital in the home (HitH) care model
- Tools for measuring acuity and dependency have been developed specifically for use in the secondary care sector and are not easily adaptable to meet the needs of patients receiving acute care at home
- A service providing acute care in the home developed a measurement tool specifically for use within the HitH care model, which considers aspects of procedural complexity, interdisciplinary working, risk stratification and complaints and comorbidities to quantify acuity and dependency
- For acutely unwell patients with complexity who are managed in the community setting, daily scoring using this method enables workforce leaders to alter allocation, assess risk and monitor changes in patient acuity and dependency over time

CPD REFLECTIVE QUESTIONS

- Reflect on how confident you feel about managing high-acuity patients within their own homes. What are the key challenges for nurses in the community when managing acutely unwell patients?
- What factors do you consider when assessing the acuity and dependency levels of your own workload?
- What local education resources are available to help you develop your assessment skills in the management of acutely unwell patients?
- How could you implement this acuity measure into your daily practice to help quantify the acuity of your workload?

Banerjee P, Tanner G, Williams L. Intravenous diuretic day-care treatment for patients with heart failure. Clin Med (Lond). 2012; 12(2):133–136. https://dx.doi.org/10.7861%2Fclinmedicine.12-2-133

Brangan E, Banks J, Brant H, Pullyblank A, Le Roux H, Redwood S. Using the National Early Warning Score (NEWS) outside acute hospital settings: a qualitative study of staff experiences in the West of England. BMJ Open. 2018; 8(10):e022528. https://doi.org/10.1136/bmjopen-2018-022528

Butler C, Brigden C, Gage H et al. Optimum hospice at home services for end-of-life care: protocol of a mixed-methods study employing realist evaluation. BMJ Open. 2018; 8(5):e021192. https://doi.org/10.1136/bmjopen-2017-021192

Caplan GA, Sulaiman NS, Mangin DA, Aimonino Ricauda N, Wilson AD, Barclay L. A meta-analysis of "hospital in the home". Med J Aust. 2012; 197(9):512–519. https://doi.org/10.5694/mja12.10480

Charalambous C, Koulori A, Vasilopoulos A, Roupa Z. Evaluation of the validity and reliability of the Waterlow Pressure Ulcer Risk Assessment Scale. Med Arch. 2018; 72(2):141–144. https://doi.org/10.5455/medarh.2018.72.141-144

Cubitt M, Downie E, Shakerian R, Lange PW, Cole E. Timing and methods of frailty assessments in geriatric trauma patients: a systematic review. Injury. 2019; 50(11): 1795–1808. https://doi.org/10.1016/j.injury.2019.07.026

David A, Saunders M. The use of acuity and frailty measures for district nursing workforce plans. Br J Community Nurs. 2018; 23(2):86–92. https://doi.org/10.12968/bjcn.2018.23.2.86

Dover N, Lee GA, Raleigh M et al. A rapid review of educational preparedness of advanced clinical practitioners. J Adv Nurs. 2019; 75(12):3210–3218. https://doi.org/10.1111/jan.14105

Dowell S, Moss G, Odedra K. Rapid response: a multiprofessional approach to hospital at home. Br J Nurs. 2018; 27(1):24–30. https://doi.org/10.12968/bjon.2018.27.1.24

Facultad J, Lee GA. Patient satisfaction with a hospital-in-the-home service. Br J Community Nurs. 2019; 24(4):179–185. https://doi.org/10.12968/bjcn.2019.24.4.179

Faris R, Flather M, Purcell H, Poole-Wilson P, Coats A. Diuretics for heart failure. Cochrane Database Syst Rev. 2016; 4:CD003838. https://doi.org/10.1002/14651858.CD003838.pub4

Federman AD, Soones T, DeCherrie LV, Leff B, Siu AL. Association of a bundled hospital-at-home and 30-day postacute transitional care program with clinical outcomes and patient experiences. JAMA Intern Med. 2018; 178(8):1033–1040. https://doi.org/10.1001/jamainternmed.2018.2562

Gonçalves-Bradley DC, Iliffe S, Doll HA et al. Early discharge hospital at home. Cochrane Database Syst Rev. 2017; 6:CD000356. https://doi.org/10.1002/14651858.cd000356.pub4

Gray E, Currey J, Considine J. Hospital in the home nurses' assessment decision making: an integrative review of the literature. Contemp Nurse. 2018; 54(6):603–616. https://doi.org/10.1080/10376178.2018.1532802

Griffiths P, Saville C, Ball J, Culliford D, Pattison N, Monks T. Performance of the Safer Nursing Care Tool to measure nurse staffing requirements in acute hospitals: a multicentre observational study. BMJ Open. 2020; 10(5):e035828. https://doi.org/10.1136/bmjopen-2019-035828

Griffiths P, Saville C, Ball J, Jones J, Pattison N, Monks T; Safer Nursing Care Study Group. Nursing workload, nurse staffing methodologies and tools: a systematic scoping review and discussion. Int J Nurs Stud. 2020; 103:103487. https://doi.org/10.1016/j.ijnurstu.2019.103487

Halatchev IG, Wu WC, Heidenreich PA et al. Inpatient versus outpatient intravenous diuresis for the acute exacerbation of chronic heart failure. Int J Cardiol Heart Vasc. 2021; 36:100860. https://doi.org/10.1016/j.ijcha.2021.100860

Hendriks JM, Lee G. Shared decision-making: the patient on the forefront of care coordination. Eur Heart J Qual Care Clin Outcomes. 2020; 6(4):231–233. https://doi.org/10.1093/ehjqcco/qcaa039

Inada-Kim M, Knight T, Sullivan M et al. The prognostic value of national early warning scores (NEWS) during transfer of care from community settings to hospital: a retrospective service evaluation. BJGP Open. 2020; 4(2). https://dx.doi.org/10.3399%2Fbjgpopen20X101071

Kidd M, Grove K, Kaiser M, Swoboda B, Taylor A. A new patient-acuity tool promotes equitable nurse patient assignments. Am Nurse Today. 2014. https://tinyurl.com/fx6ty82s (accessed 16 September 2021)

Lee G, Sakone P, Mulhall H, Kelleher K, Burnett K. Using hospital at home to reduce admissions. Nursing Times. 2015; 111(36-37):4

Lee GA, Freedman D, Beddoes P, Lyness E, Nixon I, Srivastava V. Can we predict acute medical readmissions using the BOOST tool? A retrospective case note review. Acute Med. 2016; 15(3):119–123

Lee GA, Titchener K. The Guy's and St Thomas's NHS Foundation Trust @home service: an overview of a new service. London J Prim Care (Abingdon). 2016; 9(2):18–22. https://doi.org/10.1080/17571472.2016.1211592

Lee G, Pickstone N, Facultad J, Titchener K. The future of community nursing: hospital in the home. Br J Community Nurs. 2017; 22(4):174–180. https://doi.org/10.12968/bjcn.2017.22.4.174

Pericàs JM, Cucchiari D, Torrallardona-Murphy O et al; Hospital Clínic 4H Team (Hospital at Home-Health Hotel). Hospital at home for the management of COVID-19: preliminary experience with 63 patients. Infection. 2021; 49(2):327–332. https://dx.doi.org/10.1007%2Fs15010-020-01527-z

Pickstone N, Lee GA. Does the @home team reduce local emergency department attendances? The experience of one London service. Int Emerg Nurs. 2019; 46:100774. https://doi.org/10.1016/j.ienj.2019.04.003

Ploeg J, Matthew-Maich N, Fraser K et al. Managing multiple chronic conditions in the community: a Canadian qualitative study of the experiences of older adults, family caregivers and healthcare providers. BMC Geriatr. 2017; 17(1):40. https://dx.doi.org/10.1186%2Fs12877-017-0431-6

Pullyblank A, Tavaré A, Little H et al; West of England Patient Safety Collaborative. Implementation of the National Early Warning Score in patients with suspicion of sepsis: evaluation of a system-wide quality improvement project. Br J Gen Pract. 2020; 70(695):e381–e388. https://doi.org/10.3399/bjgp20x709349

Raleigh M, Allan H. A qualitative study of advanced nurse practitioners' use of physical assessment skills in the community: shifting skills across professional boundaries. J Clin Nurs. 2017; 26(13-14):2025–2035. https://doi.org/10.1111/jocn.13613

Rockwood K, Song X, MacKnight C et al. A global clinical measure of fitness and frailty in elderly people. CMAJ. 2005; 173(5):489–495. https://doi.org/10.1503/cmaj.050051

Shepperd S, Butler C, Cradduck-Bamford A et al. Is comprehensive geriatric assessment admission avoidance hospital at home an alternative to hospital admission for older persons?: a randomized trial. Ann Intern Med. 2021; 174(7):889–898. https://doi.org/10.7326/m20-5688

Shin B, Kim SH, Yong SJ et al. Early readmission and mortality in acute exacerbation of chronic obstructive pulmonary disease with community-acquired pneumonia. Chron Respir Dis. 2019; 16:1479972318809480. https://doi.org/10.1177/1479972318809480

Ural D, Çavuşoğlu Y, Eren M et al. Diagnosis and management of acute heart failure. Anatol J Cardiol. 2015; 15(11):860–889. https://dx.doi.org/10.5152%2FAnatolJCardiol.2015.6567

Vranas KC, Jopling JK, Scott JY et al. The association of ICU acuity with outcomes of patients at low risk of dying. Crit Care Med. 2018; 46(3):347–353. https://doi.org/10.1097/ccm.0000000000002798

Yiadom MYAB, Baugh CW, Barrett TW et al; ED Operations Study Group 2015. Measuring Emergency Department Acuity. Acad Emerg Med. 2018; 25(1):65–75. https://doi.org/10.1111/acem.13319