Acute deterioration in care homes: exploring optimal approaches to identification and management.

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Abstract

When care homes residents experience an acute deterioration in their health status, they may receive care that is reactive and not in line with their preferences. The aim of this work was to explore how acute deterioration is managed in care homes, and to identify strategies to improve care. To achieve this, a multiple methods approach was employed.

A repeated cross-sectional study showed that the complexity of resident care need is increasing, meaning that they are often living with many of the functional and physiological characteristics which would be used to recognise or indicate acute deterioration in other populations. An ecological study highlighted the susceptibility of residents to COVID-related mortality, its association with vital sign abnormalities at a population level, and the widespread use of the National Early Warning Score (NEWS2) in care homes. This is consistent with the policy drive to use remote monitoring and deterioration tools, especially NEWS2, in care homes. Qualitative work showed that the NEWS2 may have a useful role in managing acute deterioration, especially supporting carer judgement. However, implementation challenges, inconsistent uptake, and unintended consequences in this setting remain significant concerns. A quantitative study demonstrated that higher NEWS2 measurements (on hospital admission) were associated with adverse health outcomes. NEWS2 may therefore aid care decision-making for hospitalised residents, but its use in the care home setting remains unclear.

A scoping review about deterioration tools demonstrated that the majority of studies described an intervention in which SBAR (situation-background-action-recommendation), NEWS2 or STOP AND WATCH was a component. Overall, there was no robust evidence that deterioration tools improve resident care, but there was evidence that tools can increase the confidence of care home staff in managing acute deterioration.

The body of evidence presented in this thesis identifies important evidence gaps, and features of deterioration tools that should be prioritised for future development, such as supporting care home staff judgement and intuition about acute deterioration. A common theme throughout this programme of work is the implementation challenges of introducing novel deterioration interventions into care homes. Future research should be underpinned by

implementation science theory with care homes residents and staff at the centre of intervention co-production.

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Declarations

I declare that this thesis is my own work and that I have correctly acknowledged the work of others. This submission is in accordance with University and Academic Unit guidance on good academic conduct.

I certify that no part of the material offered has been previously submitted by me for a degree or other qualification in this or any other University.

I confirm that the word length is within the prescribed range as advised by my Academic Unit and Faculty.

I confirm that my thesis contains collaborative work. My independent contribution for each publication is detailed on the co-authorship forms, which can be found as an appendix in this thesis.

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Abbreviations

A+E	Accident and Emergency
CFAS I and II	Cognitive Function and Ageing Studies I and II
CFIR	Consolidated Framework for Implementation Research
ECP	Emergency care practitioner
EDIS	Early Detection of Infection Scale
EHCH	Enhanced Health in Care Homes
ELSA	English Longitudinal Study of Ageing
GP	General practitioner
IPC	Infection prevention and control (IPC) measures
LTCF	Long-term care facility
MDT	Multi-disciplinary team
MRC	Medical Research Council
NEWS/NEWS2	National Early Warning Score/National Early Warning Score 2 (updated 2017)
NHS	National Health Service
NPT	Normalisation Process Theory
RESTORE2	Recognise Early Soft Signs, Take Observations, Respond, Escalate
SAMBA	Society for Acute Medicine Benchmarking Audit
SBAR	Situation-background-recommendation-action tool
Stop and Watch	S - seems different to usual, T - talks or communicates less than usual, O - overall needs more help than usual, P - participated in activities less than usual, A - ate less than usual, N - no bowel movement in 3 days, or diarrhoea, D - drank less than usual, W - weight change, A - agitated or nervous more than usual, T - tired, weak, confused or drowsy, C - change in skin colour or condition, H - help with walking/transferring/toileting more than usual.

Publications

The following seven published papers (**PP 1-7**) in peer-reviewed journals constitute my thesis submitted for the degree of MD:

PP1 **Barker RO**, Hanratty B, Kingston A, Ramsay SE, Matthews FE. Changes in health and functioning of care home residents over two decades: what can we learn from population-based studies? Age and Ageing 2021;50(3):921-7.

PP2 **Barker RO**, Stocker R, Russell S, Hanratty B. Future-proofing the primary care workforce: A qualitative study of home visits by emergency care practitioners in the UK. European Journal of General Practice 2021;27(1):68-76.

PP3 Stocker R, Russell S, Liddle J, **Barker RO,** Remmer A, Gray J, Hanratty B, Adamson J. Experiences of a National Early Warning Score (NEWS) intervention in care homes during the COVID-19 pandemic: a qualitative interview study. BMJ Open 2021;11(7): e045469.

PP4 **Barker RO**, Atkin C, Hanratty B, Kingston A, Cooksley T, Gordon A, Holland M, Knight T, Subbe CP, Lasserson D. National Early Warning Scores Following Emergency Hospital Transfer: Implications for Care Home Residents. Journal of the American Medical Directors Association. 2023;24(5):653-656

PP5 Stow D, **Barker RO**, Matthews FE, Hanratty B. National Early Warning Scores and COVID-19 deaths in care homes: an ecological time-series study. BMJ Open 2021; 11(9):e045579

PP6 **Barker RO**, Eastaugh CH, Searle B, Wallace SA, Craig D, Hanratty B. Which acute deterioration tools are used in long-term care facilities and how have they been evaluated? A scoping review. BMC Health Services Research 2025;25(1):765

PP7 **Barker RO**, Astle A, Spilsbury K, Hanratty B. COVID-19 testing during care home outbreaks: the more the better? Age Ageing 2021; 50(5): 1433-5.

These additional papers published in peer-reviewed journals support and complement the body of work presented in the thesis, but are not presented for assessment as part of my MD thesis:

Vardy ER, Lasserson D, **Barker RO**, Hanratty B. NEWS2 and the older person. Clinical Medicine 2022;22(6):522-524.

Tavaré A, Pullyblank A, Redfern E, Collen A, **Barker RO**, Gibson A. NEWS2 in out-of-hospital settings, the ambulance and the emergency department. Clinical Medicine 2022;22(6):525-529.

Searle B, **Barker RO**, Stow D et al. Which interventions are effective at decreasing or increasing emergency department attendances or hospital admissions from long-term care facilities? A systematic review. BMJ Open 2023;13(2):e064914.

Johnson EE, Searle B, Lazo Green K, Walbaum M, **Barker RO,** Brotherhood K, Spiers GF, Craig D, Hanratty B. Interventions to Prevent Hospital Admissions in Long-Term Care Facilities: A Rapid Review of Economic Evidence. J Am Med Dir Assoc 2024;25(8):105034.

The following papers contribute directly to the aims of my thesis but were published outside of my period of candidature. They are presented for information, but not for assessment:

Barker RO, Craig D, Spiers G, Kunonga P, Hanratty B. Who Should Deliver Primary Care in Long-term Care Facilities to Optimize Resident Outcomes? A Systematic Review. J Am Med Dir Assoc 2018;19(12):1069-1079.

Barker RO, Stocker R, Russell S, et al. Distribution of the National Early Warning Score (NEWS) in care home residents. Age and Ageing 2019;49(1):141-5.

Russell S, Stocker R, **Barker RO**, Liddle J, Adamson J, Hanratty B. Implementation of the National Early Warning Score in UK care homes: a qualitative evaluation. British Journal of General Practice 2020;70(700):e793-e800.

Executive summary

There are almost half a million people living in care homes in England. Care home residents are a large and important population. They are some of the oldest and most vulnerable people in our society, many living with high levels of care need. Nursing homes employ registered nurses on-site, while residential homes rely on visiting National Health Service (NHS) professionals to provide nursing care as needed. The majority of care home residents are in their last years of life. When residents experience a rapid decline in health due to short-duration illnesses, such as infections, this is called acute deterioration or illness. In these scenarios, residents rely on care home staff detecting signs of deteriorating health and then working with healthcare professionals, usually General Practitioners (GP) and/or community nurses, to care for them. Managing deteriorating resident health poses a challenge for care home and healthcare staff because older adult residents often do not display overt signs of acute illness, and their deterioration trajectories are frequently unpredictable.

The effective management of acute deterioration in care homes ensures that residents receive proactive care that is consistent with their wishes. Acute health deteriorations can indicate a need for active treatment in the care home or in hospital, or a need to consider end-of-life care. Despite its importance, there is currently no standardised system for identifying and managing acute deterioration in care homes. The aim of this work was to explore how acute deterioration is managed in care homes, and to identify strategies to improve care. To achieve this, a multiple methods approach was employed. The publications in my thesis demonstrate the importance and complexities of managing acute deterioration, and highlight key considerations for designing and implementing future interventions to enhance the response to acute deterioration in care homes.

To improve healthcare in care homes, it is essential to understand the trends in residents' health and care needs. I conducted a repeated cross-sectional study based on three longitudinal datasets, which revealed that the complexity of health and care needs of residents in England and Wales has increased over the last two decades **(PP1).** Therefore, residents experience acute health deterioration against a background of ever-increasing complex multimorbidity (**PP1**). This means that they are often living with many of the

functional and physiological characteristics which would be used to recognise or indicate acute deterioration in other populations. An ecological study (**PP5**) highlighted the susceptibility of residents to COVID-related mortality, its association with vital sign abnormalities at a population level, and the widespread use of the National Early Warning Score (NEWS2) in care homes.

There is a strong policy drive to expand the use of deterioration tools in care homes, such as the NEWS2. NEWS2 was developed for use in secondary care to assist hospital teams to recognise and respond to acute illness. It involves measuring vital signs (e.g. temperature, oxygen saturation), which generates a score and a recommended response.

The broadening skill-mix in primary care means that non-medical healthcare professionals, such as community paramedics, are responding to acute deterioration in care homes. Community paramedics (**PP2**) assessing acute deterioration in care homes is likely to increase the use of NEWS2, which is already standard practice in settings like hospitals, with an emphasis on standardised communication about acute illness across the NHS. However, NEWS2 has been transferred from secondary care without modification for care homes, meaning that its suitability for the unique care home population had not been evaluated prior to my work.

Two qualitative studies (one published before my MD candidature) concluded that NEWS may have a useful role in the care home response to acute illness, such as enhancing the judgement and confidence of care home staff (**PP3**). However, implementation challenges were described in both studies, such as the additional time taken for staff to measure NEWS alongside their other competing priorities, as well as the practical challenges in measuring vital signs for residents (**PP3**).

Another concern from the academic community is that care home residents' age, frailty, and background health problems may limit the applicability of NEWS2 and reduce its ability to predict poor outcomes for residents. A quantitative study in my MD provides important evidence to address this uncertainty, showing that care home residents with higher NEWS2 scores on emergency admission to hospital were more likely to experience long hospital admissions and to die within seven days (**PP4**). This suggests that NEWS2 may have a role as an adjunct to acute care decision-making for hospitalised residents. However, a significant evidence gap remains about whether NEWS2 measured in care homes could fulfil the same

role for residents. It is likely that NEWS2 should play a less prominent role in resident care in care homes, with its usage depending on the individual resident's needs and preferences.

The use of NEWS2 in care homes continues to be a subject of debate in clinical and academic communities. There are ongoing concerns about the potential for NEWS2 to compromise care, by over-medicalising care homes and undermining their social and palliative care ethos. Given the uncertainties about the role of NEWS2 in resident care, a scoping review was required to map the whole range of tools available internationally, and the evidence underpinning their use in care homes. The scoping review (**PP6**) concluded that, despite strong policy drivers advocating the use of deterioration tools in care homes, there is currently no robust evidence to support their use. The majority of studies included in this review described an intervention in which SBAR (situation-background-action-recommendation), NEWS2 or STOP AND WATCH was a component. Most studies concluded potential benefit from deterioration tool use. There is some evidence that long-term care staff feel that tools, especially SBAR, improve confidence in managing acute deterioration and aid communication with external healthcare professionals. However, studies were generally low on the Hierarchy of Evidence, and no study compared deterioration tools to standard care. In addition, none of the qualitative studies explored residents' experiences of the use of deterioration tools. These are important evidence gaps that should be considered in future research.

This programme of work has consistently highlighted the implementation challenges of introducing new interventions into care homes aimed at improving the management of acute deterioration. Similar implementation challenges have been described in relation to novel policies and interventions in other aspects of resident care (**PP7**). A key factor contributing to these common challenges is that care home residents and staff have not been involved in the development of interventions or their implementation strategy. The competing priorities and demands on care home staff have often been overlooked. Moreover, contextual factors, and in particular the significant variation between care homes - including differences in facility size, staff skill-mix and ratios, and organisational cultures - have not been adequately addressed. These implementation challenges increase the potential for inconsistent uptake of acute deterioration tools and interventions across care homes.

It is important that policymakers place care homes at the centre of the design and implementation of novel interventions. This approach is necessary to ensure the unique contextual factors of care homes, and the individual needs of residents, are considered. This is necessary to ensure that the design and implementation of future interventions align with the priorities of both residents and staff (**PP7**).

The body of my evidence identifies features of deterioration tools that should be prioritised for future development, such as supporting carer judgement and intuition about acute deterioration. However, significant evidence gaps in the management of acute deterioration in care homes have also been identified. The perspectives of care home residents have not been adequately represented in research to date, and the direct impact of interventions on improvements in resident care remains uncertain.

My work emphasises important considerations for improving resident care during acute health deteriorations. Future research could usefully establish principles for developing complex interventions designed specifically for care homes, rather than assuming that interventions from other settings will improve resident care. This will require the adoption of co-production techniques and implementation science methodology. It is essential that care homes are central to intervention development, to ensure that novel interventions align with the priorities of both residents and staff. Patient and Public Involvement and Engagement (PPIE) activities have helped shape my MD, and will continue to ensure that my future work in this area is focused on what life is really like for people living or working in, or visiting, care homes.

CHAPTER 1. The importance of acute deterioration in care homes

In this chapter, I provide an overview of the care home setting in the United Kingdom (UK) and explain why the topic of acute deterioration is important for people who live and work in care homes, as well as for the wider health and social care system.

1.1 Care homes in the UK

Care home residents represent a large and important population in our society. There are estimated to be approximately 440,000 people living in care homes in the UK,[1-4] representing a bed base three times that of the hospital sector.[5] In 2021, the Office for National Statistics estimated that 56% of residents in England and Wales were aged 85 years and over, with 23 female for every 10 male residents aged 65 years and over.[6] Approximately 98% of residents identified in the "White" ethnic group.[6]

Care homes are institutional settings where older adults live and receive long-term social and health care, either residential or nursing homes. In nursing homes, registered nurses provide 24 hour clinical care and oversee care delivery, usually from a team of non-registered care assistants.[7] In care homes without on-site registered nurses, referred to as residential homes, care support staff or care assistants provide social care for residents.[7] Across the large number of UK care homes, there is wide variation in staffing profiles. Staff turnover in the care home workforce, amongst nurses and care assistants, is high and there are a large number of staff vacancies.[8] A lack of stability in the workforce creates challenges for those who live and work in care homes, and particularly for improving care quality in this setting.

Care homes are independent organisations and not part of the National Health Service (NHS). In the Care Homes Market Study (2017) it was estimated that there are 5,500 different providers operating approximately 11,300 care homes for older adults in the UK.[9] The oldest and most vulnerable groups in our society live in care homes.[7] Despite an ageing population in the UK, there has been a decrease in the total number of care home places. In England in 2012, for every person aged over 75, there were 6.1 places in residential homes and 5.2 places in nursing homes. By 2023, this had decreased to 4.6 and 4.3 respectively.[10]

Care home residents have complex care needs, and there is a perception that these needs have increased over time.[11] However, there is a paucity of evidence from epidemiological

studies to substantiate this assertion. This important evidence gap is addressed in published paper (**PP1**[12]) in chapter 2.

1.2 Acute deterioration in care homes

Acute illnesses are those of short duration, either an exacerbation of a pre-existing problem, or the rapid onset of a new condition,[13] for example infections like pneumonia. Acute illness can cause rapid deterioration in care home resident health, and residents experience high rates of emergency hospital attendance and admission.[14] Improving how care homes and healthcare staff work together to respond to acute deterioration is a key component of enhancing resident care.

Concerns have been raised about the quality of healthcare in care homes, including how acute deterioration is managed.[15-18] Responding to acutely deteriorating residents is challenging for both care home staff and healthcare professionals external to the care home, such as general practitioners (GP), as signs of acute deterioration are often subtle or absent.[19] The unique challenges of responding to acute deterioration in care homes are discussed in chapter 2.

When residents experience acute deterioration, it is typically the care home team or the resident's family or friends who notice the initial signs, which are often subtle, especially in the early phases. Care home staff frequently rely on observations of changes in functioning (e.g. reduced mobility), and their intuition, to alert them to an evolving illness that could deteriorate rapidly. The next task is for the care home team to assess the severity of illness, and to determine whether ongoing observation is a proportionate strategy or if consultation with an external healthcare provider is necessary. This may involve a series of 'escalations' within the care home team[20] prior to escalation to an external healthcare provider, usually a GP or community matron. The next step involves care home staff and healthcare professionals working together to determine whether the deterioration signals an acute illness that can be managed effectively within the care home, or if it represents a more severe acute illness that may require hospital-level care (if consistent with the individual resident wish). Alternatively, the observed changes represent in resident health may simply reflect normal day-to-day variation for that particular resident. In formulating the care plan, healthcare and care home staff consider the resident's care preferences, which may be documented in advance care plans.

This process of identifying and managing acute deterioration is summarised in figure 1.

The effectiveness of the response to acutely deteriorating residents is a product of how care homes interact with primary care, and the wider healthcare system. The framework for Enhanced Health in Care Homes (EHCH), 2020,[21] is modifying the way care homes and primary care interact to deliver resident care in England. Multidisciplinary meetings (between care home staff, community healthcare staff (GPs, community nurses) and specialists, such as geriatricians) form a key element of the EHCH. Despite this model of care, there is no standardised system for working across the care home-primary care interface to deliver care for people who experience acute deterioration in care homes.

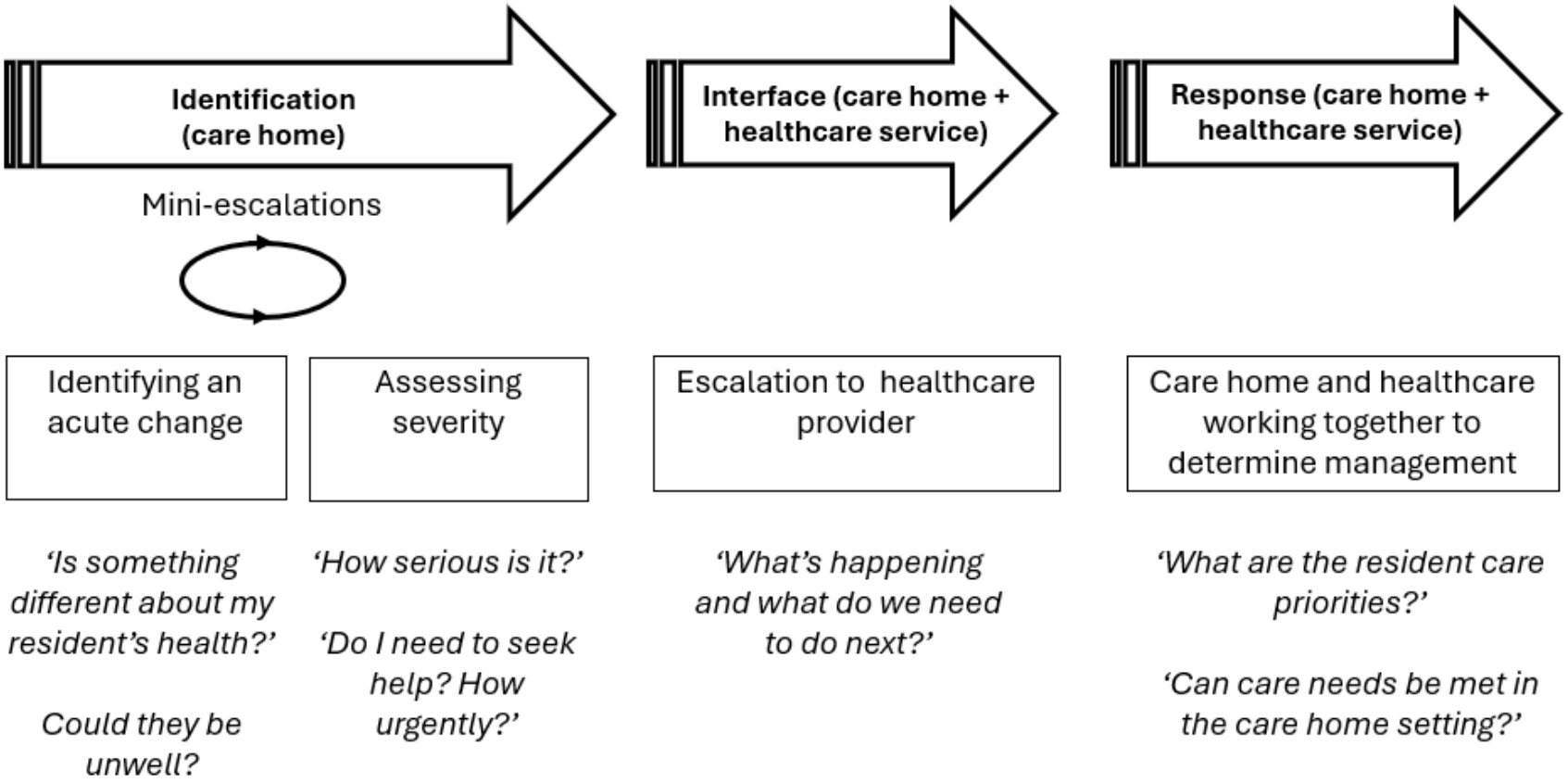

Figure 1: The process of responding to acute deterioration in care homes (adapted from Barker et al, BMC Health Services Research 2025[22]).

1.3 Effective response to acute deterioration: proactive care

The prompt identification of acute deterioration is essential to delivering care that is both responsive and tailored to the individual needs and preferences of residents and their family/friends.

An acute decline in a resident's condition may signal the need for active treatment, either in the care home or in hospital. When non-severe acute illnesses are identified and managed proactively, many residents can be cared for in their care home. This has the benefit of care in familiar surroundings, especially important for people living with dementia.[23]

Delayed recognition of acute deterioration may lead to worsening illness severity and a missed opportunity to deliver care in the care home setting. This increases the risk of adverse health outcomes, such as avoidable unplanned hospital attendance.[24] Hospital admission can be particularly problematic for care home residents, as in-patient care carries additional risks, such as delirium, loss of function and hospital-acquired infections.[25-27] Furthermore, residents may express a preference to remain in their care home when they are acutely unwell.[28,29] Hospitalisation may be particularly distressing for residents with dementia and their families.[30]

In England, care home residents experience 40-50% more emergency hospital attendances than the general population over 75 years old,[14] and are frequently hospitalised towards the end of life.[29] Despite the challenges of determining if an admission can be classed as truly 'avoidable,'[31] half of hospital admissions from care homes have been categorised as such.[16] However, it is important to acknowledge that transfer to hospital may, in some cases, align with the wishes of residents/their families and friends. Early identification of acute deterioration remains important in these scenarios too, enabling timely access to hospital-based care.

1.4 Effective response to acute deterioration: end-of-life care

A palliative care ethos is central to the care provided in care homes.[32] One study of 2,444 residents in England reported that 56% had died within one year of care home admission.[33] An acute deterioration in a resident's health may signal an end-of-life trajectory,[34] and the need for care home and healthcare staff to focus their attention on palliative care. Early

recognition of such trajectories supports the prioritisation of comfort and dignity at the end of life, often aligning with residents' preferences to remain in their familiar surroundings.[35] With support from primary and specialist palliative care services,[33] care homes are well-positioned to deliver high quality end-of-life care. Timely identification of end-of-life deteriorations create a valuable window of opportunity to initiate or review advance care planning decisions,[20,36] which are recognised as important components of effective end-of-life care.[37]

In summary, the proactive identification of acute deterioration is a fundamental aspect of responsive, resident-centred care. Despite this, the management of acute deterioration for care home residents is often reactive, rather than proactive, and may not reflect residents' values or preferences.[23] This thesis contributes to efforts to enhance the recognition and response to acute deterioration, which is an important part of improving care for people living in care homes.

1.5 Impact of acute deterioration on the secondary healthcare system

High rates of emergency conveyance to hospital can place considerable strain on the healthcare system and the ambulance service. In 2016/2017, the total number of residents presenting to Accident and Emergency (A+E) from care homes in England was 260,000, representing 6.5% of the total number of attendances for older adults over 65 years-old.[38] It is estimated that care home residents are responsible for 7.7% of emergency hospital bed days, despite constituting only 2.8% of adults over 65 years-old.[38] Pneumonia and urinary tract infections, common causes of acute deterioration, were identified as the two conditions most often associated with potentially avoidable hospitalisation.[38]

Unscheduled use of hospital emergency departments by care home residents continues to be a key issue for researchers, care providers, and policymakers. During my MD, I contributed to two evidence syntheses about interventions that decrease urgent and unscheduled hospital attendance.[39,40] However, the use of interventions to respond to acute deterioration was not a focus in these studies or other related research

1.6 My perspective as a GP

I believe that GPs have a pivotal role in delivering high quality care to residents. A recent realist review supports this notion by concluding that GPs are central to quality improvement in care homes.[41] However, there are competing demands on GPs when prioritising resident care, and care home residents result in a disproportionately high workload for GPs, measured by the number of clinical contacts.[42] Scenarios of acutely deteriorating care home residents are often high-challenge consultations for GPs, especially where there is uncertainty about the illness trajectory and diagnosis. In addition, healthcare staff frequently receive information from care homes that contains little objective data on which to base medical treatment recommendations. GPs have described the 'emotional burden' associated with the uncertainty of diagnosing infections in older adults, and whether hospital admission is required.[43] Despite the importance of GPs in responding to acutely deteriorating residents and the impact that care homes have on their working lives, there is little understanding about how GPs deliver acute care in these scenarios.

The key factors motivating my research about acute deterioration in care homes stem from my work as a GP. I work with care home staff to deliver care for residents experiencing acute deterioration and, despite the challenges described, I witness the benefit for residents and their families/friends, as well as staff, when acute deterioration is identified promptly and managed proactively according to resident wishes. Equally, I see the adverse impacts on all stakeholders when this is not achieved. This is my motivation for conducting this programme of research.

Although I have collaborated with colleagues from social care, nursing, and care homes, it is important to acknowledge that my primary care perspective has influenced my approach to this programme of research and my thesis.

1.7 Patient and public involvement and engagement

Public involvement in research means "research being carried out 'with' or 'by' members of the public rather than 'to', 'about' or 'for' them."[44] Patient and Public Involvement and Engagement (PPIE) has been an important component of this programme of work, ensuring that my research has maintained a key focus on the priorities of people who live and work in care homes.

PPIE activities, since the conception of this work, have made important contributions in defining the scope and aims of the research. Discussions at Newcastle University care home interest events,[45] attended by key stakeholders including care home staff and patient groups, health and social care professionals and service commissioners, have highlighted acute deterioration in care homes as important and worthy of study. I have also conducted more focused public engagement meetings with VOICE members, a Newcastle University supported PPIE organisation.[46] Earlier meetings helped to refine the research questions, ensuring that they are focused on care home residents and staff.

For my MD, I convened a PPIE advisory group of five VOICE members from a diverse range of backgrounds, including health and social care, and with personal experience of relatives in care homes. Important contributions to the research plan have included discussions about the burden of responsibility that care home staff may feel to make 'medical' decisions. This insight has helped inform the design of the qualitative topic guide for **PP3**.[47]

1.8 Research question, aims and objectives

Research question

How is acute deterioration in health managed in care homes and how can the response to acute deterioration be enhanced?

The overall aim of this programme of work is to explore how acute deterioration in care homes is managed, and to identify strategies to improve resident care. Specific objectives within this were to:

1. To describe how acute deterioration is identified and managed in care homes, and the associated challenges.

2. To map the range of tools and interventions used to identify and respond to acute illness in care home residents, and to synthesise the evidence underpinning their use.

3. To identify key evidence gaps to inform future intervention development

4. To identify key characteristics required for the development of novel deterioration tools/interventions to improve the management of acute deterioration in care homes.

Findings from my seven published papers submitted for the degree of MD (included as appendices) are used to support the findings in this thesis, alongside other papers that I have published outside the candidature of my MD.

CHAPTER 2. Care homes: a unique context for acute deterioration

This chapter explores the features of care homes, and key characteristics of those who live and work in these homes, which need to be considered in the care of residents who experience acute deterioration. **PP1**[12] and **PP2**[48] take a central role in this chapter.

2.1 Characteristics of the care home population: increasing complex multimorbidity and care needs (PP1)

The starting point to understanding acute deterioration in care homes is to understand the background health and care needs of residents before they experience acute deterioration. Despite being a large and important population, whose health should be monitored closely, there is no easily accessible information on the health and functioning of care home residents. Although recent research has focused on piloting a minimum dataset for UK care home residents,[49,50] this does not yet exist as it does in other countries like the United States of America.[51] There is a perception that the care needs of residents have increased over time,[11] but there is a paucity of evidence from epidemiological studies to substantiate this assertion. Access to routine health service data on individual residents requires time, funds and expertise, whilst many research studies omit residents at the outset or censor their data when they move into a home.[52]

This paucity of data, combined with concerns over the quality and equity of primary care in care homes,[17,18] place greater importance on information from epidemiological studies. The UK has several high-quality cohort studies, but the number of care home residents in each individual study is small. **PP1**[12] was important in bringing together data from different surveys in England and Wales for analysis, to make the best use of existing data and fill an important gap in our understanding of the health and functioning of care home residents.

I conducted a repeated cross-sectional study using data from three longitudinal studies - Cognitive Function and Ageing Studies (CFAS) I and II, and the English Longitudinal Study of Ageing (ELSA).[12] This study incorporated 2,280 observations from 1,745 care home residents, across a 24-year period (1992 to 2016). I created composite domains of multimorbidity and disability by using variables common to the three datasets. The results demonstrate a trend of increasingly severe disability, from 63% in 1992 to 87% in 2014. This trend was due mainly

to increases in difficulty, or needing assistance with, dressing (P-trend = 0002) and bathing (P-trend<0.001). The prevalence of complex multimorbidity, defined as problems in at least three out of six body systems, showed increases within each study – from 33% to 54% in CFAS I/II (1992 to 2012) and from 26% to 54% in ELSA (2006 to 2016).

PP1 provides an important in-depth understanding of trends in health and care needs of residents over time, in England and Wales. This study substantiates the perception that the care needs of care homes residents has increased over time. This is an important finding because rising levels of disability and ill-health have profound resource implications, placing increasing demands on care home and healthcare staff. This may be a barrier to the proactive management of acute deterioration. **PP1** highlights that when residents experience acute deterioration, rapid changes in physical and/or mental health are occurring on the background of complex multimorbidity and severe disability. This means that care homes residents are living with characteristics or features that may be used to recognise acute deterioration in other settings. Signs of acute deterioration may be falsely attributed to residents' baseline frailty and health problems. For example, residents with dementia are living with a baseline confusion, meaning that delirium due to an acute illness (such as infection) may be more difficult to recognise. The vital sign changes that accompany common acute illnesses, such as infection, may also be masked by underlying respiratory or cardiac co-morbidities.

PP1 is relevant to acute deterioration in care homes, because high levels of background resident multimorbidity and disability are likely to result in important differences in how residents experience acute deterioration, the symptoms and signs of acute illness, and the way that these physical and mental health changes occur.

2.2 Acute deterioration in care homes: a unique set of challenges

The process of identifying and responding to acute deterioration in care homes is described in the previous chapter and summarised in figure 1. This presents a unique set of challenges for care home and healthcare staff. Signs of acute deterioration are often subtle or absent,[19] and deterioration trajectories are frequently unpredictable.[34] Residents, especially those living with cognitive impairment/dementia, are often unable to communicate that they feel

unwell or articulate their healthcare needs. Care home residents, like other older adult groups, have a tendency to under-report symptoms to their caregivers.[53]

Compared to other patient groups, deterioration trajectories for care home residents are less well-defined and frequently more unpredictable. Deterioration in health can be more gradual, with declines over weeks-to-months, followed by acute changes over hours-to-days. It is often difficult for care home and healthcare staff to know if deteriorating health represents an acute illness with a reversible cause, expected day-to-day variation, or the accumulation of health problems requiring a palliative care approach.

Even when an acute health deterioration has been identified promptly, the decision-making process about how to manage the scenario is complex for care home and healthcare staff. GPs have described the difficulty in weighing up the risks of hospitalisation compared to managing infection in the older adult's home.[43] Similarly, care home staff undergo a complex decision-making process when making decisions about transfer to hospital, involving a balance between benefits and risks to residents, and to themselves as decision-makers.[20]

Many residents have preferences for how they would wish to be cared for, when they experience acute deterioration. This may include ceilings of care, or 'predetermined highest level of intervention deemed appropriate by a medical team, aligning with patient and family wishes, values and beliefs.'[54] For some care home residents, this may mean that the highest level of intervention would be care deliverable in the care home, and exclude hospitalisation.

A high proportion of care home residents are living with cognitive impairment, which may mean that they lack the mental capacity to make informed choices over future care. Consequently, preferences of care are often determined and conveyed by relatives or friends. In such circumstances, it is necessary for care home and healthcare staff to consider the wishes of resident and their relatives/friends when delivering care for residents who are deteriorating.

The complexities surrounding care home resident acute deterioration mean that these scenarios provide some of the greatest challenges for care home and healthcare staff in their daily practice.

2.3 The evolving landscape of acute deterioration

The COVID-19 pandemic was an unparalleled public health emergency in modern memory. The management of acute illness changed markedly in the early phase of the COVID-19 pandemic, and these changes continue to influence the landscape of acute deterioration in care homes.

The COVID-19 pandemic placed an intolerable burden on residents, relatives, and staff.[55,56] High rates of infection and mortality were recorded in care homes across the world.[57-60] The pandemic highlighted a pressing need to enhance the detection and management of acute deterioration in care homes. In common with other acute illnesses, the presentation of COVID-19 amongst care home residents may be atypical. Residents may first display non-respiratory symptoms, such as delirium and diarrhoea/abdominal pain.[61,56]

The COVID-19 pandemic meant that information about deteriorating residents was often exchanged digitally, and medical treatment decisions were made without direct clinical assessment.[62] This has paved the way for remote monitoring to become a mechanism for care homes and primary care to interact and exchange information about residents with deteriorating health.

I co-authored the British Geriatrics Society guidance on COVID-19 in care homes. The guidance was published in the early phase of the pandemic (March 2020), and was viewed more than 125,000 times.[63] This guidance highlighted the potential for RESTORE2 (Recognise Early Soft Signs, Take Observations, Respond, Escalate), a composite deterioration tool,[64] to aid care home staff to recognise COVID-19.[63] RESTORE2 is a deterioration tool that integrates 'soft signs' (subtle indicators that a resident may be developing an acute illness), the National Early Warning score (NEWS2) score, and SBAR (situation-background-action-recommendation).[64,65] Whilst deterioration tools like NEWS2 were being introduced in care homes prior to the COVID-19 pandemic, the urgency of the pandemic significantly accelerated their deployment. The role of deterioration tools in care homes is discussed in chapter 4.

2.4 The broadening healthcare skill-mix (PP2)

In the UK, acute and planned primary care for care home residents has traditionally been delivered by GPs, who do not have specialist expertise in the medical care of older adults.

However, healthcare professionals with different backgrounds (such as community matrons) are increasingly taking on this role. Prior to my MD, I published a systematic review on the range of healthcare professionals delivering healthcare to care home residents in different countries across the world.[66] I concluded that the addition of specialists doctors and nurses, with specific expertise in geriatrics, has the potential to improve health outcomes for residents living in long-term care facilities. Since this review, the framework for Enhanced Health in Care Homes (EHCH), 2020,[21] has changed the way care homes and primary care interact to deliver resident care in the UK. A key element is the delivery of multidisciplinary meetings between care home staff, community healthcare staff (GPs, community nurses) and specialists, such as geriatricians. This model of care meant that community matrons are often the first-contact healthcare professional for care homes when there is a concern about acute deterioration.

In England, the 'Additional Roles Reimbursement Scheme'[67] has meant that community paramedics are now conducting home visits in care homes. **PP2**[48] is a study about the expanding skill-mix in primary care, focusing specifically on Emergency Care Practitioners (ECP) who were employed by the ambulance service. The term ECP was used in this study as it is a more widely recognised term amongst the international readership of the European Journal of General Practice. Community paramedic is the term used in the UK. Using the term ECP[68] in this study also accounted for the fact that half of the ambulance service staff had a nursing background and half were paramedics.

I played an instrumental role in establishing a five-month pilot of ambulance service practitioners conducting home visits across three general practices in the North-East of England. Over this time-period, 857 home visits were conducted, the majority of whom were to older adults. The most common medical problems assessed were respiratory and urinary symptoms, musculoskeletal problems and soft tissue injuries,[48] which are typical of symptoms experienced by care home residents who are seen by healthcare professionals for acute care needs.[69]

PP2 was a qualitative study of pilot participants. There were nine individual interviews with patients, two focus groups and a dyadic interview with primary care staff, and a focus group with ambulance service staff. General practice staff perceived that care home teams were 'broadly receptive' of ECPs conducting visits in care homes but there were specific instances

where staff specifically requested a GP visit. This included situations where staff perceived the medical problem to be complex, and for residents who may be approaching the end of their life.

The relevance of PP2 to the current programme of work lies in the growing trend for non-medical healthcare professionals, such as community paramedics and community matrons, to deliver acute care for care home residents in the community. The measurement of vital signs plays an important role in patient assessment by community paramedics, and NEWS2 (the subject of the next chapter) is used in the ambulance service for triage and the assessment of acute illness. The deployment of community paramedics to visit residents is likely to increase the measurement of vital signs and use of NEWS2 in care homes.

In this **PP2**, patients and healthcare staff expressed preconceptions about the expertise of different professionals in new roles, and the 'boundary work' involved in non-medical healthcare professionals becoming integrated in roles traditionally ascribed to GPs. This finding is relevant for novel models of acute deterioration in care homes, especially when non-medical healthcare professionals, such as community paramedics and nurses, are the first-contact healthcare professional for care home staff. When developing new models of care for acute deterioration, it will be important to consider the value that care home residents, family, friends and staff place on being assessed by a specific professional group. This may be especially relevant to a GP with whom care home residents, and their families and friends may have had long-standing therapeutic relationships. Although care home residents were visited by ECPs in **PP2**, a limitation of this work is that we did not directly capture the views of care home staff or residents due to the need for a more extensive research ethics process, which was not possible due to the time constraints of the study

As well as the important contribution to this programme of work, PP2 also represented a significant milestone in my development towards becoming an independent researcher. As the principal investigator, I secured funding, obtained the research governance permissions and I was the (joint) first author on the publication in European Journal of General Practice. This leadership experience provided valuable insights into the additional responsibility of managing a research project, including the necessity of troubleshooting when challenges arose. I also had to mitigate conflicts of interest as participants were recruited from the

practice where I work as a GP. I designed the recruitment process to ensure that my involvement in the study did not result in patients or staff feeling obliged to participate.

2.5 Chapter summary

Improving the response to acute deterioration in care homes is important for residents, and a healthcare policy priority, especially following the COVID-19 pandemic. The process of responding to resident deterioration is inherently complex for care home and healthcare staff, as the signs of acute illness are often subtle, and deterioration trajectories can be unpredictable. The publications in this chapter provide contextual information about the background on which novel deterioration interventions are being introduced. The following studies are concerned with the escalating care needs of residents resulting in increased demand on carers, the diversification of the primary care workforce, and the increasing role of remote monitoring after the COVID-19 pandemic. Alongside the unique characteristics of care homes, it is factors like these that must be considered when introducing novel acute deterioration interventions at the care home-primary care interface.

CHAPTER 3. The National Early Warning Score

A chapter has been devoted to the National Warning Score (NEWS2), as this is widely advocated for use across the care home sector in the United Kingdom (UK). The findings of three papers in this programme of work are discussed, to explore the role of NEWS2 in managing acute deterioration in care homes.

3.1 What is NEWS2?

The National Early Warning Score (NEWS) is advocated for use across the UK healthcare system,[70] and is the tool most widely promoted by national policy makers for adoption in care homes. NEWS was updated to NEWS2 in 2017, with amendments to the chart used to record physiological parameters and calculate the NEWS2.[70] The updated version incorporated the addition of 'new confusion' which is important given the association between delirium and mortality in older adults.[71] In this chapter, both terms NEWS and NEWS2 are used, as some of the studies were conducted before the updated version was introduced.

NEWS2 is a standardised system designed for recognising and communicating about acute illness in hospitals. Proponents of NEWS2 suggest that it can provide a 'common language' for sharing information about resident deterioration between care homes and primary care/emergency services.[70] NEWS2 requires the measurement of temperature, pulse, systolic blood pressure, respiratory rate, oxygen saturation and level of consciousness. The overall NEWS2 triggers a response, ranging from continued monitoring to emergency service involvement.[70]

NEWS2 was designed for use in hospital settings. The ability of NEWS2 to predict further deterioration and adverse health outcomes, such as death or critical care admission, is well-evidenced for hospitalised patients.[70,72] However, there is little specific evidence for its use with care home residents and research in community settings is especially sparse.[73,74] The value of NEWS2 may be dependent on the population to which it is applied.[75,76] Concerns have been expressed that it may be less applicable to care home residents because of their age, frailty and multimorbidity,[74,77] all of which may influence NEWS2 and its ability to identify residents at risk of adverse outcomes.

Over several years, there has been an increasingly strong policy drive for NEWS2 to be used across community settings, including in care homes. The NHS National Patient Safety Improvement Programme stated an aim to 80% adoption of deterioration management tools like NEWS2, RESTORE2/mini and SBAR in non-acute settings by March 2024.[5] Implementation of the NEWS in care homes has taken place across multiple regions in the UK,[65,78,79] despite lack of validation and limited evidence outside the hospital setting.[75,80,81]

3.2 Evidence from qualitative studies

I have contributed to two qualitative studies about NEWS being implemented in care homes, in two different regions in the North-East of England.[47,79]

The first study, published before my MD candidature, was to my knowledge, the first qualitative study published in a peer-reviewed journal to explore the experiences of care home staff in using NEWS. NEWS recorded on a digital tablet was implemented widely across a whole Clinical Commissioning Group area. Qualitative interviews were conducted with 15 care home staff, five health professionals, and one healthcare manager.

The main findings from this study were that care home staff acknowledged that NEWS could enhance the response to acute illness, citing improved communication with the NHS and increases in confidence of care home staff in approaching acute deterioration. This was encapsulated by a care home deputy manager participant, who said, '*It does give you the backup when you're ringing for professional help … they, kind of, listen a bit more.'*

However, only one third of care homes became regular users of the intervention. We concluded that implementation had not accounted for the complexity of the NEWS intervention or the care home setting, resulting in barriers to successful NEWS implementation. For example, there was no consideration of the difficulty in measuring vital signs on residents who may be living with cognitive impairment, and distressed or agitated. The main implementation challenges described were the competing priorities, demands on care home staff and insufficient training. These themes were illustrated by a specialist nurse who worked across multiple care homes:

'I cover nine homes and I could probably straightaway think [specific care homes] are doing well with it … But, that's the minority. The rest are either struggling or paying lip service …

sometimes I think "would I even want them to be worrying about the NEWS scores, would I actually want them to be worrying about more basic: have they given them a drink; have they made sure that they've been up to the toilet?".'

Shortfalls in communication and implementation were also described, with this deputy manager stating:

'…and I think receptionists at GPs … you would ring and say "we've done a NEWS score" and they'd be like "what does that mean?".'

A key recommendation from this study was the need to involve care homes and primary care in interventions aiming to improve care in care homes.

PP3[47] was a complementary study about how a digital NEWS intervention was used during the COVID-19 pandemic, which had accelerated intervention roll-out in the study region. The intervention included extended features, such as photography for wounds, and education and support delivered through 'clinical educator.' A principal objective of this study was to understand how NEWS influenced acute care provision during the pandemic. This was achieved through qualitative interviews with 10 care home staff and seven NHS staff.

We found that the NEWS intervention facilitated remote triage and decision-making during the COVID-19 pandemic. Consistent with the findings from our previous study, by using NEWS, care homes felt a sense of empowerment, as though it acted as an adjunct to staff intuition and a common clinical language. These findings were encapsulated by this NHS specialist nurse, who stated:

'*I really love the NEWS tablet and for why, because I think it totally empowers the care staff. […] Care staff, when they say, 'They're just not right. I don't know what's wrong with them, but the person's not right'. Now they've got a little more ammunition to say, 'well actually, such-and- Such isn't very well. These are the observations …' and it makes them have more of a voice. That's what I love about it. So, when they ring the GP and they say, 'Well actually the observations are blah, blah, blah', they're almost listened to a little bit more because they've got some sort of clinical information rather than just saying, 'Oh I don't know what's wrong with them'. I think that applies to here and now as well with the pandemic.'*

Care home staff, when suspecting COVID-19, often prioritised the measurement of specific parameters (particularly oxygen saturations and temperature), rather than using the composite NEWS. This pattern of NEWS use does not match the perceived benefit derived from using the measurement of all vital signs to generate a composite score. It suggests that tools may need to be flexible to be adopted for use in care homes. Another important finding, in contrast to our previous study, is that care homes were supported to use the NEWS intervention and staff valued the role of the NHS clinical educator when adopting NEWS into the home.

3.3 Summary of evidence from qualitative studies

Across the two studies, there is evidence that care home staff perceive NEWS as having the potential to improve the response to resident acute deterioration. The main benefit of NEWS was providing staff with objective evidence, to support their judgement when residents deteriorate, as well as helping staff to communicate their concerns to external healthcare professionals. There were instances described when NEWS was perceived to enhance the response to acute deterioration in care homes, but there were also important examples described, when this was not the case.

The two papers emphasise the need for more robust implementation strategies, and the benefit of ongoing support for care homes from clinical staff. This was particularly important to help care homes adapt NEWS to the key differences of the care home setting (compared to the hospital setting), and to mitigate the risk of inconsistent uptake of NEWS within care homes, and across the sector. These qualitative papers also highlighted the potential for unintended consequences, such as displacing carers from their caring role. This is a critical consideration because, as **PP1** showed, the care needs of residents are increasing over time.

The perspectives of care home residents or their friends/families were not represented in either study, and this remains a key evidence gap. Despite being the healthcare professionals primarily responsible for acute healthcare delivery in care homes and a key stakeholder, GPs also did not participate in either study. It is important to consider the perspectives of GPs and other primary healthcare professionals (such as community matrons) on the use of NEWS and more broadly about acute deterioration in care homes. Previous studies have identified GPs as less likely to be familiar with and receptive to NEWS.[80,82]

3.4 Evidence from quantitative studies

I have also two published two quantitative studies examining NEWS/NEWS2 measurement in care home residents. The first paper, published prior to my MD, presented a descriptive analysis of approximately 19,500 NEWS measurements collected across 46 care homes in the North-East of England over a 30-month period (2016-2019).[73] To my knowledge, this study represented the first instance of NEWS measurements from care homes being published in a peer-reviewed journal. From the dataset, it was possible to distinguish whether the NEWS had been measured routinely or prompted by carer concern.

One key finding is that the majority of NEWS measurements were not elevated. Approximately one-third (28%) of residents had a score of 0, and two-thirds had a low score (2 or less). This finding challenges the assumption that care residents, even in the absence of acute deterioration, may have an elevated NEWS due to their complex medical conditions. We concluded that NEWS measurements in care homes were consistent with those observed in other out-of-hospital settings.

Another significant finding was that carer concern about a deterioration in resident health status was associated with higher NEWS measurements. Specifically, 18% of residents had a high NEWS (5 or more) when measurements were prompted by carer concern, compared to only 7% of baseline readings. In the absence of data on resident outcome linked to NEWS2 measurements, it was not possible to ascertain if high NEWS measures were triggering appropriate escalation. Additionally, it was not possible to exclude the possibility of low scores providing staff with a false sense of reassurance.

My second quantitative study, **PP4,**[83] used a dataset that did enable the relationship between resident NEWS2 and health outcomes to be explored. This is important because although the ability of NEWS2 to predict further deterioration and adverse outcomes, such as critical care admission and death, is well-evidenced for hospitalised patients generally,[70,84] it is not known if these findings apply for care home residents. Concerns have been raised that the advanced aged of care home residents, as well as their frailty and background health problems, may adversely influence the ability to NEWS2 to predict adverse health outcomes.[74,77]

The aim of **PP4** was to explore the ability of NEWS2 (measured on admission to hospital) to identify residents at risk of adverse health outcomes, such as death and prolonged

hospitalisation. The sample of approximately 670 care homes residents admitted to 160 hospital sites was drawn from the Society for Acute Medicine Benchmarking Audit (SAMBA), which is a UK national audit that collects data on adults attending hospital non-electively (unplanned).

PP4 shows that higher NEWS2 on admission to hospital was associated with requiring hospitalisation (up to 7 days), prolonged hospitalisation (more than 7days) and death. I performed a multinomial regression to explore the relationship between four NEWS2 categories – low (NEWS2 ≤2), intermediate (3-4), high (5-6), critically high (≥7) – and discharge on the day of admission, admission and discharge within 7 days, prolonged hospitalisation, and death.

Comparing residents with a low NEWS2, those with a high or critically high NEWS2 had 3.6 times higher (relative risk ratio (RRR) 3.56; 95% CI 1.02-12.37) and 9.5 times higher (RRR 9.47; CI 2.20-40.67) risk of experiencing prolonged hospitalisation (with reference to the same-day discharge outcome group). The risk of care home resident in-hospital mortality within 7 days was 14 times (RRR 13.62; CI 3.17-58.49) and 54 times higher (RRR 53.50; CI 11.03-259.54) for residents with a high and critically high NEWS2 respectively.

I summarised the results by stating that, 'the risk of hospitalisation for up to 7 days, prolonged hospital admission, and death (compared with same-day discharge) is higher for residents with intermediate, high, or critically high NEWS2 (compared with the low NEWS2 category).' The risk of these outcomes increases with progressively higher NEWS2 category. However, the statistically significant differences occur when comparing high and critically high NEWS (not intermediate scores) with low NEWS2 categories.

We concluded that NEWS2 may have an important role for hospital care teams in making acute care decisions for care home residents who are hospitalised, but it remains unknown if the same can be applied to residents experiencing acute deterioration in the care home setting. Given that **PP4** was novel, linking NEWS measurements with resident outcome, I was invited to publish an NIHR Alert.[85]

I have also co-authored a third quantitative study, **PP5**.[86] This is an ecological study, the aim of which was to investigate if NEWS could contribute to COVID-19 surveillance in care homes during the pandemic. This was achieved by aggregating individual level data for NEWS

measurements and making comparisons with area-level aggregate data for all-cause and COVID-19 mortality. All-cause and COVID-related mortality data were obtained from the Office for National Statistics (ONS) weekly reported registered deaths. ONS reporting areas and geographical labels for care homes were mapped as closely as possible.

Data were analysed from 6,464 care home residents with at least one NEWS measurement. A total of 29,656 NEWS recordings were made across 46 local authority areas in England. Between the 23rd of March 2020 and the 10th of May 2020, there were 1,532 deaths with an underlying cause of COVID-19 (and 4,221 due to other causes excluding COVID-19).

The key finding from this study is that a 2-week lag was observed between peaks in the highest NEWS measurements and deaths, both COVID-19 and non-COVID-19 related. The proportion of 'above-baseline' measures of high respiratory rate ($r=0.73$, $p<0.05$ for a 2-week lag) and low oxygen saturation ($r=0.80$, $p<0.05$ for a 2-week lag) appear to follow the pattern of COVID-19 and non-COVID-19 deaths more closely than other component measures. These findings led to a conclusion that NEWS measures could fulfil a useful role in COVID-19 surveillance.

The relevance of **PP5** to my programme of work is that it reinforced how susceptible care home residents are to severe forms of acute illness, such as COVID-19, with high rates of COVID-related mortality. Secondly, the paper showed that NEWS was being widely used in care homes during the COVID-19 pandemic. Thirdly, at a population level, oxygen saturation, respiratory rate and temperature provide a similar signal to the complete NEWS. However, it is not possible to determine from these data if certain components of NEWS may be more useful than others at identifying acute deterioration at the individual resident level.

3.5 The role of NEWS2 in care homes: opinions from commentaries

During my MD, I was a co-author on two commentaries about the use of NEWS2 in community settings,[71,87] including its role in care homes. We discussed that, despite robust evidence for NEWS2 being able to accurately predict adverse outcomes in hospitalised residents, there is a paucity of evidence for care homes. We reflected on the fact that care home residents' age, frailty, and multiple long-term conditions could make NEWS2 less applicable for care home residents.

The intended role of NEWS2 acting as an adjunct (as opposed to replacing) to clinical decision-making was reinforced, as well as causes of acute deterioration which would not be expected to influence the NEWS2 measurement (such as acute stroke). An important conclusion was that NEWS2 should play a less prominent role in medical decision-making for care home residents, compared to other patient populations and settings. We asserted that NEWS2 should be considered a smaller 'piece of the jigsaw' in the clinical decision for care home residents.[71] The balance between the relative importance of carer/clinician intuition compared to objective measures, such as vital signs and NEWS2, is discussed later in this chapter.

NEWS2 in care homes is a topic that continues to polarise opinion within the research and clinical communities. In my role as a member of the NHS Managing Deterioration Safety Improvement Programme Advisory Group,[88] the rationale proposed for using NEWS2 is clear. The theory is that the measurement of NEWS2 can combine with carer instinct to pick up deterioration more promptly, and this can then trigger the appropriate healthcare response. NEWS2 can then act as a 'common language' between care home and healthcare staff so that care is proactive, as opposed to reactive.

There are equally robust concerns expressed about using NEWS2 in care homes. In an editorial[74] published in response to my first study published about the profiles of NEWS2/vital signs in care homes, concerns included the potential for NEWS2 to over-medicalise care homes. The authors highlighted that NEWS2 could adversely influence the palliative care ethos in care homes, [74] and expressed concern about the opportunity cost due to the time taken for care home staff to conduct physical observations. Concerns were also expressed about the reduced predictive power of NEWS in frail, older adults.[74]

3.6 The role of NEWS2: summary statement

From the research evidence in this programme of work and my clinical perspective as a GP, I think that NEWS2 could improve the care of residents when they experience acute deterioration, in certain circumstances. However, NEWS2 would not be applicable to all scenarios of resident acute deterioration. There are many instances when NEWS2 would have no role in resident care, such as when residents are receiving end-of-life care. The decision to measure vital signs and NEWS2 should be taken by healthcare professionals and care home

staff, tailored to the individual resident's care priorities. If NEWS2 was used routinely for all residents, this would increase the chance of unintended consequences, such as the over-medicalisation of care homes, compromising the palliative care ethos in care homes,[74] and taking staff away from their care duties.

Primary healthcare professionals, especially GPs, are more likely to place weight on the individual vital sign measures in their clinical decisions, as opposed to the aggregate NEWS2. It is important to remember that NEWS2 is intended to support the assessment of healthcare and care home about the severity of acute deterioration and illnesses, not to replace their judgment. When assessing acute deterioration, there is a balance between the importance of care home/healthcare staff intuition and objective measures. Measuring vital signs and NEWS2 offers objectivity, but it is only one piece of the 'decision-making jigsaw,'[71] and it should take a less prominent role for care home residents. From the research evidence to date, and my clinical perspective, I think that NEWS2 used alone is unlikely to significantly improve the response to acute deterioration in care homes.

3.7 NEWS2 in care homes: remaining uncertainties

Despite the evidence presented in this chapter, important questions remain about the role of NEWS2 in responding to acute deterioration in care homes. Future research in this area should focus on addressing the following questions:

1. Does NEWS2 lead to improve in care home resident outcomes?
2. Is NEWS2 consistent with how residents would wish to be cared or when they experience acute deterioration?
3. What are the unintended consequences of NEWS2? Could NEWS2 result in over-medicalisation of the care home setting?
4. How does NEWS2 influence the interaction between care homes and primary care when residents are acutely unwell?
5. How would primary healthcare professionals utilise the NEWS2 in their clinical decisions?
6. Should NEWS2 be measured routinely or deployed specifically when residents are displaying signs of acute illness (according to the individual circumstance)?

3.8 Chapter summary

Collectively, the evidence from the three studies in my thesis (and two other papers I have co-authored prior to my MD), form a body of work that accounts for a significant proportion of the evidence base in the scientific literature about the role of NEWS2 in care homes. I have presented qualitative evidence to show the potential of NEWS2 to improve resident care, principally by supporting carer judgement about resident deterioration. However, there were also scenarios in which NEWS2 did not enhance the response to resident care. This suggests that rather than being employed uniformly in all situations of resident deterioration, NEWS2 is more likely to improve resident care when used selectively, according to the individual scenario. Implementation challenges were also an important theme in the qualitative studies.

Quantitative studies in this programme of work helped to address concerns that the physiological changes accompanying acute deterioration may differ for care home residents, due to the complexity of their health problems, which could limit the usefulness of NEWS2. There was no evidence from quantitative studies to support this concern. The distribution of NEWS2 measures in care homes and the association between NEWS2 on admission to hospital and adverse health outcomes appears to be consistent with other patient populations. However, neither study linked NEWS2 measured in care homes to health outcomes. The body of evidence in this chapter has also highlighted other key evidence gaps, such as the impact of NEWS2 on residents' experience of care when they undergo acute deterioration.

The role of NEWS2 in care homes is a keenly debated topic, and the evidence gaps mean that its role remains unclear. The role of vital signs and NEWS2 is likely to represent a smaller element of the overall resident care decision-making when compared to other patient populations. The unintended consequences of NEWS2 use in care homes, such as over-medicalising care, must be carefully considered in future work.

CHAPTER 4. The range of deterioration tools

In this chapter, the range of deterioration of deterioration tools employed in care homes is explored in detail. This was important given the uncertainties about the role of NEWS2 in improving resident care discussed in chapter 3. **PP6**[22] is the focus of this chapter.

4.1 Scoping review methodology

PP6[22] is a scoping review about the deterioration tools used in long-term care facilities and how they have been evaluated. This contributes to the emerging evidence base about acute deterioration in care homes. Unlike previous reviews about acute deterioration in care homes, [89] [90] this study focused specifically on deterioration tools and explored the outcomes that have been used to evaluate them. The search strategy identified studies under the internationally recognised term of long-term care facilities (LTCF), to identify tools in use outside of the UK. LTCF is an umbrella term used to describe institutional settings where people live and receive long-term social and health care, which would include care homes with and without on-site nursing.

Standard scoping review methodology was employed to search five databases (MEDLINE, APA PsychInfo, Embase, CINAHL, HMIC) and specific websites, with no restriction on study design.

4.2 The range of deterioration tools

Twenty-six studies were eligible for inclusion in the narrative synthesis, with the majority of studies (23 out of 26) published in peer-reviewed journals. Ten studies were conducted in the UK. Overall, the included studies had a wide range of methodologies but there was only one study with a randomised study design. Deterioration tools were often used as part of multi-faceted interventions but to be eligible for inclusion, studies were required to report outcome measures specific to the deterioration tool.

The scoping review revealed nine different deterioration tools in total. The tools identified aimed to: 1) aid the recognition of acute deterioration by care home staff, either through the observation of changes in resident condition or objective measures such as vital sign measurement; and/or 2) structure communication about acute deterioration between LTCF and healthcare staff. The deterioration tools were designed for use by LTCF staff to identify

acute deterioration and escalate their concerns. They were not designed for use by healthcare staff to support their clinical decision-making.

The majority of included studies described an intervention of which SBAR (situation-background-action-recommendation) was a component, followed by the NEWS/NEWS2, and Stop and Watch.[91] The SBAR tool aims to provide a structure for communication (situation-background-action-recommendation) between healthcare providers.[92] In LTCFs, this was being used by care staff to structure communication when escalating their concerns to healthcare professionals.

The Stop and Watch[91] is a tool that captures changes in resident health and wellbeing that carers would observe in their daily interactions with residents. The tools covers 12 categories of observations such as 'seeming different to usual' (S), talking less (T), overall needing more help (O) and pain (P).[91] The Significant Seven tool[93] facilitates the recognition of similar features of resident deterioration including pain, confusion and altered appetite, which could signal acute deterioration. Similarly, the Early Detection of Infection Scale (EDIS) tool[94,95] uses changes in resident wellbeing, such as reduced appetite and confusion, to alert LTCF staff to acute deterioration. The PREVIEW-ED[96] tool prompts 'personal support workers' to observe if the resident is their 'normal self,' and whether they should escalate their concerns to registered staff. The tool then prompts registered staff to complete an assessment. RESTORE2[64,65] is a composite deterioration tool that incorporates 'soft signs' (informal observations by care staff of 'unwellness'), NEWS2 and SBAR.[65]

4.3 Where do the tools act on the deterioration pathway?

In this paper, I mapped the point at which the tools acted on the deterioration pathway, as shown in figure 2. The majority of tools are designed to assist care home staff in identifying resident acute deterioration. SBAR acts at the interface between LTCF staff and healthcare care staff. NEWS2 aims to act at multiple phases in the process of responding to acute deterioration, as it is purported to have a role in the recognition and the assessment of severity of acute illness, as well as acting as a 'common language' for communication between care homes and healthcare services. RESTORE2, as a composite tool, aims to improve the management of acute deterioration by facilitating the identification, assessment of severity and communication between care home and healthcare staff.

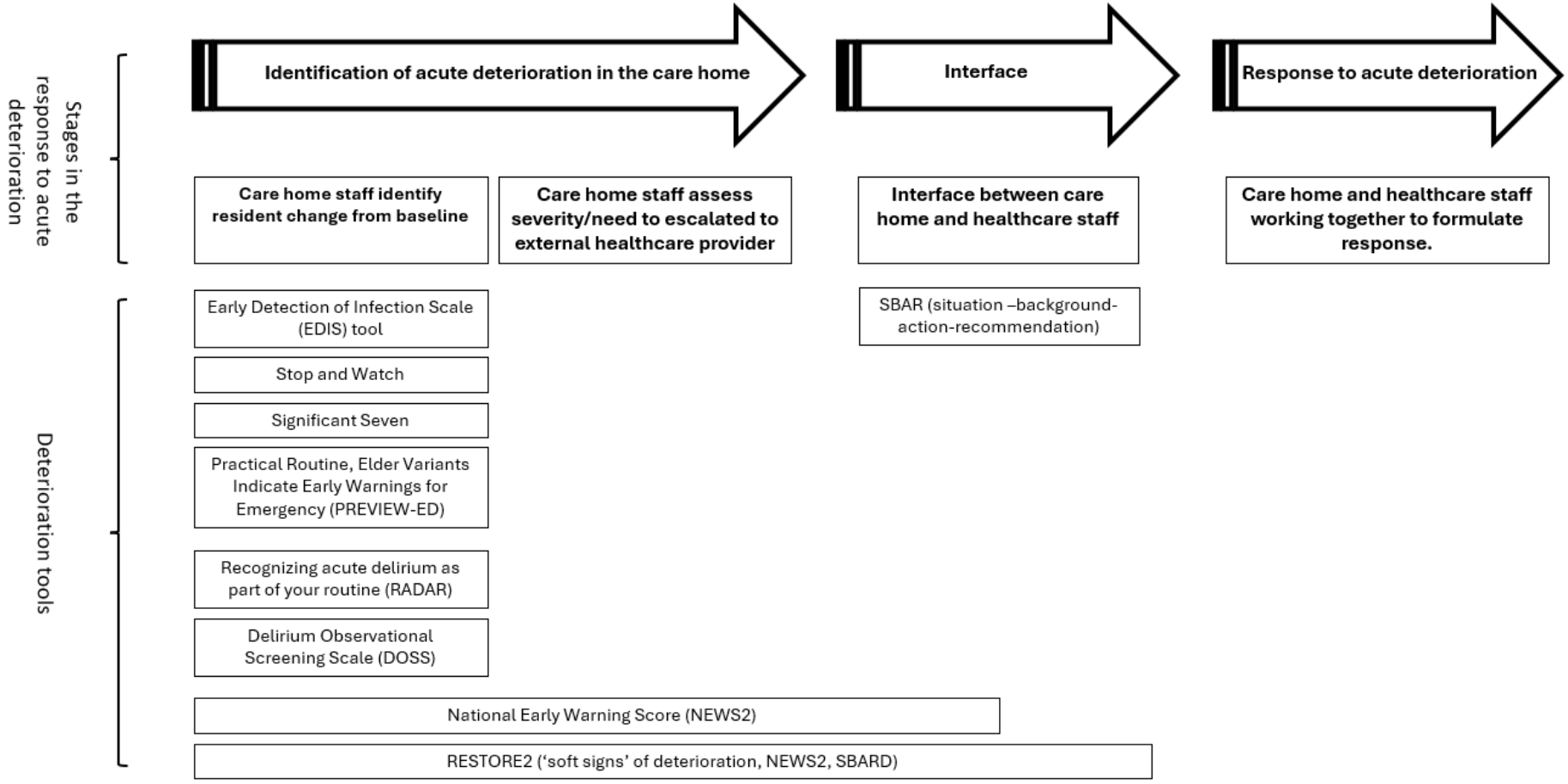

Figure 2: the process of responding to acute deterioration and at which stage deterioration tools are intended to act (adapted from Barker et al, BMC Health Services Research 2025[22]).

4.4 Key results and conclusions

I found that the majority of studies concluded potential benefit from using tools to respond to acute deterioration. As with the qualitative studies described in the previous chapter,[47,79] there is evidence that LTCF staff perceive deterioration tools, especially SBAR, as improving staff confidence in managing acute deterioration and aiding communication with external healthcare professionals. I concluded that the future development of novel approaches to acute deterioration should focus on interventions that support carer judgement and instinct. Although it was not within the primary aims of the scoping review, the challenges of implementing deterioration tools in care homes was a strong theme. The competing demands on care home staff emerged as a particularly important implementation challenge. This is supported by findings from the qualitative work, as described in chapter 3.

This scoping review has highlighted important evidence gaps. A significant proportion of studies were conducted at single-sites and no study presented outcome data for deterioration tools compared to standard care using a randomised study design. Outcome measures used in the study were heterogenous, and there were no data on resident experience. This work concluded that there is emerging evidence that deterioration tools may have a role in responding to acute deterioration in LTFCs but that direct benefits for resident care have not been shown. Despite policy drivers to use deterioration tools in LTCFs in the UK, we did not identify robust evidence to support their use.

4.5 Chapter summary

There is not sufficiently strong evidence to know if deterioration tools enhance resident care when they experience acute deterioration. Most notably, the impact on resident wellbeing and quality of life is not known. There is a tendency for tools like NEWS2 and SBAR to be transferred from other settings, especially secondary care, without modification for long-term care facilities. This does not account for the differences in acute illness presentation, deterioration trajectories, physiology or resident priorities for care discussed in earlier chapters.

CHAPTER 5. Implementation challenges

In this chapter, the challenges relating to the implementation of deterioration tools in care home settings outlined in previous chapters are discussed in more detail. Although the exploration of implementation challenges was not a specific aim of my thesis, this has emerged as an important theme throughout my research. I use **PP7**[97] to compare these specific challenges with a different aspect of resident care.

5.1 Normalisation Process Theory

Despite the potential benefit of using deterioration tools as described in this programme of work, implementation challenges and inconsistent uptake in care home settings remain significant concerns. Normalisation Process Theory (NPT)[98] was utilised as a framework to support analysis and interpretation of the evidence underlying these concerns. NPT is a middle-range implementation theory that aims to provide a 'conceptual framework for understanding and evaluating the processes by which new health technologies and other complex interventions are routinely operationalised in everyday work, and sustained in practice.'[99] It proposes four constructs that represent the different kinds of work that people do around implementing a new practice: coherence (sense-making); cognitive participation (engagement); collective action (work done to enable the intervention to happen) and reflexive monitoring (appraisal of the benefits/costs of the intervention).[98] I have chosen NPT as a implementation science middle-range theory because it helps us to consider the 'work' that care home staff are required to do to enable acute deterioration interventions to be 'normalised[98]' in care home settings. NPT has been used to analyse the barriers to the implementation of other interventions in care homes, including nutritional guidelines.[100] My programme of work has identified barriers to implementation that relate to the four NPT constructs outlined above.

5.2 Disconnect between policymakers and care homes

Unscheduled secondary care use by care home residents is a key issue for policymakers, and there is a strong policy drive to improve the response to acute deterioration in care homes. However, given the range of challenges faced by staff in meeting the complex care needs of residents described in **PP1**, it is not clear how care homes prioritise acute deterioration

alongside their other care demands. A study about research priorities in care homes used a Delphi consensus technique with care home staff to explore the range of research questions important for care homes.[101] Delivering 'person-centred care' was highlighted as one of 15 priority areas, and this could include acute deterioration. However, all the other priority area questions had a non-medical focus, such as 'how can care homes be made to feel more like a home?'

An important finding from my programme of work is that acute deterioration interventions have not been co-produced with care home staff/residents. Instead of being designed by these end-users of the interventions, they have often been transferred from other settings into care homes with limited consideration of the needs of this specific setting. Policymakers have tended to focus on the use of tools to help staff identify signs of acute deterioration but, due to a lack of co-design with care homes, there is insufficient evidence to know if this is the approach that care home teams would take in their daily practice. Focusing on acute deterioration as an area for improving resident care, and specifically using deterioration tools, may not have made 'sense' to staff resulting in low levels of 'coherence' and engagement ('cognitive participation') with such interventions. Qualitative findings from my MD suggest a lack of alignment between the policy agenda and the priorities of care homes, which is likely to have contributed to inconsistent understanding or buy-in from staff about the value/purpose of acute deterioration interventions. If care home staff feel that novel interventions are being imposed on them, rather than being collaboratively developed with them, this may further reduce coherence and engagement.

Moreover, policymakers and commissioners have focussed on the role of care homes in improving the response to acute deterioration, despite the requirement for a system-wide approach. There has been insufficient policymaker and researcher attention directed towards how healthcare services interact with care homes to deliver care for residents experiencing acute deterioration. This is particularly relevant for interventions, such as NEWS2 and SBAR, that are designed to improve the transfer of information at the care home-primary care interface. Specific examples have been described by care home staff in qualitative data, for example staff reporting examples of NEWS2 not being well-received by primary care and ambulance teams. This could result in staff feeling a low level of 'coherence.' In relation to 'collective action,' the absence of a system-wide approach to developing and implementing

deterioration tools fails to account for the inter-organisational work that care home staff are required to do when managing residents' needs.

In summary, there is an apparent disconnect between the priorities for policymakers/researchers, and the people who work in care homes. Deterioration interventions have tended to be implemented in a 'top-down' fashion, with an approach taken from health services and without consideration of the social care context. In terms of NPT, this means that acute deterioration interventions did not necessarily make sense to care staff ('coherence'). This resulted in a minority of care homes being fully invested in the interventions ('cognitive participation'), with additional barriers encountered when attempts were made to operationalise delivery across organisations ('collective action').

5.3 The complexity of the care home setting

The complexity of the care home setting is acknowledged to present significant challenges for researchers conducting intervention research. [102] When conducting research in this setting, it is essential to account for the strains on care home resources, staff, capacity and workload. [102] However, the daily challenges facing care home teams have generally not been fully accounted for when novel approaches to acute deterioration have been implemented. The time required to learn about and use novel interventions has been described as a burden on care home teams. Incompatibility with the workload of care home staff is a key barrier to implementation identified during my programme of research, which would impede 'collective action'[98] by care homes to adopt deterioration interventions consistently.

The complexities of staffing in care homes, such as the use of non-permanent/agency staff and high staff turnover, especially within the management structure of care homes, presents another important barrier. Changes within the management structure of care homes are acknowledged to impede implementation, as care home managers have a crucial role in understanding and valuing the purpose of novel interventions.[103] A lack of support from care home managers has been identified during my programme of research as a factor in low 'collective action' in implementing NEWS2.

5.4 Assumptions about knowledge and skill sets

My programme of research has highlighted the tendency for those who have introduced novel acute deterioration interventions into care homes to make assumptions about the knowledge and skills of care home staff. Studies in my MD have described the tendency for assumptions to be made about how an intervention from a different care setting (for example secondary care) may work in care homes, with lack of consideration around the extent to which tasks considered uncomplicated in other settings would also be feasible in care homes. A prominent example is NEWS2 and the measurement of vital signs, which can present challenges if residents are resistive, such as those living with dementia. Implementation in practice ('collective action') was hindered by practical challenges and time constraints on staff.

The assumptions about the skillsets of carers have also been coupled with insufficiently robust training programmes and resources to support implementation. This inhibits intervention uptake, as it reduces the likelihood of 'collective action.'

Traditional role boundaries, and the perception that certain tasks (such as taking vital sign measures for NEWS2) are the domain of the medical profession, have not been considered in work so far. This was highlighted as an important process in **PP2**[48] in relation to community paramedics performing roles traditionally ascribed to GPs. Role conflict[100] may have limited the acceptability of interventions like NEWS2 for care home staff and reduced 'cognitive participation.' The potential power dynamics between care home and healthcare staff, and role conflict is a valuable future research focus.

5.5 Links to other work and editorial (PP7)

Care homes are considered to be unique settings to conduct intervention research,[102] as described in chapter 2, and they are said to be 'relatively slow'[104] to implement evidence-based practice.

The barriers to implementation identified in this programme of work reflect the broader challenges of implementing complex interventions in care homes. There are links to an editorial, **PP7,**[97] I wrote about a national policy for care homes to conduct intensive testing regimens to identify COVID-19 outbreaks promptly. The aim of this policy was to enhance the

ability of care home teams to respond to COVID-19 outbreaks and to initiate the robust infection prevention and control (IPC) measures.[105] In this study that prompted my editorial, two out of four care homes had not completed follow-up testing, indicating inconsistent adherence to the policy.[105]

We highlighted concerns from the care home sector about care home providers and senior staff not been sufficiently engaged in the development of these guidelines, and hence limiting 'coherence' and 'cognitive participation.' The same observation applied to studies in my MD about the potential for care homes to have perceived that acute deterioration tools had been imposed on them, rather than being collaboratively developed with them. In the editorial, we discussed the 'mismatch between what is written in the (IPC) guidance and what is feasible for care home teams, including residents potentially being resistive and distressed by the process of testing (using nasopharyngeal swabs).[106] There is a parallel to be drawn with residents living with dementia being resistive to the measurement of vital signs.

The conclusion of the editorial is the need for policies to place care homes 'at the centre' of novel interventions to ensure that they are 'consistent with the priorities of people who live and work in care homes.' This is also an important consideration for future work on acute deterioration interventions.

5.6 The role of implementation science

In this programme of work, I have found that policy makers and researchers have given limited consideration to implementation science theory when implementing novel interventions and evaluating their impact. This has amplified the inherent challenges of implementing complex interventions in care homes and is likely to have contributed to the inconsistencies in intervention uptake identified in my work.

In this chapter, I have applied NPT retrospectively, categorising the main implementation challenges according to the four NPT constructs. Whilst this is a legitimate approach to drawing on NPT, and utilised in previous studies in this setting,[100] future work should incorporate implementation science theory in the study design from the outset.

5.7 Inconsistent intervention uptake

The body of work in my MD has demonstrated the inconsistent uptake of acute deterioration tools/interventions across care homes. This could mean that care homes already delivering the highest quality of care are more receptive to adopting novel interventions. On the contrary, care homes struggling to meet the everyday care needs of their residents are already in a weaker position to adopt, and benefit from, novel interventions. This could result in a widening of the care quality gap across the care home sector.

The inconsistent uptake of deterioration interventions presents a challenge to the standardisation of care across the care home sector. Standardisation of care delivery is often the aim of healthcare interventions, with the intention of achieving improved reliability, efficiency and better patient outcomes.[107] However, it is acknowledged that standardisation can come into conflict with 'customisation,' which is important to accommodate the needs, preferences and circumstances of individuals.[107] This is an especially important trade-off to consider when aiming to improving the response to acute deterioration in care homes. There is a requirement for interventions to be adaptable to the specific circumstances of individual care homes and their surrounding healthcare services. It is unlikely that interventions transferred other contexts, such as the hospital setting, will be adopted successfully and improve resident care.

5.8 Chapter summary

The NPT framework has been used to illustrate why current approaches to acute deterioration would be difficult to implement in care homes. The implementation challenges highlighted in this programme of research provide a strong foundation for improving care for residents experiencing acute deterioration in future work. Implementation theory and frameworks will have an important role in ensuring successful adoption of tools across care homes and mitigate the risks of inconsistent intervention uptake. It is essential that future policies and interventions place care homes at the centre of their development, to ensure that staff understand the purpose of interventions and that interventions are compatible with their work. Future interventions need to be adaptable account for the heterogeneity between care homes; facility size, staff skill-mix/staffing ratio, as well as organisational cultures. There

is unlikely to be a singular-solution to improving the response to acute deterioration in care homes and a system-wide approach is required.

CHAPTER 6. Thesis summary and future directions

6.1 Strengths and limitations

Using multiple methodologies, my thesis makes a unique contribution to our understanding of acute deterioration in care homes, offering insights from research, policy, and practice perspectives. The programme of work in my thesis is developing an evolving evidence base about acute deterioration in care homes, and highlights key characteristics required for future research, intervention development and evaluation in care home settings.

This body of research has the potential to improve the care for care home residents, a large and important population in our society, which is under-served in research.[108] More broadly, my work identifies strategies to enhance the adoption of interventions aimed at improving care for older adults living with frailty and multiple long-term conditions, particularly at the interface between health and social care.

A limitation of this research is the absence of direct representation of care home residents' perspectives, as they were not involved as research participants in the included studies. Additionally, limitations in the available datasets prevented a direct evaluation of the impact of acute deterioration tools on resident care.

This body of work highlights important evidence gaps, which are summarised in table 1, alongside implications for future intervention design and research.

6.2 Summary statement on the role of deterioration tools

The evidence in this programme of work suggests that deterioration tools have the potential to improve care for residents experiencing acute deterioration. To maximise their benefits, deterioration tools must either be specifically designed for care homes or sufficiently adapted to meet the unique needs of this setting. Tools must be flexible, enabling individual care homes to utilise them in a way that benefits their unique resident population and aligns with the specific skillset of the care home team. A deterioration tool would require multiple components to act at the different points on the deterioration pathway. It is likely that vital sign measurement (and the aggregate NEWS2) score can enhance the early recognition of acute deterioration and support carer judgement about the timing and mechanism of

escalating their concerns. There is also evidence that the SBAR tool may help care home staff to structure the transfer of information to healthcare professionals. A deterioration tool should aim to integrate the intuitive knowledge of care home staff about their residents with objective measures, in order to support carer judgement and healthcare professional medical decision-making. This approach would offer the greatest potential for deterioration tools to improve the care residents experiencing acute deterioration.

6.3 My perspective as a GP

I have conducted this research, published academic papers and written this commentary from my perspective as a general practitioner. In my daily clinical practice, providing healthcare to care home residents is among the most challenging yet rewarding aspects of my work. Working with care home staff to manage acute deterioration is a common clinical scenario, yet it remains one of the most complex and demanding. I frequently witness examples of proactive care, where residents receive medical treatment in their care home or hospital that aligns with their wishes. I also observe scenarios where acute deterioration is recognised as part of an end-of-life trajectory, ensuring that residents receive appropriate palliative care. Unfortunately, there also instances where the response to acute deterioration is neither proactive nor effective, resulting in residents not receiving timely medical care that is consistent with their wishes. These situations may lead to unplanned emergency hospital attendance, causing distress for residents and their family/friends, as well as care home/healthcare staff feeling a sense of disappointment. When acute deterioration is managed proactively and effectively, I see benefits for residents, their family/friends, care home and healthcare staff, as well as the wider healthcare system. This is why I want to continue to do research in this area. I am passionate about improving care for care home residents, both through research and my clinical practice.

My personal perspective is that adopting the EHCH framework[21] has potential to improve the care of residents, including during episodes of acute deterioration. The regular meetings (intended to be weekly) of an established multi-disciplinary team (MDT) provide care home staff with the opportunity to share their concerns about residents who are experiencing deteriorating health. I believe that the improved continuity of care means that patterns of deterioration in an individual resident are more effectively recognised. The regular MDT meetings offer a platform for pre-emptive conversations about residents' wishes, especially

about transfer to hospital and end-of-life care. Enhanced continuity of care means that healthcare professionals making medical treatment decisions are more likely to understand the care preferences of residents, and to have been involved in advance care planning. Continuity of care is particularly important for residents, with wide-ranging potential to improve resident care, including during acute deterioration.

As a GP, my perspective on improving the response to acute deterioration is shaped by my values of continuity of care, knowledge of the individual (and often their families) over time, and person-centred care. From a primary care perspective, care homes are seen as extensions of the community setting. I see synergies between people living in care homes and older adults living in their own home with multiple long-term conditions and frailty, particularly in how they experience acute deterioration and how this can be managed effectively.

Although improving care for residents when they experience acute deterioration is a shared goal across social care, nursing, palliative care and emergency care, our approaches may differ depending on our professional roles. There are common challenges such as balancing 'risk' when making decisions about managing acute deterioration,[20] such as avoiding the under-treatment of reversible causes of acute deterioration or the over-medicalisation of the natural dying process.[20,36]

Qualitative data from my programme of work suggests that care home staff are more likely to view acute deterioration through the lens of daily function, and their knowledge of what 'normal' is like for their residents. Their perspectives are more likely to be grounded in caregiving and close relationships with their residents. The perspective of palliative care professionals is more likely to be grounded in acute deterioration being a transition to end-of-life. Colleagues working in emergency care often witness the end-result of delayed recognition of acute deterioration, and experience the challenge of making acute medical decisions for residents, usually without prior knowledge of their preferences for care.

As well as representing the perspectives of those who live and work in care homes, multidisciplinary collaboration is essential in future work in this area.

6.4 Future challenges and features of future research

The management of acute deterioration has long been recognised as an aspect of healthcare delivery for care home residents that requires improvement. Improvements require a systems-wide approach with complex interventions that are effective across the boundary of care homes and healthcare services. Care homes are complex settings to conduct intervention research,[102] and they are described as being 'relatively slow'[104] to implement evidence-based practice. The evidence presented in my thesis suggests that a singular solution to this complex problem, effective across the whole range of care homes, is unlikely to emerge. This combination of factors means that acute deterioration in care homes will remain a challenge in future years. However, my work provides clear direction on the next steps for research in this area.

The evidence presented in this programme of work suggests that future research to enhance the response to acute deterioration should have the following characteristics:

- Guided by the principles set out in the Medical Research Council framework for developing complex interventions.
- Represent the resident perspective, by involving residents and/or their families/friends. A strong PPIE component is key to achieving this.
- Adopt co-production methodology to ensure that care home residents and staff are place at the centre of the development novel interventions policies.
- Use implementation science framework to identify/categorise anticipated barriers/facilitators to intervention adoption.
- Measured resident health-related outcomes as part of the evaluation strategy.

6.5 Post-doctoral research plan

This thesis paves the way for post-doctoral research, the aim of which would be to develop a complex intervention to enhance the response to acute deterioration in care home residents. This future programme of work will be guided by the Medical Research Council (MRC) framework for developing and evaluating complex interventions.[109]

In my first strand of future work, qualitative methods will be used to capture resident and family/friend experiences of deterioration and explore the explore the perspectives of care

home and healthcare staff on managing acute deterioration. Individual qualitative interviews will be conducted with residents and their family/friends, care home and healthcare staff to explore a) the experiences of residents and their family/friends of resident acute illness and b) how care home and healthcare staff manage resident deterioration.

In the second strand of work, implementation science theory will be used to identify/categorise anticipated barriers/facilitators to intervention adoption in care homes and map these against potential evidence-based implementation strategies. Findings from my MD and the qualitative interviews will be reviewed and synthesised in order to identify; a) potential intervention components that reflect the priorities of residents and their family/friends, care, home and healthcare staff in relation to acute deterioration; and b) common barriers and facilitators to the implementation of existing or future interventions or tools in care homes. These themes will be mapped against an appropriate implementation theory and/or framework,[99] such as Normalization Process Theory (NPT)[98] or the Consolidated Framework for Implementation Research (CFIR),[110] to categorise these factors (e.g. whether they are related to the characteristics of the tool/intervention itself; to organisational or system-level contextual factors; or to the views and preferences of relevant stakeholders such as care home staff, residents and/or their families). Next, based on the identified barriers/facilitators, I will assemble a menu of potential implementation strategies that can be subsequently tailored/refined by relevant stakeholders in co-design workshops. In doing so, I will ensure that the design of the implementation strategy is guided by both a robust theoretical framework and relevant empirical evidence.

My third area of work will involve co-design workshops to create a novel intervention that aims to improve the identification and response to acute deterioration. I will work with residents (where feasible) and/or family or friends, care home and healthcare staff and service commissioners to co-design the intervention, in two stages:

a) Defining the principles of the intervention and incorporating evidence from my MD and other work packages to determine its components.

b) Devising a delivery structure for the intervention that accounts for the barriers and facilitators highlighted in other work packages.

To ensure the adoption, implementation, and long-term effectiveness of interventions, it is crucial to understand the context of care homes.[79] It is necessary to gain insights into the experiences and challenges faced by staff in managing resident deterioration. Care home staff will participate in the qualitative study and play a central role in intervention co-production, ensuring that future interventions are feasible, acceptable, and sustainable.[111] As a GP, I recognise that understanding how care home and healthcare staff work together to respond to acute resident deterioration is critical to the success of future work. It will also be important to engage the support of care home managers, to ensure that they understand the intervention and see its value, to achieve successful adoption of an intervention to improve the response to acute deterioration.

One challenge in developing an acute deterioration intervention will be accounting for the significant variation in how healthcare services are structured around care homes across different regions of the UK.[112] To ensure relevance and generalisability, my future research will extend its reach to include a broader range of regional contexts.

6.6 Patient and public involvement and engagement in future work

My PPIE advisory group has made important contributions to my post-doctoral research plan including:

1/ Highlighting that traditional professional hierarchies between care home and healthcare staff could be a potential barrier to care home staff contribution during mixed participant co-design workshops. We have discussed strategies to mitigate this.

2/ Supporting the involvement of care home residents in the research by offering practical suggestions to overcome potential barriers to meaningful participation, such as adapted communication methods for those living with cognitive impairment.[113]

3/ Advising on how the recruitment strategy can be tailored to my dual clinician and researcher role, to ensure that residents and their family/friends, and staff appreciate that participation in the research is voluntary.

Emerging research findings will be subject to scrutiny by the PPIE group, and they will participate in qualitative data analysis. Findings will also be discussed at the care home resident PPIE group, convened by the North-East and North Cumbria Applied Research

Collaboration. I will work with PPIE partners to co-produce the plain English summaries and to secure the dissemination of my findings to non-academic audiences.

6.7 Chapter summary

This thesis provides the foundations for developing an evidence-based intervention to respond to acutely deteriorating residents that accounts for the complex needs of care home residents and the challenges faced by staff. Research in this area must cut across health and social care and involve multiple disciplines including GPs, community nurses and ambulance staff. Most important for me, my future research should be of direct benefit to residents, helping to ensure prompt management of their acute deterioration and prompt delivery of care that is in line with their wishes. The proposed intervention should provide care home staff with a structure for identifying deterioration and communicating their concerns to healthcare staff. There will be benefits for community healthcare staff if the intervention can improve the triage process of concerns from care home staff. Early and more targeted response to acutely deteriorating residents would benefit the healthcare system, reducing demands on the NHS, and in particular the costs (both financial and opportunity or personal costs) associated with potentially avoidable hospital admissions.

Features of evidence to date	Consequence/evidence gap	Future considerations
The tendency for a 'top-down' approach to intervention implementation, taken from health services and without consideration of the social care context.	1/ A potential mismatch between the priorities of policymakers and care homes. 2/ Inconsistent engagement with interventions.	Meaningful involvement of care homes in intervention co-design is required in future work.
A disproportionate emphasis on the role of care homes in improving the response to acute deterioration.	Interventions and research have focused on care homes, with insufficient attention on healthcare services.	Future work is required to adopt a system-wide approach so that healthcare services support the delivery of acute care in care homes.
A limited evidence base about the perspectives of healthcare professionals/lack of engagement with other key stakeholders.	A limited understanding of how care home and healthcare professionals work together.	The need for qualitative data on the experiences of healthcare professionals of managing acute deterioration e.g. GPs.
Care home residents have not been involved in deterioration tool design.	The perspective of care home residents about acute deterioration and their priorities for care is unknown.	Involvement of residents and/or their families/friends as participants in intervention co-design.
Insufficient consideration for the daily challenges facing care home teams, and competing priorities.	1/ Inconsistent engagement with the use of deterioration tools. 2/ A lack of understanding about the potential unintended consequences of tool use	Future work needs to account for the strains on care home resources, staff, capacity and workload.
The complexity of using deterioration interventions in the care home setting has not been sufficiently acknowledged.	The transfer of deterioration tools from other settings may be burdensome for care home staff.	Meaningful engagement of care home staff in intervention co-design is required in future work.
Deterioration tools have been introduced into care homes without a formal implementation strategy.	Inconsistent uptake of interventions.	The need to use implementation science theory to identify barriers/facilitators to intervention adoption.
The outcomes used to evaluate interventions/tools have not measured direct impact on resident care.	A lack of evidence about whether tools/interventions improve resident care.	Resident health-related outcomes should be measured as part of future evaluation strategies.

Table 1: Key implementation challenges, consequences/evidence gaps and future considerations for future work.

6.8 Conclusion

My thesis presents a body of evidence that makes an important contribution for improving resident acute deterioration care, emphasising the relevance to both health and social care. The complexities of this challenge and key considerations for designing and implementing future interventions have been highlighted. I have identified evidence gaps, features of deterioration tools that should be preferred for future development, and I have explored the need to adopt implementation science theory. In future work, it is essential that care home residents and staff are central to intervention co-production, to ensure that future interventions are consistent with the lives of those who live and work in care homes.

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RESEARCH PAPER

Changes in health and functioning of care home residents over two decades: what can we learn from population-based studies?

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Abstract

Background: Care home residents have complex care and support needs. There is a perception that the needs of residents have increased, but the evidence is limited. We investigated changes in health and functioning of care home residents over two decades in England and Wales.
Methods: We conducted a repeated cross-sectional analysis over a 24 year period (1992–2016), using data from three longitudinal studies, the Cognitive Function and Ageing Studies (CFAS) I and II and the English Longitudinal Study of Ageing (ELSA). To adjust for ageing of respondents over time results are presented for the 75–84 age group.
Results: Analysis of 2,280 observations from 1,745 care home residents demonstrated increases in severe disability (difficulty in at least two from washing, dressing and toileting). The prevalence of severe disability increased from 63% in 1992 to 87% in 2014 (subsequent fall in 2016 although wide confidence intervals). The prevalence of complex multimorbidity (problems in at least three out of six body systems) increased within studies over time, from 33% to 54% in CFAS I/II between 1992 and 2012, and 26% to 54% in ELSA between 2006 and 2016.
Conclusion: Over two decades, there has been an increase in disability and the complexity of health problems amongst care home residents in England and Wales. A rise in support needs for residents places increasing demands on care home staff and health professionals, and should be an important consideration for policymakers and service commissioners.

Keywords: care homes, health, disability, CFAS, English longitudinal study of ageing, older people

Key Points

- Care home residents have complex care and support needs.
- Despite a perception that the needs of care home residents have increased over time, the epidemiological evidence is limited.
- This study demonstrates an increase in the level of disability and the complexity of health problems amongst care home residents in England and Wales over two decades.
- The rise in support needs for care home residents places increasing demands on care home staff and health professionals, and should be an important consideration for policymakers and service commissioners.

Background

Care home residents are known to have high needs for health and social care support [1]. There is a perception amongst care home and NHS staff that residents' needs have grown in number and complexity in recent years [1, 2]. However, evidence from epidemiological studies about changes in the resident population is limited. People in care homes take part in some research, but many studies exclude residents, either at the start or at the point when they move into a care home [3].

Information about the health of UK care home residents is available from a small number of population-based cohort studies, including the Cognitive Function and Ageing Studies (MRC CFAS—here called CFAS I and CFAS II) [4], and the English Longitudinal Study of Ageing (ELSA) [5].

Analysis of these and other data point to a possible rise in care needs. A study based on ELSA (2002 to 2015) described an increase in the number of health conditions and functional deficits amongst older people who were about to move into a care home [6]. The proportion of older people living with dementia in care settings increased from 56% in CFAS I (1991–1994) to 70% in CFAS II (2004) [7]. Despite nearly all residents in long-term care having functional impairment at both time points, more were chair or bed-bound in CFAS II (34%) compared to CFAS I (22%) [8].

An in-depth understanding of trends in the health and functioning of care home residents is needed as care providers and policy makers strive to meet the needs of this complex population. In the absence of a minimum dataset for UK care home residents, this study set out to synthesise data from existing cohort studies of ageing in England in Wales. The aim is to investigate how the health and functioning of care home residents in epidemiological studies in England and Wales have changed over time. This will be done by addressing the question of how the proportion of care home residents experiencing complex multimorbidity, severe disability and poor self-reported health has changed over time.

Methods

Study design and participants

Data were obtained from MRC-CFAS (CFAS I), CFAS II and ELSA. Full details of the CFAS I [9] and CFAS II study design and methods have been described in detail elsewhere [7]. Briefly, CFAS I and II are both interview population-based cohort studies [8]. The CFAS I interviews were conducted between 1991 and 2003 in five geographical areas in the UK (Cambridgeshire, Gwynedd, Newcastle, Nottingham, Oxford). CFAS II interviews took place between 2008 and 2012 using three of the same geographical areas (Cambridgeshire, Newcastle, Nottingham) and the same study design. ELSA is a panel study of men and women aged ≥50 years living in England [5]. Participants are interviewed approximately every 2 years [5]. ELSA does not recruit new participants from care homes but attempts to collect data on those who transfer into a care home during the follow-up period [6]. The ELSA core datasets for each individual wave were used to identify all participants who had an institutional interview, either in-person or informant, to define the care home population. The ELSA harmonised dataset, which incorporates proxy responses, was then used to investigate the variables of interest. Individuals were included if they were original participants or refreshment sample participants (partners were excluded) for all interviews from wave 3 to wave 8. In addition, to reflect the ageing sample, individuals who were below the age of 65 at each interview wave were excluded. In CFAS I and II, participants living in council residential or nursing homes, private nursing homes or long stay hospitals defined the care home population. CFAS I and II used informant interviews to supplement respondent information in the case of cognitive or physical frailty impairing the interview. Respondent and interview information was merged.

Variable description

We explored changes in self-reported health, levels of multimorbidity and disability. Self-reported health was reported as excellent, good, fair or poor in ELSA and CFAS studies. For the multimorbidity and disability domains, we selected core variables that were common to CFAS and ELSA, to allow comparison across datasets. These core variables were combined into new variables, which were used to make inferences about multimorbidity and disability. The variable groupings are shown in Supplementary Tables S1 and S2.

Disability was measured as difficulty in undertaking activities of daily living. Activities relevant to care home residents were included, such as help with going to the toilet. Variables less relevant to care home residents, higher on the hierarchy of disability [10], for example, the ability to do the shopping and prepare a meal, were excluded. Participants were classified as having a severe disability if they had difficulty, or needed assistance, with two out of the three domains—washing, dressing and going to the toilet.

In the multimorbidity domain, we selected variables that have been shown to be risk factors for functional decline in older adults [11]. The medical conditions in the core variables were grouped according to body system: cardiovascular, cerebrovascular, musculoskeletal, endocrine, respiratory or cognition. The resident was classified as having morbidity in a domain if they had a medical condition related to that particular body system. Complex multimorbidity was defined as having a morbidity in at least three out of six body systems [12] (Supplementary Table S2).

Statistical analysis

STATA15 was used to conduct a repeated cross-sectional analysis study. At the mean time point for each round of data collection, the prevalence of core and derived variables was calculated. In CFAS I and II, the interview question about medical conditions was sometimes phrased according to responses at a previous wave of data collection ('since we last saw, has your Doctor told you . . . '). In these instances, responses from previous rounds of data collection were considered in order to derive the prevalence. Baseline (cross-sectional) weights were released into both studies. To adjust for longitudinal attrition inverse probability weighting was calculated for each wave taking account of age, sex, health status, disability, self-reported health, and care home status at the previous wave. Individuals who were lost from the studies due to death were not included within the longitudinal attrition weights calculated (for ELSA death (after wave 6) was part of the imputation model). To account for item non-response within an interview, multiple

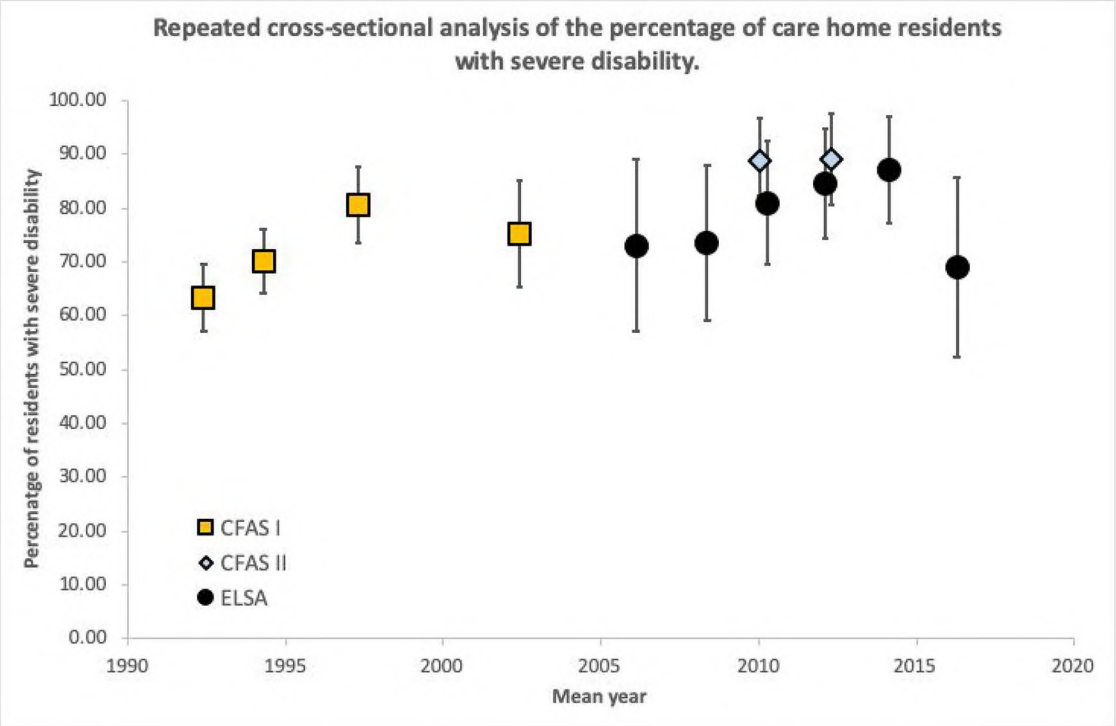

Figure 1. Prevalence of severe disability amongst care home residents from 1992 to 2016 in CFASI/II and ELSA studies. Severe disability defined by difficulty in two out of the three domains (washing, dressing and toileting).

imputation was undertaken. Each study had its own multiple imputation model for all variables that are used to calculate self-reported health, multimorbidity and severe disability, together with care home status, age and sex. Multiple imputation by chained equations using 50 imputation samples were used. Logistic regression was used to model the relationship between the presence of each variable with age and interview wave. The main analysis presents predicted probabilities of each variable within the age group 75–84 years, which are used in the analysis to adjust for the longitudinal nature of the data and as small numbers make age-standardisation unstable. Trends over time were estimated from a generalised linear hierarchical model. A sensitivity analysis to account for including the same individuals at more than one interview presents only the cross-sectional results from the individuals the first time they were interviewed in a care home (see supplementary appendix).

Findings

Study Participants

We analysed 2,280 observations from 1,745 care home residents of which 74% were female. The mean age was 85. Data sources and participant characteristics are presented in Table 1. Data were obtained from 365 observations from the ELSA cohort, waves 3 (2006) to 8 (2016). There were no participants in care homes in waves 1 or 2. There were 1,608 observations from care homes across four waves of CFAS I, spanning a period from 1992 to 2003. There were 307 observations across the two waves of data collection for CFAS II, from 2009 to 2013.

Functioning and disability

There is an emerging trend showing that the prevalence of severe disability is increasing between 1992 (63%—CFAS) and 2014 (87%—ELSA) (Figure 1, Supplementary Table S1), P-trend < 0.001. This trend is largely driven by increases in the prevalence of difficulty, or needing assistance with, dressing (P-trend = 0002) and bathing (P-trend < 0.001). A less clear pattern was observed for toileting (though still statistically significant P-trend < 0.001). The prevalence of severe disability fell in 2016 (ELSA) though the estimate has a wide confidence interval and more data is needed to determine whether this fall persists, given the consistency of increases demonstrated in previous years.

Health and multimorbidity

The prevalence of complex multimorbidity amongst care home residents showed increases within each study over time, from 33% to 54% in CFAS I/II (1992 to 2012) and from 26% to 54% in ELSA (2006 to 2016), but not overall (Figure 2, Supplementary Table S2) (though the hierarchical model did suggest an overall trend P-trend < 0.001). This may reflect the differences in multimorbidity reporting and the diagnostic criteria used for each study. For CFAS I and II, the prevalence of problems with cognition increased

Table 1. Data sources and participant characteristics

Study	Round of data collection	Modal year	Number of participants in care homes. All/first interview	Median age all/first interview	Gender (% female)
CFAS I	SO	1992	630/630	84/84	74.9
CFAS I	S2, C2	1994	574/331	84/83	73.3
CFAS I	S6, C6	1997	256/130	87/86	76.4
CFAS I	CX	2002	148/125	87/88	77.8
ELSA	Wave 3	2006	47/47	85/85	72.2
ELSA	Wave 4	2008	62/45	86/87	77.0
ELSA	Wave 5	2010	69/47	86/86	71.3
ELSA	Wave 6	2012	72/46	88/88	79.2
ELSA	Wave 7	2014	59/34	88/88	68.8
ELSA	Wave 8	2016	56/44	91/91	79.7
CFAS II	Wave 1	2010	202/202	86/86	71.6
CFAS II	Wave 2	2012	105/64	88/87	74.0

from 75% in 1992 to 95% in 2012. ELSA exhibited a similar trend, increasing from 60% in 2006 to 81% in 2016. Likewise, for CFAS I and II, the prevalence of cardiovascular disease doubled from 22% (1992) to 41% (2012) and for ELSA 37% (2006) to 54% (2016). The prevalence of musculoskeletal disease (arthritis) was high at all data collection points, but there was no observable trend in cerebrovascular (stroke), endocrine (diabetes) and respiratory disease.

Self-rated health

Figure 3 shows that self-rated health does not appear to change across the study period (P-trend = 0.12). It remained constant in CFAS I and CFAS II as nearly 50% of care home residents expressing fair/poor health. This was higher in ELSA, but with wide confidence intervals as informant interviews could not be used for this variable.

Sensitivity analysis

Similar results were seen if only responses from the first interview residents undertook in the care home setting were used to investigate the trends.

Discussion

Over two decades, there has been an increase in the levels of disability amongst care home residents in England and Wales, as well as increases in complex multimorbidity, demonstrated using data from three longitudinal studies. Compared to residents in preceding decades, this study suggests that current care home residents have greater needs for support and consequently are likely to place greater demands on the staff and services who care for them.

Comparison with other work

This study substantiates the perception that meeting the needs of care home residents is becoming more demanding and complex. It adds to current evidence indicating that, over time, older people in a range of settings are living with more medical conditions and more severe levels of disability [6–8]. The trends reported here were observed in both the CFAS and ELSA cohorts. The size and health of the care home population are the result of a complex network of direct and indirect influences. The number of care home beds has fallen from a peak in the mid-1990s, linked to the implementation of the NHS and Community Care Act in 1993 [13], just after our study started. However, the availability and funding of community-based social care, wider economic factors and policies that impact directly on staffing, such as the national minimum wage, are all likely to have played a role [14, 15].

Strengths and limitations

This is a novel, detailed exploration of how the health profile of UK care home residents has changed over more than two decades. A clear picture has emerged from analyses of data drawn from nationally representative studies that differed in their base populations, time, scope of data collection and purpose. This increases our confidence that the findings are representative of what is happening in care homes in England and Wales. However, it is important to acknowledge the limitations of our study design. None of the studies were designed to specifically investigate the health of care home residents, and some of the available measures of disability, such as the ability to shop, were not relevant to this population. As expected, the variables in the two datasets were not identical. There were differences in how the questions were asked. CFAS participants were asked to distinguish between 'difficulty performing' and 'needing assistance' with ADLs, for example. To harmonise constructs such as disability or multimorbidity across studies, the study team was obliged to make some judgements on the comparability of measures. Nevertheless, despite these limitations, the message across different measures and datasets was the same.

Implications for future research

Our findings emphasise the importance of developing systematic data collection on the health and functioning of care home residents in the UK [3], similar to the minimum dataset in the USA [16]. In the longer term, access to a standardised set of information about the health and function of care home residents would allow more detailed exploration

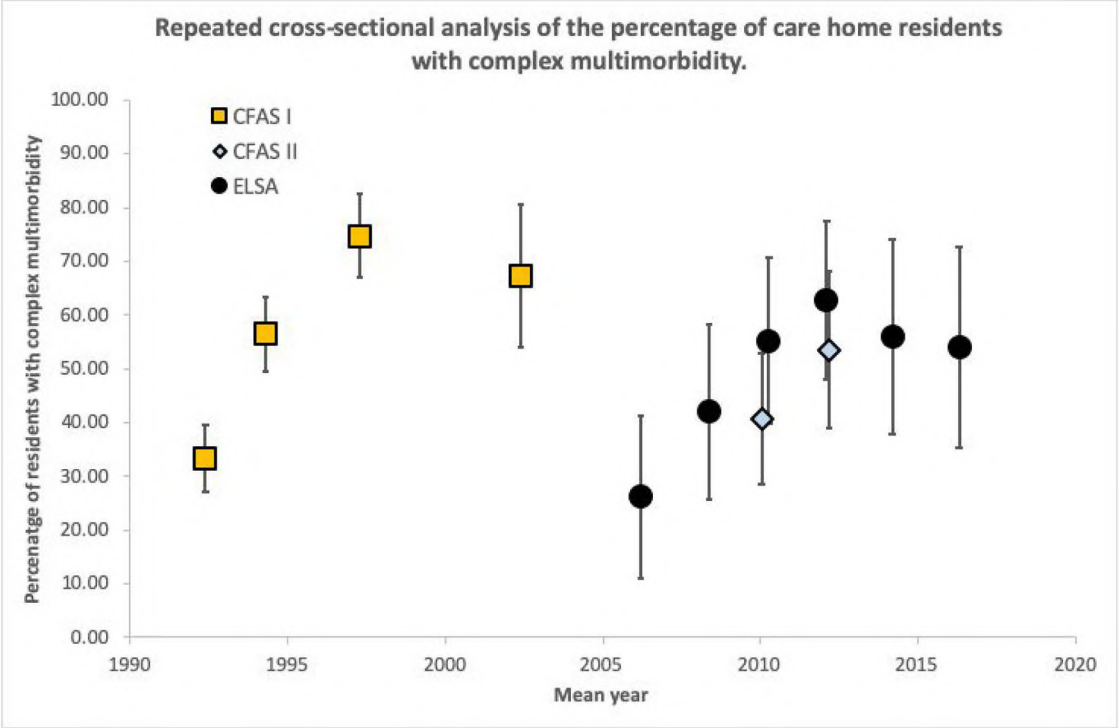

Figure 2. Prevalence of complex multimorbidity amongst care home residents from 1992 to 2016 in CFASI/II and ELSA studies. Complex multimorbidity defined by medical conditions in at least three out of six domains (cardiovascular, cerebrovascular, musculoskeletal, respiratory, endocrine and cognition).

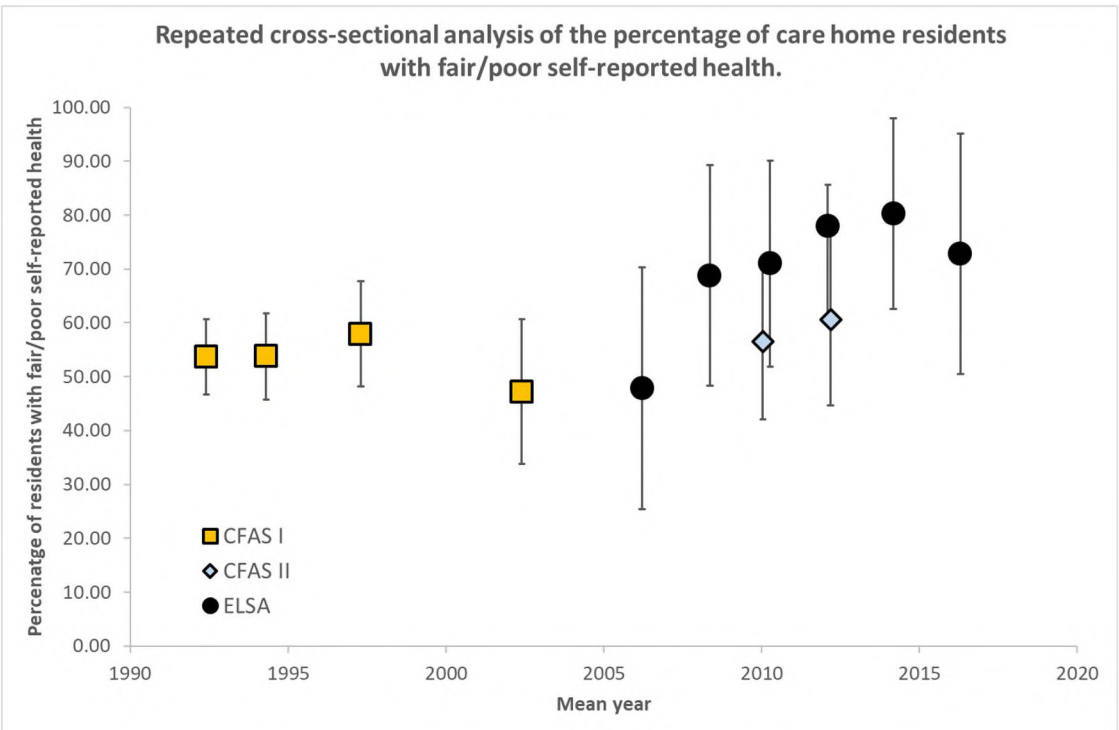

Figure 3. Prevalence of fair/poor self-reported health amongst care home residents from 1992–2016 in CFASI/II and ELSA studies.

of changes in health and functioning for care home residents, without the need for resource-intensive cohort studies.

As the complexity of residents' needs intensifies, the number of people in care homes is also expected to increase. The size of the care home resident population aged over 65 years has not changed since 2001, despite an 11% increase in the overall population at this age [17]. However, the proportion of people aged over 85 living in long-term care establishments is increasing [18]. Future expected gains in later life expectancy will lead to substantial increases in care needs, and it is predicted that 71,125 more care home places will be required in the UK by 2025 to meet these demands [19]. The increase in care needs requires urgent attention from policy makers and care providers to secure the resources required for future care home residents.

Conclusion

This study demonstrates increases in the level of disability and the complexity of health problems amongst care home residents in England and Wales over two decades, which place additional demands on care home staff and health professionals. This should be an important concern for policymakers and service commissioners to ensure that the complex needs of care home residents are met in future.

Supplementary Data: Supplementary data mentioned in the text are available to subscribers in *Age and Ageing* online.

Declaration of Conflicts of Interest: None.

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ORIGINAL ARTICLE

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Future-proofing the primary care workforce: A qualitative study of home visits by emergency care practitioners in the UK

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KEY MESSAGES

- In this pilot, patients, GPs and Emergency Care Practitioners (ECPs) felt that ECPs performing primary care home visits positively impacted patient care and GP workload.
- Overcoming preconceptions about ECP role and expertise, and remodelling professional boundaries between ECPs and GPs were particularly important.

ABSTRACT

Background: Broadening the skill-mix in general practice is advocated to build resilience into the primary care workforce. However, there is little understanding of how extended-scope practitioners from different disciplines, such as paramedicine and nursing, embed into roles traditionally ascribed to general practitioners (GPs).

Objectives: This study sought to explore patients' and professionals' experiences of a primary care home visiting service delivered by emergency care practitioners (ECPs), in place of GPs; to determine positive impacts/unintended consequences and establish whether interdisciplinary working was achieved.

Methods: Three practices in England piloted an ECP (extended-scope practitioners with a paramedic or nursing background) home visiting service (November 2018–March 2019). Following the pilot, focus groups were conducted with each of the three primary healthcare teams (14 participants, including eight GPs), and one with ECPs (five participants) and nine individual patient interviews. Data were analysed using a modified framework approach.

Results: The impact of ECP home visiting on GP workload and patient care was perceived as positive by patients, GPs and ECPs. Initial preconceptions of GPs and patients about the ECP role and expertise, and reservations about the appropriacy of ECPs for home visiting, were perceived to have been overcome by the expertise and interpersonal skills of ECPs. Fostering a culture of collaboration between ECPs and GPs was instrumental to remodelling professional boundaries at the practice level.

Conclusion: Broadening the skill-mix to incorporate extended-scope practitioners such as ECPs, to deliver primary care home visiting, presents an opportunity to increase resilience in the general practice workforce.

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General practice/family medicine; quality of care; integrated care; qualitative designs and methods

Introduction

Primary care services in the UK and Europe are facing a workforce crisis. In the UK, growth in the volume and complexity of general practice work has been compounded by falling general practitioner (GP) numbers [1,2]. Broadening the primary care workforce to reduce demand on GPs is one of 10 National Health Service England and Improvement (NHSE and NHSI) high-impact targets [3]. The British Medical Association and NHS England five-year plan (2019) proposed over 20,000 posts for allied health professionals [3], expanding their scope of practice to support primary care teams [2]. A community paramedic working in this extended scope role is a clinician with paramedic training with 'community-focused extension of the

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Supplemental data for this article can be accessed here.

traditional emergency response and transportation paramedic model [4]', including primary care roles.

The delivery of medical care to homebound patients is integral to primary care in Europe. In the UK, GPs conduct planned and unscheduled (acute) home visits. These place a significant demand on GP time. Ambulance service clinicians, such as paramedics, are accustomed to assessing patients with acute health problems in their own homes, and may be ideally placed to take on primary care home visiting [5]. Potential benefits could include shorter waits for home visits, fewer emergency transfers to hospital, longer consultation times and increased patient satisfaction [6–8]. GPs, free from home visits, could have more time to manage other patient groups with complex needs [5,6].

There is policy support for expanding practitioners from other healthcare disciplines like paramedics into roles traditionally ascribed to GPs, despite limited evidence about the potential benefits or unintended consequences such as the impact on continuity of care [5,6]. A small qualitative study on paramedic practitioners performing home visits for patients aged >65 years found that patients deemed home visits by paramedics as acceptable, but poorly understood the role of paramedic practitioners [9].

In recent years, several professional groups have taken on new roles in UK primary care. The integration of nurse practitioners into primary care teams has been described as a 'dynamic, complex and messy' process [10], necessitating careful planning, collaboration and redefinition of professional boundaries [10–12]. More recent work on integrating physician associates in primary care suggests that professional boundaries can be redefined at the GP practice level [13]. Despite recent work exploring how paramedics may be deployed in primary care, there is a paucity of evidence about how to embed such practitioners into primary care teams [5,14].

Emergency care practitioners (ECPs) are practitioners from paramedic or nursing backgrounds, with extended scope and training to work across traditional organisational boundaries [15], such as in primary care roles. This study took the opportunity offered by a pilot of primary care home visits conducted by ECPs, to retrospectively explore patient and staff views and experiences of this model of home visiting, and answer the following research questions:

1. What are patient and primary care and ambulance staff perceptions of a home visiting service performed by ECPs in place of the GP?
2. What were the positive impacts and any unintended consequences?
3. What factors influenced collaborative working between GPs and ECPs?

Methods

Setting

Three general practices in a semi-rural area of northern England collaborated with the NHS Ambulance Trust to pilot primary care home visits conducted by ambulance service clinicians (role described below). The combined patient population across the three practices (January 2019) was approximately 25,500 (adjusted list sizes of 8293, 10,663 and 6650 patients). The rurality index and indices of deprivation scores of the three practices ranged between 1.019 and 1.074 and 9–10, respectively.

ECPs

Each day there were two or three ECPs, employed by the local ambulance service, working with three GP surgeries to conduct home visits. They were drawn from a pool of 31 ambulance service staff. Half of the ECPs (15/31) had a UK paramedic background and half were nurses (16/31). The majority (24/31) had completed advanced clinical practice (MSc or equivalent) training, equipping them with common skills to expand their scope of practice [16] (for example primary care home visiting), and the remaining staff (7/31) were undertaking this training. Regardless of their background, all ECPs identified themselves as working for the ambulance service, wore the same uniform and performed the same role.

The term ECPs will be used throughout this paper to refer to this ambulance service staff group conducting home visits. The role performed matches that of an ECP; 'a generic practitioner drawn mainly from paramedic and nursing backgrounds' with 'formal training and extended clinical skills', to fulfil roles across traditional organisational boundaries and 'to carry out initial assessment of patient need, and to either treat or refer to the appropriate care pathways' [15].

Pilot model of home visiting

This was a five-month pilot service (November 2018–March 2019), operating during routine GP working hours (Monday-Friday, 08:00-18:30). ECPs conducted home visits for patients requesting same-day

home visits. Patients or carers telephoned the practices and provided brief details to reception staff about the reason for the home visit request. GPs ensured that there was no specific reason why allocation should not be to an ECP, for example, medical emergencies requiring immediate conveyance to hospital. The ambulance trust stipulated that the following patient groups were not eligible for an ECP visit due to the scope of their training; children under 5 years, pregnant women, mental health crises and patients with palliative care needs.

Over the five-month pilot, ECPs performed 857 home visits (440 Practice 1, 281 Practice 2 and 136 Practice 3), for patients between 21 and over 100 years old. The most common problem assessed was respiratory illness, followed by musculoskeletal symptoms (non-trauma), musculoskeletal/soft tissue injury and urinary symptoms. This is typical for same-day home visit requests [17].

Sampling and recruitment

Semi-structured interviews were carried out with patients who received a home visit from an ECP. Eligible patients were identified by practice managers, in conjunction with GPs, at each surgery *via* clinical record screening. Practice staff worked in reverse chronological order, according to visit date, to maximise participant recall. Care home residents and patients unable to consent were ineligible for participation. Eligible patients were telephoned by non-clinical surgery staff to assess interest in the study. Participant information sheets and consent forms were posted, and followed up by a telephone call from the research team.

Focus groups were conducted with GP and ambulance service staff involved with the pilot. Practice managers identified potential primary care staff participants, and ECPs were identified by ambulance service management.

Table 1. Participant characteristics.

Interview type	Total participants
Patients	
GP Surgery 1	5
GP Surgery 2	3
GP Surgery 3	1
Total	9
Patient age range: 40–87 (7 female 2 male)	
Staff	
GP Surgery 1: Focus group	7
GP ($n = 4$)	
Reception staff ($n = 2$)	
Nurse ($n = 1$)	
GP surgery 2: Focus group	5
GP ($n = 3$)	
Practice manager ($n = 1$)	
Reception staff ($n = 1$)	
GP Surgery 3: Dyadic interview	2
GP ($n = 1$)	
Reception team leader ($n = 1$)	
ECPs: Focus group	5
Total	19
Grand total	28

Data collection

Data collection took place between May–October 2019 (Table 1). Topic guides were based on published literature and discussions with senior staff involved in the pilot. One-on-one interviews were employed for patients as their experience may involve sensitive discussions. Interviews with patients were conducted by RS/SR (experienced post-doctoral female researchers), by telephone or in the patient's home. Informed written consent was obtained before interviews started. Competing priorities for one practice limited the recruitment of patients for interview. The interview topic guide was designed to elicit open-ended responses, with probes to encourage greater reflection in specific areas: how the ECP home visit compared to a GP home visit, views on continuity of care, patient experience of treatment decision-making. Interviews lasted 15–60 min. Data sufficiency was determined when no new subthemes emerged.

Focus groups were utilised for staff participants, as they were known to each other, allowing participants to exchange views. Separate focus groups were conducted per physical workplace. The focus group topic guide explored expectations of ECP home visiting; whether expectations were met; communication between GPs and ECPs; perceived impact on patient care and primary care workload; and whether the pilot produced any unanticipated consequences.

Interviews and focus groups were audio-recorded and transcribed verbatim. Data collection ceased once data sufficiency was achieved; determined as when no new subthemes emerged.

Data analysis

Transcripts were analysed using a framework approach [18], which provides a flexible and rigorous approach to qualitative analysis. A matrix was constructed in Microsoft Excel, with interview and focus group topics inserted as initial themes within the framework (as columns) and populated with data by the interviewers to ensure consistency and enhance reliability. RS and SR coded interview and focus group transcripts

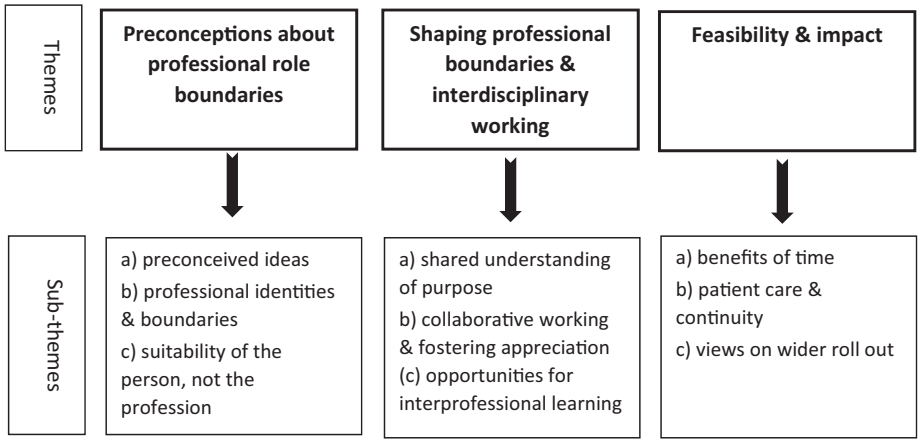

Figure 1. Themes and sub-themes.

separately, then together, iteratively revisited the framework and its themes to review and re-shape themes as they emerged from coding. Themes were then populated within the framework.

Results

Two separate focus groups were conducted with staff from two practices (one focus group per practice), plus a dyadic interview with a third practice, and one focus group with ECPs. Individual interviews were carried out with nine patients (Table 1).

Our analysis is summarised in Figure 1, according to the following themes and sub-themes.

Theme 1: Preconceptions about professional role boundaries

This theme describes participant's preconceptions about the ECP role and expertise, prior to the pilot commencing.

Preconceived ideas. While most GPs embraced the concept, some voiced reservations about the acceptability to patients of ECP home visiting. They believed that patients may have certain expectations about who visited, and prefer continuity with GPs.

> *'…we were a little bit concerned about patient acceptance of them… It's quite traditional around here isn't it? Our general practice, they're (patients) used to seeing familiar faces'. Participant 1, GP, Practice 3.*

Practice staff also expressed concerns that the ECP clinical expertise may be narrower than GPs. At the outset, the skillset, previous experience and training of ECPs were not fully appreciated.

> *'I was a little bit concerned about the level of knowledge and expertise … often our patients have lots of comorbidity and they are on a lot of drugs so actually probably the most complicated group of people that we see…'. Participant 3, GP, Practice 2.*

> *'… initially when it was all proposed it was like, "'Well who are these people? What are their skill levels? Which patients are we going to give them?"' Participant 5, GP, Practice 2.*

These perceptions were revised as the pilot progressed.

> *'…I suppose we did have a degree of apprehension that they might be a little bit risk averse when dealing with patients because as you say, they're not really used to making that many management decisions – just more stay at home or sending to hospital. But we certainly didn't find that [when the pilot started]. For the most part they were keeping people at home appropriately with appropriate safety net advice… I think that the care they provided was excellent.' Participant 1, GP, Practice 3.*

Patients also held preconceived ideas about the role of ambulance service staff, and that the arrival of an ECP meant they were sufficiently unwell to require hospitalisation. Reception staff aimed to explain to patients that the home visit may be performed by an ECP. However, many patients reported being unaware that an ECP would arrive. Patients also worried that ambulance service staff were being taken away from their emergency response role.

> *'…she (receptionist) said, 'we'll send someone out,' and I assumed it was a doctor but obviously it wasn't, so I was very surprised […] I thought, 'Is there something wrong with me, worse than what I actually said over the phone?' Ivy, patient, Practice 1 (names used are pseudonyms).*

> *'…I was thinking, them coming to me, they were called away, then someone who was experiencing a life-*

threatening thing – were they able to get to them … ?' Lisa, patient, Practice 1.

Professional identities and boundaries. The professional identity of GPs and ECPs is a key sub-theme. When discussing skill sets, both GPs and ECPs engaged in boundary work, defining the other as outside their profession's boundary. GPs positioned themselves as particularly capable in dealing with medical complexity, fearing that ECPs would be more inclined to admit patients to hospital.

'I think, as a GP, one of our skills is risk management and managing complexity and how we really didn't know what the quality of the practitioners would be, and how they would manage with that with our population in that regard … would [hospital] admissions go up?' Participant 3, GP, Practice 1.

In turn, ECPs highlighted situations where their knowledge of urgent care pathways placed them in a better position to organise efficient transfer to hospital.

'Depending on how they need to go in. It could be a transport only into hospital and are appropriate for a certain type of vehicle, which the GP might not know about'. Participant 2, ECP Focus Group.

Initial fears and preconceptions of GPs about the capabilities of the ECPs were resolved throughout the pilot, as described below.

Primary care staff and patients referred to ECPs as 'paramedics' or identified them according to the organisation they worked for. Despite some practitioners having a nursing background, as opposed to paramedic training, ECPs performed the same role, so distinctions were not made between paramedics and nurses. There was limited awareness of primary care staff of the differing professional backgrounds:

'they were advanced practitioners, and [I discovered after the pilot started that they] might have a nursing background or an entirely separate background from the sort of ambulance paramedic stream so that's a preconception again'. Participant 3, GP, Practice 1.

Suitability of the person, not the profession. Patients had positive views of ECP's expertise and interpersonal skills. Patients felt the treatment received from the ECPs was thorough and comparable with that provided by a GP.

'You're looking for a qualified person you know … To have a qualified person coming in just gives you that wee bit of confidence, so it could be a paramedic, it could be a doctor, it could be a nurse'. Jane, patient, Practice 1.

Interpersonal skills and relationships were key for patients:

' … he instantly put my husband and I at ease. He was very friendly and he had a nice smiley face. He didn't come in with – I'm gonna say a typical doctor's look on his face [chuckles] '. Ethel, patient, Practice 2.

A minority of patients preferred a GP home visit, highlighting continuity and the assurance of familiarity. One patient with a complex medical background, requiring regular home visits, reflected on the value of continuity:

'I feel very vulnerable, lying in bed as well, letting people in to your private … But she [ECP] made me feel comfortable […] I would prefer somebody who I know and who knows my history, to be honest. […] I wouldn't mind a paramedic, but a doctor is best. And with my circumstances, it's probably a better idea [to have a doctor]'. Amy, patient, Practice 3.

Theme 2: Shaping professional boundaries and interdisciplinary working

This theme describes how, at the individual practice level, the potential for preconceptions and professional boundaries to impede interdisciplinary working were navigated.

Shared understanding of purpose. Practice staff and ECPs held positive views of the pilot. The expected benefits of enhancing skill-mix, such as reducing GP workload and learning opportunities, were highlighted.

'Initially obviously we were really positive about it because […] we get a lot of home visits and anything that could be done to try and reduce that workload'. Participant 1, GP, Practice 3.

' … [what] I was sold on was that we were going to be doing more primary care work, working alongside GP surgeries … I don't want to be going around on the blue lights'. Participant 4, ECP Focus Group.

The three GP practices had the opportunity to shape the way ECPs integrated into their teams.

'It meant that the scale – we could be involved a little bit in the design of how information flowed and how we communicated'. Participant 1, GP, Practice 1.

Collaborative working and fostering appreciation. Working collaboratively was viewed as instrumental to the success of the pilot. Both ECPs and GPs reflected on the importance of positive communication, as well as trust and appreciation of each other's practices, which developed over the course of the pilot.

'[…] initially when we first went in there was – what they were giving us was sort of […] the quite simple ones […] we were capable of doing more…'. Participant 5, ECP Focus Group.

Participant 4: 'I think trying to get to that level of trust'…

Participant 5: 'yeah […] by the end of the pilot it was just go and see almost anything!' Participant 5, ECP Focus Group.

'It was apparent – the quality of assessments people were getting [from the ECPs] was really high– and the judgements, it all sounded appropriate'. Participant 3, GP, Practice 1.

Patients were also reassured by collaboration between GPs and ECPs, which maintained a level of continuity of care.

Researcher: 'How did you feel about the paramedic (ECP) calling your GP just to check?'

Ellen: 'Well it was reassuring that you're getting the right medication, because obviously your doctors know, you know? They've got all your information in front of them'. Ellen, patient, Practice 2.

Opportunities for interdisciplinary learning. The pilot created an opportunity for mutual teaching and learning. However, much of this learning was one way, with ECPs typically taking on the student's role while GPs viewed themselves as teachers. Debriefs allowed ECPs to learn about primary care, affirm their decision making and fostered working relationships.

'It became very much an educational role that you had with [the ECPs]… They were learning on the job and you were kind of educating them….' Participant 5, GP, Practice 2.

Theme 3: Feasibility and impact

This theme describes views on the impact of ECPs performing home visits in place of GPs.

The benefits of time. GPs considered their home visiting responsibilities to be time-consuming. There was a perception that ECPs released time for GPs to do other tasks.

'I think [the pilot] reduced the amount of acute visits that we [GPs] had to do… So I still visited quite a lot during the period but rather than seeing acute visits, I had more opportunity to do some of the management stuff or care planning'. Participant 5, GP, Practice 2.

Patients and GPs also appreciated the timeliness of ECP home visits, and the amount of time spent with patients – whether this was just to be listened to, or because the ECPs had time to provide a more thorough assessment.

'[…] Basically, we had the time to do that. GPs don't have the time to do that and I think that more than compensated for the fact that the patient was getting a practitioner (ECP) instead of the GP'. Participant 4, ECP Focus Group.

'[…] so going out to see them it's not just about giving them the antibiotics and steroids if that's what they need and leaving them at home […] We'll see how they use their inhalers'. Participant 1, ECP Focus Group.

Patient care and continuity. Despite the perceived benefits to patient care, there were some home visits that GPs felt would be more appropriate for them to conduct. They felt that the ECPs' skills, rooted in acute care, placed limits on their decision-making.

'I think one of the shortcomings would be some of the things that were outside of [the ECP's] knowledge or skills set […] musculoskeletal things, somebody's got a sore knee, they would give them analgesics and so forth and maybe some physio. They're not going to be thinking about further referral, knee imaging, steroid injections so I think that would then come to us. Appropriately'. Participant 3, GP, Practice 1.

Care home staff were described as broadly receptive to ECPs conducting home visits but there were instances where staff specifically requested a GP, for more complex or ongoing issues or for residents near to end of life.

'Occasionally one or two of the care homes might have said 'Not the paramedic,' and that wasn't personal… I think they just wanted a GP just to cast an eye for peace of mind as much as anything'. Participant 1, GP, Practice 2.

Views on wider roll-out. All interviewees supported a wider roll out of the ECP home visiting pilot. Some suggested minor amendments to how ECPs were embedded into practices, to maximise efficiency.

'I think that it would be much better if [ECPs] were integrated in our own teams rather than coming from outside. […] Just because I think we would be able to design a better service than they (service commissioners) could do, include them to do other things like the acute surgeries, in house training, getting the feel of how we work as a team'. Participant 1, GP, Practice 1.

Discussion

Main findings

This article presents novel qualitative data on the experiences of healthcare staff and patients of home visits performed by ambulance service ECPs, with a paramedic or nursing background. Primary care and

ambulance service staff felt that ECPs successfully integrated into primary healthcare teams and worked collaboratively with GPs, relieving some GP workload pressure. The impact on patient care was perceived to be positive by primary care and ambulance service clinicians as well as patients, although there were examples where continuity of care by GPs may be preferred by patients, especially if they felt they had complex health needs. Initial preconceptions of primary care staff and patients about the professional identity, and reservations about the appropriacy of ECPs to the home visiting role were overcome by the expertise and interpersonal skills of ECPs. Fostering a culture of collaboration between ECPs and GPs was felt by these staff groups to be instrumental in remodelling professional boundaries between GPs and ECPs.

Links with the existing evidence base

This study provides important insights into the integration of alternative, extended-scope practitioners to GPs in the delivery of medical care to homebound patients, an important consideration for primary care in the UK and European countries [19]. Our work adds to the emerging evidence of practitioners, such as paramedics and ECPs, performing primary care healthcare roles, which describes positive experiences of health professionals and patients [5,8,9,14].

The importance of role perception and professional boundaries, and the factors that contributed to successful interdisciplinary working between GPs and ECPs, was similar to previously described for practitioners from non-medical professional groups extending their scope into primary care. Initially, GPs had reservations about transferring the responsibility for home visits to ECPs. The reservations stemmed from preconceptions about the ECP skill set and the existence of traditional professional identities, which have also been described when nurses have adopted roles traditionally ascribed to doctors [12]. The initial uncertainty described by GPs was mitigated by practices having the opportunity to define the scope of the ECP's work, such as triage decisions and interdisciplinary learning, which is also an important feature of integrating nurse practitioners into primary care teams [10]. Collaboration between GPs and ECPs was another essential factor that mitigated the potential for professional role boundary conflicts [10,11,20]. As previously described for interdisciplinary working between physician associates and GPs [13], ECPs and GPs worked together to define their roles and reframe their professional boundaries at the GP practice level.

Implications

This study provides important insights into the integration of paramedics and nurses into primary care teams to perform roles traditionally ascribed to GPs, such as home visiting. First, advanced planning is important to overcome common preconceptions about the expertise and role [10] of different professional groups. Second, as described previously [9], it is important to educate patients about the roles for alternative clinicians to GPs, such as ECPs, who are working in primary care roles. Third, the unique setting and array of challenges facing different practices – rurality, different practice sizes and workforce composition [6] – means that it is important for primary care teams to have the opportunity to shape interdisciplinary working with colleagues from other healthcare disciplines.

Strengths and limitations

Our study's strength was that it captured the experiences of primary healthcare and ambulance service ECP staff, as well as patients. However, these experiences relate to three neighbouring practices in northern England so the applicability of findings to different primary care settings may vary. One GP practice found patient recruitment challenging, which may have impacted on how their experience is represented in our analysis. Originally, the ECPs had all trained as either a UK paramedic or nurse. Our study participants were not familiar with the ECP's background and we did not set out to detect differences in the experiences of healthcare professionals and patients between these two groups. Reservations expressed by care home staff about ECPs performing care home visits were reported by practice staff. Our study did not directly capture the experiences of care home staff or residents (due to the need for a more extensive research ethics process that was unfeasible in the study period). This represents an important area for future research.

Future work

Further research is required to assess the impact on health and healthcare outcomes, such as conveyance to hospital, of practitioners from alternative healthcare

disciplines (e.g. paramedics and nurses) performing home visits in place of GPs, and to explore the potential of such practitioners to take on other primary care roles, such as consultations in GP practices.

Conclusion

Broadening the skill-mix to deliver primary healthcare to homebound patients represents an opportunity to increase resilience in the general practice workforce. It is essential to address preconceptions of patients and professionals about the role and expertise of paramedics and nurses, as they adopt roles traditionally ascribed to GPs. Remodelling professional boundaries with GPs as practitioners from other disciplines take on extended scope roles, is key.

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Ethical approval

The study received ethical approvals from the Health Research Authority (refs: 266978;266040) and Newcastle University Faculty of Medical Sciences Research Ethics Committee.

Disclosure statement

The authors alone are responsible for the content and writing of the article. The views expressed are those of the authors and not necessarily those of the NHS, the NIHR or the Department of Health and Social Care.

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Experiences of a National Early Warning Score (NEWS) intervention in care homes during the COVID-19 pandemic: a qualitative interview study

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ABSTRACT

Background The COVID-19 pandemic has taken a heavy toll on the care home sector, with residents accounting for up to half of all deaths in Europe. The response to acute illness in care homes plays a particularly important role in the care of residents during a pandemic. Digital recording of a National Early Warning Score (NEWS), which involves the measurement of physical observations, started in care homes in one area of England in 2016. Implementation of a NEWS intervention (including equipment, training and support) was accelerated early in the pandemic, despite limited evidence for its use in the care home setting.

Objectives To understand how a NEWS intervention has been used in care homes in one area of North-East England during the COVID-19 pandemic, and how it has influenced resident care, from the perspective of stakeholders involved in care delivery and commissioning.

Methods A qualitative interview study with care home (n=10) and National Health Service (n=7) staff. Data were analysed using thematic analysis.

Results Use of the NEWS intervention in care homes in this area accelerated during the COVID-19 pandemic. Stakeholders felt that NEWS, and its associated education and support package, improved the response of care homes and healthcare professionals to deterioration in residents' health during the pandemic. Healthcare professionals valued the ability to remotely monitor resident observations, which facilitated triage and treatment decisions. Care home staff felt empowered by NEWS, providing a common clinical language to communicate concerns with external services, acting as an adjunct to staff intuition of resident deterioration.

Conclusions The NEWS intervention formed an important part of the care home response to COVID-19 in the study area. Positive staff perceptions now need to be supplemented with data on the impact on resident health and well-being, workload, and service utilisation, during the pandemic and beyond.

Strengths and limitations of this study

- ► This study is the first to examine the role of a National Early Warning Score (NEWS) intervention in care homes during the COVID-19 pandemic in the UK.
- ► Care home and National Health Service staff were recruited and interviewed in May 2020, providing an important insight into the COVID-19 response in this sector.
- ► The role of NEWS in identifying COVID-19 disease and monitoring resident health, was explored in-depth with semi-structured remotely conducted interviews.
- ► General practitioners and care home residents were not recruited for practical reasons; future research should directly seek rather than infer their views.

INTRODUCTION

The care home sector is one of the most overlooked components of health and social care in the UK. Care homes provide accommodation, personal care and support, and companionship to some of the most vulnerable, frail and medically complex older adults in society. There are more than 11 000 care homes (nursing and non-nursing) in the UK,[1] home to over 400 000 residents, representing 16% of those aged 85 or over. The sector is dominated by private, for-profit, providers, who provide around four-fifths of care home beds in the UK.[2] Care homes may receive some funding from the NHS, however, the majority of funding comes from local authorities, or from residents or residents' families. Care home residents receive medical care from visiting National Health Service (NHS) primary care professionals, including general practitioners and community nurses. Care configuration of NHS services for care home residents varies significantly across the country. Some areas provide a varied multidisciplinary healthcare team to support care home residents; others focus on specialist nurse provision; others have no special service.[3]

Care homes have been severely affected by the COVID-19 pandemic. The virus spread

rapidly and many residents died in a short space of time. Estimates suggest that up to half of all COVID-19 related deaths in Europe were care home residents,[4] and people working in social care are dying at two times the rate of the general population.[5] This situation has been described by the WHO as an 'unimaginable human tragedy'.[6] Many care homes have struggled with staffing, accessing personal protective equipment[7] and maintaining isolation measures during the pandemic.

In recent years, efforts have been made to support the care home sector to improve the quality of health-related care.[8] Identifying and monitoring residents for early signs of acute illness, using tools such as the National Early Warning Score (NEWS; the latest version of the scoring system is the 'NEWS2'), has been a particular area of interest.[9] The NEWS was initially developed for use in hospital settings. It requires the measurement of six parameters: temperature, pulse, systolic blood pressure, respiratory rate, oxygen saturation and level of consciousness. The overall NEWS triggers a response, ranging from repeating the measurements within a specific time frame, to initiating an emergency medical response. The NEWS is intended to serve as an adjunct to, as opposed to replacing, a clinical decision.[9]

Implementation of the NEWS into care homes is already underway across multiple regions in the UK,[10 11] despite a lack of validation and proven effectiveness outside the hospital setting.[12] The aim is to improve the response to acute illness in care home residents by improving triage and communication with external healthcare professionals, and to reduce avoidable hospital admissions. In care homes, the NEWS intervention has generally been implemented as a 'package', which includes as a minimum the training and equipment to measure the vital observations needed to generate the NEWS itself. Some implementations of a NEWS package have additionally included an ongoing support programme to care homes, and the use of a cloud-based storage system to store (and sometimes transmit to primary care staff for use in triage) NEWSs. Concerns have been expressed about the appropriateness of using the NEWS in care homes, including potential adverse influences on palliative care.[13] NEWS was also designed for use by clinically trained staff, such as registered nurses, who are not on-site in residential care facilities. Previous work indicates that while the collection of NEWS in care homes appears to be feasible,[14] the complexity of the care home context and subsequent intricacies in implementing NEWS need careful thought and planning to exploit any potential benefits for residents.[15 16] Early in the COVID-19 pandemic in the UK, the British Geriatrics Society emphasised the importance of care home staff having the skills, training, and equipment to identify deterioration in residents, and advocated the use of systems that incorporate NEWS.[17]

This study focuses on the ways in which one Clinical Commissioning Group (CCG) with a high level of socioeconomic deprivation in the North-East of England, used their NEWS intervention in response to the COVID-19 pandemic. Having initially implemented a NEWS intervention in 2016, providing care homes with the equipment for taking vital signs, a digital tablet for recording NEWS and associated training, in 2019 the CCG invested further when a nurse was appointed as a clinical educator to provide more tailored training and support to care home staff (see box 1 for an outline of the NEWS intervention in this area). While most care homes in the CCG had received the 2019 intervention, for those who had not the CCG accelerated the roll out of this, with the aim of ensuring all residential and nursing homes had the equipment and training necessary to measure residents' physical observations and calculate a NEWS.

Box 1 NEWS intervention

Pre-COVID-19

- Equipment for taking vital signs and digital tablet for measuring and recording NEWS.
- Education and support delivered by an NHS clinical educator with a nursing background covering: practical use of equipment, interpretation of individual vital signs and resulting NEWSs, contextualising NEWS observations and underpinning scoring system with the importance of 'soft signs' of deterioration.
- Internet web-based cloud storage system, whereby NEWSs are automatically uploaded from the tablet to the storage system. The NHS clinical educator and other NHS staff involved in care for each care home can access the web-based system to view NEWSs.

Additional function in response to COVID-19

- Additional functionality offered by the equipment was unlocked thereby expanding the NEWS package in this area further—notably a picture-taking facility to upload pictures of wounds.

NEWS, National Early Warning Score; NHS, National Health Service.

This paper presents a qualitative interview study with key stakeholders, with the aim of understanding how a NEWS intervention has been used in care homes during the COVID-19 pandemic in the UK, and how it has influenced resident care. Specific research questions were:

1. How have care home staff used the NEWS intervention to assess resident illness during the COVID-19 pandemic?
2. What is the experience of care home staff of using the NEWS intervention during the COVID-19 pandemic?
3. How has the COVID-19 pandemic influenced the roll out of the NEWS intervention in this area?

METHODS

Semi-structured interviews were conducted with stakeholders, including care home staff, NHS healthcare professionals and commissioners, in a CCG area in the North-East of England. This area is one of the 20% most deprived in England with high rates of morbidity and a lower-than-average life expectancy, with a resulting pressure on care home bed availability. Stakeholders were identified using purposive sampling, through existing links with local NHS staff. Participants were also asked to identify other colleagues involved in the

Box 2 Interview topics

- Perceived validity of NEWS in care homes.
- Experiences of using NEWS before, and during the pandemic.
- NEWS training for care homes.
- Perceptions on the usefulness of NEWS during the pandemic, including identification of potential cases.
- How NEWS influenced decision making and triage, within and outwith care homes.
- Variations in use of NEWS during the pandemic.

NEWS, National Early Warning Score.

NEWS intervention in this area (snowball sampling). We sought to include staff from a range of residential and nursing care homes, particularly with varied experience using NEWS, including long-standing users and users who received the intervention as part of the accelerated roll-out in response to COVID-19. A key NHS employee, known to potential participants, acted as a gatekeeper, sending introductory emails with a participant information sheet. Once consent to be contacted by the research team was secured, a researcher (RS), made direct contact by email to invite participation. All individuals approached agreed to take part. Informed consent was secured either electronically or verbally in line with Health Research Authority principles.

All interviews were carried out remotely by telephone or videoconferencing, during May 2020. Development of an interview topic guide (box 2) was informed by previous research conducted by the team, published literature evaluating the use of NEWS in care homes, and relevant literature and direct communications to the research team describing how care home staff were experiencing the pandemic in the UK. Field notes were taken after interviews.

Interviews were carried out by RS or SR (both female research associates, doctorates in health services research and medical sociology respectively, and experience of qualitative studies in care homes), audio-recorded and transcribed verbatim. All transcripts were anonymised. Interviews lasted 30–60 min.

Patient and public involvement

Patients and the public were first involved in this study at the idea generation stage, via the Newcastle University Care Home Interest PPI Group (CHIG). The research questions, topic guide and study design were discussed via email with group members before the study commenced. CHIG members stressed the importance of carrying out interviews remotely and flexibly to time constraints, given the burden of the pandemic on the health and social care sector. Our discussions with this PPI group confirmed that COVID-19 related research in care homes is viewed as a pressing research priority. PPI partners will be consulted on appropriate dissemination strategies.

Data analysis

RS and SR conducted a thematic analysis of the dataset, following the principles of Braun and Clark's six-phase framework.[18] An inductive, data-driven approach was taken to analysis, meaning that the themes generated through our analysis were identified from the data itself, rather than via the use of a pre-existing coding frame.[19] We chose this approach to collect rich data on our topic, using a contextualist approach which 'acknowledges the ways individuals make meaning of their experience, and, in turn, the ways the broader social context impinges on those meanings, while retaining focus on the material and other limits of 'reality'' (p9).[18] NVivo V.11 software was used to aid in data management. Data analysis started once the first interview was carried out, and was carried out iteratively, throughout the interviewing period and beyond.

Transcripts were read in full (phase 1—familiarisation with data), then coded line by line, separately, by RS and SR (phase 2—generating initial codes). Codes were compared within and between transcripts, using the constant comparative technique,[20] to streamline the coding framework and identify themes (phase 3—search for themes). Emergent themes were discussed within the study team (phase 4—reviewing themes) and linked together to form a final set of themes and subthemes (phase 5—defining themes) which were then situated within each of the three key research questions for the purposes of reporting (phase 6—writing up analysis). Interviews ceased when no new semantic codes, describing the experiences of staff, were identified from the data (code saturation[19]) as agreed by RS and SR.

RESULTS

We interviewed 17 stakeholders, comprising 10 from the care home sector across 7 care homes, and 7 from the NHS (see table 1). Of the seven care homes, five provided both residential and nursing care and two provided solely residential care (see table 2 for care home characteristics). There are no care homes in this area which provide nursing care only. One care home received the accelerated form of the NEWS training and implementation during the COVID-19 pandemic in the UK, the remainder had had NEWS implemented pre-pandemic.

Higher level themes are organised according to how they address each of the key research questions, which are presented in turn.

How have care home staff used the NEWS intervention to assess resident illness during the COVID-19 pandemic?

NEWS intervention during the pandemic: an adjunct to COVID-19 identification

Many stakeholders described how, prior to the COVID-19 outbreak, the use of the NEWS package had become embedded and habitualised into the everyday routines of care homes, and staff interactions with external healthcare services. Care homes recorded NEWS baseline

Table 1 Interviewees and their working role

Working role	Sector	n	Description
Care home manager *Nursing background* *Non-nursing background*	Care home	7 (3) (4)	Managers oversee the running of the home ensuring that guidelines and regulations are adhered to.
Care home senior carer/nurse	Care home	3	Senior carers provide care and limited healthcare to residents and oversee the care provided by junior carers. Care home nurses provide healthcare to residents.
Director	NHS	1	Director within a regional NHS Foundation Trust. Provided advice to the implementation team on the use of NEWS within the context of patient safety and reducing avoidable hospital admissions.
Director	NHS-related body	1	Supported the implementation team and aided networking and learning between various CCGs and academic institutions.
NHS nurses *Specialist older persons' nurse* *Clinical educator*	NHS	4 (3) (1)	Specialist nurses visit care homes to provide healthcare to care home residents. They provide a link between the care homes and external services, aiming to prevent avoidable hospital admissions. The clinical educator provided training to the care homes as well as ongoing support and monitoring.
Commissioning of NHS services for older people	NHS	1	Programme manager with a focus on technological innovation in care settings leading the implementation of NEWS in care homes.
	Total	17	

NEWS, National Early Warning Score; NHS, National Health Service.

Table 2 Care home characteristics

Care home	Care provided	Number of beds
Care home 1	General care and specialist dementia	~50
Care home 2	General care and specialist dementia	~50
Care home 3	General care and specialist dementia	~30
Care home 4	Predominately specialist dementia	~40
Care home 5	Specialist dementia and end of life care	~40
Care home 6	Specialist dementia	~40
Care home 7	General care and nursing	~30

scores regularly (for routine monitoring and comparison when residents became acutely unwell), except for those near the end of life. A NEWS was frequently requested by community healthcare professionals responding to concerns from care homes, and staff often calculated a NEWS before contacting healthcare professionals.

At the outbreak of the COVID-19 pandemic in the UK and the start of lockdown measures, use of the NEWS by care homes in this area increased substantially. Using NEWS became increasingly embedded into daily care home and NHS practices, and was viewed as a key aspect of the pandemic response in this setting. Care home staff, NHS healthcare professionals and service commissioners shared a belief that measuring NEWS, its component physiological observations, alongside the associated education and support package, have enhanced the response to deteriorating resident health during the pandemic.

Taking vital signs observations and using NEWS with the specific intention of identifying possible COVID-19 infection varied across the care homes in our study. Stakeholders highlighted the power of the NEWS in identifying early illness due to COVID-19 as well as other causes, and the ability of the NEWS intervention to facilitate remote monitoring, thereby decreasing the need for healthcare professionals to visit care homes.

Use of individual physiological observations to identify COVID-19

If COVID-19 was suspected, care home staff frequently measured temperature and oxygen saturations to use as individual physiological measures, as opposed to the NEWS. The use of these physiological observations for identifying possible COVID-19 disease was advocated by a local NHS network. Care home staff appreciated the importance of responding to isolated abnormalities in temperature or oxygen saturations to help identify possible COVID-19, even if the NEWS was not triggering a high level of concern. Stakeholders remained broadly sceptical about the sensitivity and specificity of these clinical observations to accurately help the identification of COVID-19 in this population—feeling that they went some way to help, and could prompt further investigation of potential COVID-19, but could not be conclusive.

> [There are] two main symptoms with our experience, high temperature and low oxygen saturations. We've found in a couple of our residents, […] they had no temperature, and no breathing difficulty, but I couldn't understand—and when we checked their NEWS score we found oxygen saturation was low. So it helps us in the early diagnosis and to do appropriate support for the residents. (Care home manager 1)

> The response to the infection is hugely physiological. So NEWS is a way of prompting you to do physiology. […] I think if you'd asked me six months ago I'd have said 'Actually the NEWS score is more useful than the underlying physiology'. Actually, I'd be tempted to go the other way around now and say 'You do a NEWS

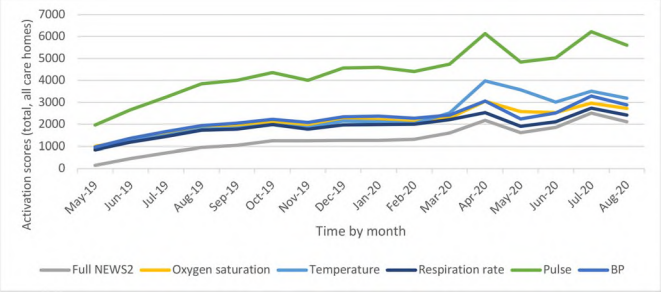

Figure 1 Frequency of NEWS2 and its component measures taken in care homes in the study area. BP, blood pressure; NEWS2, latest version of the scoring system 'National Early Warning Score'.

score because it makes you look at the physiology and you're going to go, oh my god, look at that oxygen saturation'. (NHS director)

Frequency of NEWS recordings and individual observations significantly increased month-on-month from March 2020 onwards, with some care homes taking baseline NEWSs several times a week. Other care homes recorded the NEWS sporadically, suggesting wide variation in the use of NEWS in this area during the UK pandemic. Figure 1 illustrates the increase in NEWS and individual observations recording before and during the pandemic.

Using the NEWS intervention to remotely monitor health

It was felt among care home and NHS healthcare professionals that, prior to the pandemic, NEWS could speed up initial triage and facilitate remote treatment decisions, expediting the process for residents to receive the care they required. Referrals accompanied by a NEWS reduced the need for clinicians to visit care homes to take physical observations. Identification of early illness was considered to be more efficient with the use of NEWS. Set within this context, it is perhaps not surprising that another positive aspect of the NEWS intervention during the pandemic was to facilitate remote monitoring of residents' health by healthcare professionals. This was believed to have reduced unnecessary footfall and thus infection risk, which was a major driver to the accelerated roll out of the NEWS intervention during the pandemic.

> We had to just take a stand and reflect and say, 'What do we need to do? We know that the predictions [are that COVID-19] is going to come. We're likely to have to go into lockdown. Nobody is going to be able to go into care homes'. So we thought, 'actually NEWS is an important tool in that. […] We just need to respond'. (NHS commissioner)

> CCGs have been formally told to set up remote MDT care home rounds, so they are having to put the IT in place. […] You need a digital way of recording [resident] observations, and then you can put in a safety netting process that will allow the care home to get back in touch. Because there's going to be loads of [residents] where you're going to go, 'they're not quite right but I definitely don't want to send them to hospital'. (NHS director)

The ability for NHS staff, such as community nurses, to remotely access physiological observations and compare with baselines, was of particular value. The camera facility of the NEWS tablet was also unlocked in response to the pandemic, giving external healthcare professionals the ability to assess and treat wounds remotely.

> [int: Are there any doctors or GPs who are taking it upon themselves to log on to the [cloud system] and look at the NEWS scores?] Yes, absolutely. [Pre-pandemic] I don't think it was utilised [by them], especially not as much as it could have been, but due to the COVID crisis, everyone across the city now want access to it and it's obviously taken a pandemic to realise how valuable the tool is. (NHS specialist nurse 1)

> I think the biggest change for the [use of the NEWS intervention] at the moment is the pictures. […] For example, if there was a patient who had a skin flap […] We'll say, 'Will you take a photo? Will you upload it so we can see it?' We can physically see that photo and then we can assess the severity, we can assess when the visit should next take place […] it's brilliant for that aspect. (NHS specialist nurse 2)

What is the experience of care home staff of using the NEWS intervention during the COVID-19 pandemic?

Empowerment of care home staff with the NHS agenda and language

Using the NEWS intervention to help identify and triage responses to deteriorating resident health was described by stakeholders as empowering. For care home staff, the NEWS intervention represented a helpful link to the NHS. The NEWS intervention represented objective clinical information which care home staff could generally rely on to back up their intuition that the resident was unwell (termed 'soft signs' for example, decreased appetite). Having a common clinical language which care home staff could use—or leverage for action, where necessary—was useful to promote integrated working between care homes and the NHS. It also facilitated triage to appropriate services, often negating the need for a primary care healthcare professional to attend in person, which is an important consideration during the pandemic.

Care home staff felt confident that with a NEWS reading, their concerns about deteriorating residents would be taken seriously by external healthcare professionals, as it evidenced their concerns. This was compared positively to care home staff's previous experiences seeking help from primary care, where staff often felt that concerns were not listened to. This feeling of empowerment was capitalised on by both care homes and local NHS services during the COVID-19 pandemic.

When we've rang the likes of home recovery or 111 and we're challenged as to why we're ringing, when we can't really put a finger on it that somebody's not well. Now, this [NEWS] has really aided us to be able to look for those signs, look for those symptoms, using the NEWS score and being able to give better communication across the telephone as to why and what has happened with that particular resident. I know there's been times where we've kind of been brushed off by services. And I'm a big believer in our care staff, they may not be qualified nurses but they know their residents sometimes better than we do. […] Now I feel like we've got this tool now to be able to kind of prove that somewhat as well, and it does help back up what we're saying when it comes to our residents. So it's been great. (Care home manager 2)

During the COVID-19 pandemic, care home staff were relied on to take on clinical procedures and observations usually carried out by visiting NHS professionals. This challenge to traditional role boundaries was welcomed and encouraged by NHS stakeholders, as it met the needs of the NHS to reduce footfall into care homes and limit the number of hospital admissions. In the early days of the pandemic, and without straightforward guidance for care homes, care home staff also welcomed this extension to their roles. They were able to measure and focus on clinical observations—in effect, the NEWS intervention facilitated a more objective and decisive response within care homes to tackling a then-new virus.

[int: What do you think about the use of NEWS during this pandemic in care homes?] Well I've always loved it. I really love the NEWS tablet and for why, because I think it totally empowers the care staff. […] Care staff, when they say, 'They're just not right. I don't know what's wrong with them, but the person's not right'. Now they've got a little more ammunition to say, 'well actually, such-and-such isn't very well. These are the observations …' and it makes them have more of a voice. That's what I love about it. So when they ring the GP and they say, 'Well actually the observations are blah, blah, blah', they're almost listened to a little bit more because they've got some sort of clinical information rather than just saying, 'Oh I don't know what's wrong with them'. I think that applies to here and now as well with the pandemic. (NHS specialist nurse 2)

How has the COVID-19 pandemic influenced the roll out of the NEWS intervention?

Centrality of training relationships and clinical support for accelerated implementation of NEWS during a pandemic

When the pandemic broke out in the UK, the CCG commenced a rapid roll out of the NEWS intervention to the minority of care homes in the area that were waiting for implementation. Care homes already using the NEWS intervention before the pandemic were contacted by the clinical educator to reinforce that support was available. The pandemic highlighted the importance of care homes, particularly those without registered nursing staff, having an engaged and supportive nominated NHS clinical educator.

Training and implementing the NEWS intervention in care homes during the pandemic

Training to support rapid implementation during the pandemic consisted of a short, socially distanced visit from the clinical educator to the care home, training one or two key members of staff in the home rather than a larger body of staff, and without a practical component. This rapid roll out model demonstrated that relationships built during training were integral to ongoing NEWS use and understanding. The training constraints related to the pandemic were perceived as having had a major impact on the quality of the rapid implementation and confidence of staff.

[During the rapid training], I don't feel like I built great rapport. I don't feel like it instilled that much confidence in them and I haven't really received many phone calls from those homes. Yes they're doing NEWS, but usually the homes that I've really been visibly in, really supported them and built those rapports and stuff up with, I feel like I get more phone calls which is great because they want support which then that in turn means they've picked up something, they're looking for answers and help and they get it. Where those other homes, I would worry that maybe they don't feel as confident to pick up the phone and speak with me because I've raced in, did what I had to do and then left—and it's very difficult to build up rapport over time, and trust. (NHS specialist nurse 1)

Ongoing clinical support for care homes during the pandemic

Emphasis was placed on the importance of ongoing clinical support for care homes. In this area, care home staff had access to the clinical educator and a specialist nurse with a specific care home remit. Having these key contacts, who were knowledgeable and approachable, was valued by care home staff and capitalised on during the COVID-19 pandemic. They were able to build on long-term relationships with each other, cultivating understanding of each sector and respect for each other's role and remit.

This is not just about the technical or the medical aspect, it's often about the relationships that [clinical educator] is then building up. […] I think that methodology has worked because you're consolidating it with a really good grip and really getting [care homes] to be the expert. (NHS commissioner)

[Clinical educator] is a very approachable person. You can email him, you phone him and in all fairness, we would probably see [clinical educator] at least probably once a week. He'll pop in just to make

sure everything is alright and we're well, you know, and if we're having any problems. So that support is continually there. (Care home manager 4)

This cross-sector team working helped to legitimise use of NEWS in a non-NHS setting, and smoothed many processes of integrated care over traditional NHS and social care boundaries.

DISCUSSION

Summary of findings

The roll out of the NEWS intervention in the study area was accelerated by COVID-19. Care home staff and NHS commissioners viewed it as an important part of a combined care home-NHS response to care delivery during the pandemic. The NEWS intervention was used as an adjunct to carer identification of deteriorating resident health, whether due to COVID-19 or other acute illnesses. It was perceived to have facilitated remote decision-making by healthcare and care home staff and minimised footfall in care homes during the pandemic. In relation to possible COVID-19 infection, care home staff reported increased reliance on specific physiological measures such as oxygen saturations, as opposed to the overall NEWS. Care home staff felt empowered by their extended role in the measurement of physiological observations; better able to respond to resident deterioration and communicate their concerns to healthcare professionals. The intervention encompassed training and support from a clinical educator and sharing of clinical measurements and NEWS with health services. Dis-entangling the relative contributions of education, technology and clinical assessment to resident care is challenging.

Comparison with other work

Previous evaluations of the use of NEWS in a non-hospital setting reflect many of our findings, including the benefits of using a common clinical language, and facilitating communication between sectors.[21] The importance of using NEWS as a part of a wider assessment of health, rather than a ritualistic, task-oriented procedure,[22] has been stressed by both the UK Royal College of Physicians[9] and those evaluating its use in other settings including primary[13] and community care.[21] The clinician-led training and ongoing support model for the NEWS intervention in place in this area addressed these concerns.

There is some evidence to support the use of NEWS in the identification of and triage of hospital patients with suspected COVID-19.[23 24] However, there have been calls for NEWS to be modified with a more sensitive score for oxygen demand to better account for the development of hypoxic respiratory failure in COVID-19 patients.[25] Evidence for the use of NEWS in community settings during the pandemic remains sparse. There is little comparable evidence available to evaluate the utility of NEWS in care homes specifically during the COVID-19 pandemic.

This intervention led to an increase in assessment and monitoring of a vulnerable population of care home residents during a global pandemic. Greater vigilance and attention to physiological measures within care homes may be the critical component, irrespective of the detail of NEWS and adherence to an escalation plan. However, this intervention has a number of features that minimised face to face contacts with residents, which should reduce infection risk for residents and staff. This is important, as a high proportion of care home residents are asymptomatic when they test positive for COVID-19,[26] a finding reflected in the experiences of our interviewees. Bluetooth transfer of data from measuring equipment to digital tablet, cloud data storage and the possibility of rapid information transfer to outside agencies, were all of potential benefit during COVID-19. The lack of any requirement to manually input recordings from thermometers and blood pressure monitors was a time saving feature, that promoted accuracy and uptake,[27] and in the pandemic, minimised time in close contact with the resident. It is also noteworthy that during COVID-19, staff often completed a subset of measurements, rather than a complete assessment. Selection of what were perceived to be the most important measures (oxygen saturation and temperature) was a modification of NEWS that further reduced staff resident contact. It is also supported by recent evidence[28] that highlights the potential utility of individual oxygen saturation, respiratory rate and temperature measurements. However, reducing the range of measurements does mean that a NEWS cannot be calculated. Whether the absence of a NEWS per se over and above the individual measurements has any impact on resident care, is an important question for the future.

From an implementation perspective, the training and support for the NEWS intervention was delivered by an experienced NHS nurse who understood the needs of the sector. In terms of work needed to implement change,[27] the organisational burden of planning and implementation for the CCG and NHS clinical educator was minimised as they had already been actively engaged in a revised implementation prior to the pandemic and thus there was a pre-existing awareness and embeddedness of NEWS across the care home sector in the region. Most care home staff in our sample were already familiar with NEWS prior to the pandemic, hence, a shift in roles and identities to take on NEWS related work had already taken place, and only minimal work was needed to engage care home staff in implementation[27] or to change working practices, after the outbreak. This pre-existing familiarity, coupled with the reported ease of use of the NEWS equipment and the support from the wider healthcare system, enhanced the adoption, spread and scale-up[27] of the NEWS intervention in these care homes during the pandemic.

Regular, informal contact from a trusted NHS professional to care homes may have been particularly important

early in the pandemic, when information was sparse and there were many uncertainties about how best to provide care.[29] The focus in training on identifying 'soft signs' of deterioration was also significant. So called 'soft signs'—a resident having a reduced appetite for a favourite food, for example—are not perceived as measurable or objective. However, they are observed by care home staff, and have their own unique importance.[30] Inclusion within the training could be seen as a validation of care home staff contribution to resident care.

Implementation of change in the care home sector is challenging. Resources are limited and pressures on staff in particular, may limit the potential to engage in new initiatives.[31]Engaging and supporting care homes, with a good understanding of their needs, is critical when implementing change.[16 32] In this case, the intervention was introduced from outside the sector, raising the possibility that it would be perceived as irrelevant or inappropriate for use in care homes. Prepandemic and ongoing NHS support for the NEWS intervention legitimised and enhanced its use, reflecting other studies in the care home sector.[33] Widespread changes to working practices during COVID-19 are also likely to have had a major influence on staff readiness to embrace change.

Strengths and limitations

We were able to interview 10 care home staff from 7 care homes in the locality, and 7 NHS staff, despite the pandemic-related pressure on the NHS and social care sectors during the interviewing period (May 2020). This represents a strength of our study and highlights the importance that interviewees placed on the topic and expressing their views. However, the views of care home staff working in less senior roles, such as non-senior carers, was less represented due to care home staffing pressures. Our data may not reflect all care home experiences in other areas of the country, particularly those who are not working with NEWS. Similar interventions have been introduced across England, but this model is specific to the study area, which makes comparison with cross-sector interventions in other geographical areas more difficult.

Despite our efforts, we were unable to recruit GPs, which we believe was due to the pressure the pandemic had placed on primary care. The pandemic visiting restrictions in care homes also meant that we were unable to interview any care home residents themselves to explore their experiences during the pandemic and their understanding of care had been influenced by the introduction of the NEWS intervention. Future work should aim to include these groups, so that their views are directly included rather than inferred.

CONCLUSION

The NEWS intervention may have a useful role in care homes during the COVID-19 pandemic, enhancing remote working and offering staff some clinical reassurance and structure to their role. However, it is important to acknowledge the paucity of data on NEWS in care homes, despite increasing uptake. Positive staff perceptions from this study now need to be supplemented with data on the impact on resident health and well-being, workload and service utilisation, during the COVID-19 pandemic and beyond. A multidisciplinary consensus on best practice for NEWS use in this sector is required.

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Contributors RS, SR and JA designed the study with JL and BH. RS and SR conducted interviews. RS, SR and JA analysed data. RS, SR, JA and BH drafted the article, and AR, JL, JG and ROB performed critical revision of the article for important intellectual content. RS is guarantor of the paper. All authors approved the final version to be published.

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Original Study - Brief Report

National Early Warning Scores Following Emergency Hospital Transfer: Implications for Care Home Residents

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A B S T R A C T

Objective: Care home residents have high rates of hospital admission. The UK National Early Warning Score (NEWS2) standardizes the secondary care response to acute illness. However, the ability of NEWS2 to predict adverse health outcomes specifically for care home residents is unknown. This study explored the relationship between NEWS2 on admission to hospital and resident outcome 7 days later.
Design: Repeated cross-sectional study.
Setting and Participants: Data on UK care home residents admitted to 160 hospitals in two 24-hour periods (2019 and 2020).
Method: Chi-squared and Kruskal-Wallis tests, and multinomial regression were used to explore the association between low (score ≤2), intermediate (3–4), high (5–6), and critically high (≥7) NEWS2 on admission and each of the following: discharge on day of admission, admission and discharge within 7 days, prolonged hospital admission (>7 days), and death.
Results: From 665 resident admissions across 160 hospital sites, NEWS2 was low for 54%, intermediate for 18%, high for 13%, and critically high for 16%. The 7-day outcome was 10% same-day discharge, 47% admitted and subsequently discharged, 34% remained inpatients, and 8% died. There is a significant association between NEWS2 and these outcomes ($P < .001$). Compared with those with low NEWS2, residents with high and critically high NEWS2 had 3.6 and 9.5 times increased risk of prolonged hospitalization [relative risk ratio (RRR) 3.56; 95% CI 1.02–12.37; RRR 9.47; CI 2.20–40.67], respectively. The risk of death was approximately 14 times higher for residents with high NEWS2 (RRR 13.62; CI 3.17–58.49) and 54 times higher (RRR 53.50; CI 11.03–259.54) for critically high NEWS2.

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This study was approved by a University Faculty of Medical Sciences Research Ethics Committee.

The authors declare no conflicts of interest.

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Conclusion and Implications: Higher NEWS2 measurements on admission are associated with an increased risk of hospitalization up to 7 days duration, prolonged admission, and mortality for care home residents. NEWS2 may have a role as an adjunct to acute care decision making for hospitalized residents.

Care homes deliver care for residents living with complex care needs,[1-4] representing a population with high rates of emergency transfer to hospital.[5] Care home is an umbrella term for long-term care facilities with and without on-site nursing staff, termed nursing homes and residential homes respectively in the United Kingdom (UK).

Older adult residents often do not display overt signs of acute (short-duration) illness,[6] otherwise termed deterioration. The trajectory of deterioration among care home residents may be unpredictable,[7] posing challenges for health care teams in care home and hospital settings. The National Early Warning Score (NEWS2) is a "track and trigger" system used across UK hospitals to support clinical judgment in identifying patients at risk of further deterioration,[8] in order to facilitate prompt and appropriate clinical responses. NEWS2 requires measurement of 6 parameters: temperature, pulse, systolic blood pressure, respiratory rate, oxygen saturation, and consciousness.[8] The overall NEWS2 triggers a response, ranging from repeating observations within a specific time period, to initiating an emergency medical response.[8]

NEWS2 is advocated for use across the UK health care system,[8] and is increasingly being adopted in care homes.[9,10] The ability of NEWS2 to predict further deterioration and adverse health outcomes, such as death or critical care admission, is well-evidenced for hospital patients overall,[8,11] but not specifically for care home residents. The evidence to support NEWS2 use in care homes is sparse.[9,12] The value of NEWS2 may be dependent on the population to which it is applied[13,14] and concerns have been expressed that it may be less applicable to care home residents because of their age, frailty, and multimorbidity,[12,15] all of which may influence NEWS2 and its ability to identify residents at risk of adverse outcomes.

This study aimed to explore the ability of NEWS2, on emergency admission to hospital, to identify care home residents at risk of admission and discharge within 7 days, prolonged hospitalization (>7 days), and death (within 7 days).

Methods

The sample of care home residents was drawn from the Society for Acute Medicine Benchmarking Audit (SAMBA),[16-19] a national audit (UK) of acute medical care. Participation is open to all hospitals receiving acutely unwell (non-elective, adult) medical patients, excluding non-acute and community hospitals.

Two waves of SAMBA data collection, each conducted over a 24-hour period, were analyzed: June 27, 2019,[16,19] and January 30, 2020.[17] Patients not living in care homes and those younger than 60 years were excluded. This defined the study population as older adults living in care homes who were admitted to hospital for acute care, either via the emergency department or directly to acute medical units.

The NEWS2 on arrival to hospital was categorized into 4 groups: low (NEWS2 0–2), intermediate (3–4), high (5–6), and critically high (≥7).[9] The following outcomes were recorded.

- Same-day discharge (no overnight stay).
- Hospital admission followed by discharge within 7 days.
- Ongoing inpatient care at 7 days (ward-level/intensive care or readmission).
- Died within 7 days of admission.

STATA 15 was used to conduct the Kruskal-Wallis test to investigate the null hypothesis of no difference in median NEWS2 across outcome groups. Pearson's χ^2 was used to test the null hypothesis of no association between NEWS 2 category and resident outcome. Multinomial logistic regression modeled the relationship between NEWS2 category and outcome, using low NEWS2 and same-day discharge as reference categories, and adjusted for age, gender, and SAMBA wave. This dataset did not include contextual information about resident comorbidity, dependency, or frailty.

Results

Data from 676 acute hospital admissions across 160 UK hospital sites across 2 waves of SAMBA were analyzed. It is possible, but improbable, that this does not represent 676 unique residents; for the same resident to be represented twice, this would require the same individual to be admitted to hospital in the two 24-hour periods of data collection 6 months apart. Approximately 70% (486 of 676) of residents were older than 80; 70% were women.

A low level of missing data meant that NEWS2 and outcome data were available for 665 admissions out of the total of 676. Across 665 admissions, resident outcome 7 days after emergency presentation was as follows: 10% (69 of 665) same-day discharge, 47% (315 of 665) admitted and discharged within 7 days, 34% (229 of 665) remained inpatient, 8% (52 of 665) died (as displayed in Table 1). The median score on arrival at hospital was 2, range 0 to 18. The NEWS2 category for residents was as follows: 54% (356 of 665) low, 18% (121 of 665) intermediate, 13% (84 of 665) high, and 16% (104 of 665) critically high (Table 1). Therefore, most (72%) presented with a low/intermediate NEWS2, approximately one-third (28%) with a high or critically high NEWS2.

The Relationship Between NEWS2 and Study Outcomes

Among 356 admissions with a low NEWS2, 15% (52 of 356) of residents were discharged on the same day, 48% (171 of 356) were admitted and discharged within 7 days, 34% (121 of 356) remained in hospital at 7 days, and 3% had died (12 of 356). The outcomes for the 121 intermediate scores were similar: 10% (12 of 121), 50% (61 of 121), 34% (41 of 121), and 6% (7 of 121), respectively. This is in contrast to the 104 admissions with a critically high NEWS2: 2% (2 of 104) same-day discharge, 34% (35 of 104) discharged within a week, 41% (43 of 104) remained in hospital, and 23% (24 of 104) had died (as displayed in Table 1). There is a significant association between NEWS2 category and resident outcome ($P < .001$).

The median NEWS2 was 1 for same-day discharge, 2 for discharge within 7 days and admission >7 days, and 6 for residents who died. Overall, the differences observed between the median NEWS2 across different outcome groups are significant ($P < .001$).

Multinomial Regression Model

Multinomial regression explored the relationship between NEWS2 category and unordered outcome categories (see methods and Table 2). In comparison with low NEWS2, residents with a high or critically high NEWS2 had approximately 3.6 times [relative risk ratio (RRR) 3.56; 95% CI 1.02–12.37] and 9.5 times (RRR 9.47; CI

Table 1
The Distribution of 7-Day Outcome for Care Home Residents According to NEWS2 Category

Resident Outcome	Number (%) of Residents According to NEWS2 Category				Total (%) for Outcome Category
	Low	Intermediate	High	Critically High	
Same-day discharge	52 (15)	12 (10)	3 (4)	2 (2)	69 (10)
Discharge within 7 days	171 (48)	61 (50)	48 (57)	35 (34)	315 (47)
Inpatient at 7 days	121 (34)	41 (34)	24 (29)	43 (41)	229 (34)
Death within 7 days	12 (3)	7 (6)	9 (11)	24 (23)	52 (8)
Total (%) in NEWS2 category	356 (54)	121 (18)	84 (13)	104 (16)	

2.20–40.67) increased risk of prolonged hospitalization, respectively (with reference to the same-day discharge). The risk of death in hospital within 7 days was approximately 14 (RRR 13.62; CI 3.17–58.49) and 54 (RRR 53.50; CI 11.03–259.54) times higher for residents with a high or critically high NEWS2, respectively.

In summary, the risk of hospitalization for up to 7 days, prolonged hospital admission, and death (compared with same-day discharge) is higher for residents with intermediate, high, or critically high NEWS2 (compared with the low NEWS2 category). Although the risk of these outcomes increases with progressively high NEWS2 category, statistically significant differences are observed only when comparing high and critically high NEWS2 (but not intermediate scores) with low NEWS2 categories.

Discussion

Higher NEWS2 measurements on emergency presentation to hospital are associated with an increased risk of admission for up to 7 days, prolonged hospitalization (>7 days), and mortality for care home residents. The main differences are observed for residents with high or critically high NEWS2 (with reference to the low NEWS2 category), with no (statistically) significant difference for intermediate readings. The findings suggest that, in conjunction with clinical judgment, the NEWS2 on arrival to hospital following emergency conveyance has a role for hospital teams in identifying residents who are at highest risk of further deterioration. This is especially pertinent for residents with the highest NEWS2 readings (≥5), who are the most likely to experience adverse health outcomes, and who require urgent decisions about what level of medical intervention is required and is consistent with their care preferences. It is possible that high (≥5) NEWS2 may help clinical teams to identify residents on arrival to hospital who may be experiencing an end-of-life event, to facilitate discussion with families and carers about treatment intensity and palliative care decisions. Our findings do not suggest that NEWS2 should replace clinical judgment or override residents' wishes, which are paramount.

Comparison With Other Work

Care home residents in this study have higher mortality rates across all NEWS2 categories compared with the total population in the corresponding SAMBA cohorts, 1.7% in 2019[19] and 2.3% in 2020.[17] This is likely to reflect the high levels of frailty and multimorbidity[1,3] in the care home population, leading to susceptibility to adverse outcomes. It is also possible, because frailty is associated with blunted homeostatic response, that residents are less likely to manifest physiological derangement during acute illness, meaning that even those with lower NEWS2 are at higher risk of deterioration than people with similar scores who do not live in a care home and are not as frail. This hypothesis would require empirical testing.

NEWS2 is increasingly being adopted in care homes across the United Kingdom.[9,10] Previously published work demonstrated that only 7% of residents in care homes had a high or critically high NEWS2 at baseline, rising to 18% if care home staff were concerned about resident deterioration.[9] The cohort of residents in this study have a higher proportion (28%) of high/critically high scores on admission to hospital. This indicates higher levels of physiological derangement in residents admitted to hospital than observed in care homes, and is an expected finding for residents requiring acute hospital care. One of the reasons that NEWS2 may perform differently in care home settings is because the prevalence of severe acute illness would be substantially lower than in hospital settings.[12] This is one of the reasons that specific validation in the care home setting is required.

The risk of mortality (23%) in this study was significantly higher for residents with critically high NEWS2 (≥7), compared with previously reported (30-day) mortality rates for adult patients across the age spectrum (13%).[14] This suggests that the highest NEWS2 readings are associated with a particularly high risk of mortality for care home residents, compared with the general population.

Strengths and Limitations

To our knowledge, this is the first study to explore the association between NEWS2 on arrival at hospital and health outcomes in a large, nationally representative dataset. As participation in SAMBA is voluntary, there may be differences between participating and non-participating hospitals, although the size of the hospitals that participate is comparable to acute hospital services nationally,[20] and covers urban and rural locations across the UK.[17]

It is recognized that NEWS2 trajectory is particularly important,[21] but neither subsequent nor baseline (when not acutely unwell) NEWS2 were available, with outcomes measured at 7 days in this study. It is important to acknowledge that NEWS2 is designed to identify people at imminent risk of deterioration, and loses discriminatory value over longer time periods.[22]

Table 2
The Relative Risk Ratio (RRR) of 7-Day Outcomes Across Different NEWS2 Categories (Adjusted for the Effect of Age, Gender, and Wave)

Outcome Category (Reference Category is Same-Day Discharge)	RRR of Outcome at Each NEWS2 Category (CI)			
	Low (Reference Category)	Intermediate	High	Critically High
Overnight hospitalization and discharge within 7 days	—	1.53 (0.76–3.08)	5.00* (1.49–16.75)	5.41* (1.26–23.33)
Inpatient at 7 days (prolonged hospitalization)	—	1.46 (0.70–3.03)	3.56* (1.02–12.37)	9.47* (2.20–40.67)
Mortality within 7 days	—	2.43 (0.78–7.56)	13.62* (3.17–58.49)	53.50* (11.03–259.54)

The reference NEWS2 group was low and the reference outcome category was same-day discharge.
*Denotes statistical significance at the .05 level.

In this study, we had no access to contextual information such as resident preferences/frailty, community outcomes, or primary diagnosis. Frailty may be a more important variable than age when it comes to understanding the appropriateness of NEWS2 in vulnerable groups of older adults.

Estimates of relative risk for the least commonly observed outcomes (such as death) within the smallest NEWS2 categories (such as critically high), reached statistical significance, but are imprecise.

Implications for Future Research

Further research is required to evaluate the performance of the NEWS2 in care home residents, a population characterized by frailty and complex care needs,[1] to ascertain whether it enhances the delivery of resident-centered care.

The use of NEWS2 in care homes is becoming widespread despite a limited evidence base.[9,12,23] Further research is required to establish the association between care home NEWS2 measures and (both primary and secondary care) health outcomes.

Conclusion and Implications

Higher NEWS2 measurements on emergency presentation to hospital are associated with an increased risk of hospitalization for up to 7 days, prolonged admission, and mortality for care home residents. NEWS2 may have a role as an adjunct to acute care decision making for hospitalized residents.

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National Early Warning Scores and COVID-19 deaths in care homes: an ecological time-series study

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ABSTRACT

Objectives To investigate whether National Early Warning Scores (NEWS/NEWS2) could contribute to COVID-19 surveillance in care homes.

Setting 460 care home units using the same software package to collect data on residents, from 46 local authority areas in England.

Participants 6464 care home residents with at least one NEWS recording.

Exposure measure 29 656 anonymised person-level NEWS from 29 December 2019 to 20 May 2020 with component physiological measures: systolic blood pressure, respiratory rate, pulse rate, temperature and oxygen saturation. Baseline values for each measure calculated using 80th and 20th centile scores before March 2020.

Outcome measure Cross-correlation comparison of time series with Office for National Statistics weekly reported registered deaths of care home residents where COVID-19 was the underlying cause of death, and all other deaths (excluding COVID-19) up to 10 May 2020.

Results Deaths due to COVID-19 were registered from 23 March 2020 in the local authority areas represented in the study. Between 23 March 2020 and 10 May 2020, there were 5753 deaths (1532 involving COVID-19 and 4221 other causes). We observed a rise in the proportion of above-baseline NEWS beginning 16 March 2020, followed 2 weeks later by an increase in registered deaths (cross-correlation of r=0.82, p<0.05 for a 2 week lag) in corresponding local authorities. The proportion of above-baseline oxygen saturation, respiratory rate and temperature measurements also increased approximately 2 weeks before peaks in deaths.

Conclusions NEWS could contribute to COVID-19 disease surveillance in care homes during the pandemic. Oxygen saturation, respiratory rate and temperature could be prioritised as they appear to signal rise in mortality almost as well as NEWS. This study reinforces the need to collate data from care homes, to monitor and protect residents' health. Further work using individual level outcome data is needed to evaluate the role of NEWS in the early detection of resident illness.

Strengths and limitations of this study

- This is one of the few studies providing population level surveillance information on the care home population during the initial peak of infections from COVID-19.
- This study uses widely available public health mortality information, combined with individual level health observations based on vital sign measurements (National Early Warning Scores), that could be useful for population-level COVID-19 disease surveillance during future waves of COVID-19 infection in care homes.
- The ecological study design was used as a pragmatic approach to make best use of available data: but this is not a causal study, nor a study of diagnostic accuracy, and it is liable to the ecological fallacy.
- Further research using individual level information on mortality and diagnoses, linked to NEWS, is required to evaluate the role of NEWS in assessing individual residents with suspected COVID-19 infection.

INTRODUCTION

Care homes have experienced high rates of COVID-19 infection and death. In England, over half of excess mortality in the first months of 2020 is estimated to have been in this setting.[1] Surveillance of COVID-19 in care homes has been difficult, because of a paucity of testing, and the lack of experience with how this disease presents in older people.[2]

An increasing number of UK care homes now collect National Early Warning Score (NEWS). This tool (originally developed by the Royal College of Physicians in 2012,[3] and updated in 2017)[4] is used in hospitals in the UK to identify patients at risk of acute deterioration and improve patient safety. NEWS requires the measurement of six simple physiological parameters: temperature, pulse, systolic blood pressure, respiratory rate and oxygen saturation and level of consciousness or new confusion. The score generated should trigger a prespecified response, ranging from repeating the score within a specific timeframe, to seeking urgent medical attention.[5]

The British Geriatrics Society produced guidelines for managing COVID-19 in care

homes for older people. To support triage, they recommend training staff to measure a resident's vital signs (temperature, blood pressure, heart rate, pulse oximetry and respiratory rate) when COVID-19 infection is suspected.[6] The risks and benefits of this approach are unknown. In community settings, elevated NEWS scores have been associated with prompt review by a health professional and poor health outcomes.[7] Evidence to support the use of NEWS in care homes is limited, and whether it can support care home staff to identify or predict deterioration in the health of residents is unclear.[8–11] NEWS observations, particularly measurement of blood pressure, require close contact between residents and care home workers, which may transmit COVID-19 infection.

This study will address the dearth of published evidence on the use of NEWS in any setting during the COVID-19 pandemic.[12] The aim is to describe change in NEWS and its components over time and align these data with COVID-19 and all-cause mortality in care homes in England. We address the question of whether NEWS can contribute to surveillance during the pandemic, and whether an abbreviated NEWS (excluding one or more of the component measures) would suffice.

METHODS

Study design and setting

We conducted an ecological study by aggregating individual level data for the exposure of interest (NEWS) and comparing these results to area level aggregate data for the outcome of interest (all cause and COVID-19 mortality). Participants were all residents of care homes utilising the same commercial software with cloud storage of data, and they all had at least one NEWS recording.[13] We did not apply any further population inclusion/exclusion criteria.

Exposure information

Anonymised person-level NEWS (and the slightly modified NEWS2)[4] information were obtained from 1 December 2019 to 20 May 2020 including the individual component vital sign measures of NEWS: blood pressure, respiratory rate, pulse rate, temperature and oxygen saturation. Demographic information on the care home resident (age and sex) were obtained, along with a geographical identifier to examine regional variation. NEWS recordings were made by care home staff using a specific, commercially available package designed to reduce measurement error. The commercial provider supplies equipment to measure vital signs and record physiological observations, automatically generate NEWS, and upload the data to their cloud storage servers. The system has previously been described elsewhere.[11]

Outcome measurement

Geographical death data were obtained from Office for National Statistics (ONS) weekly reported registered deaths in care homes due to COVID-19, and all cause deaths (excluding COVID-19) available from week 1 (beginning 29 December 2019), to week 19 (ending 10 May 2020).[14] ONS reporting areas and care home geographical labels were mapped as closely as possible.

Analysis

We established baseline levels for NEWS and its component observations, in our population using centile cut points in a random subset of 70% of data collected between December 2019 and 1 March 2020 (prior to the likely outbreak of COVID-19 in care homes in England). These cut points were then validated in the remaining 30% of observations made before March 2020. NEWS scores above the 80th centile score were defined as above-baseline. For individual physiological observations, upper and lower thresholds were established using the 80th and 20th centile measurements in the same random subset (we calculated the lowest 20th centile only for oxygen saturation: only lower values indicate a health problem). These cut points represent markers of increase in each parameter at a population level and are not measures of clinical concern at the individual resident level, which are defined elsewhere.[4] We removed biologically implausible values from the data set before creating the centile cut points (online supplemental table 1). We used quantile regression to measure the impact of age and sex on centile scores but did not find evidence to support age/sex specific 20th and 80th centile cut points in this population (details available from the authors on request).

We calculated the proportion of above-baseline NEWS measurements and the component observations on a weekly basis, aggregated across all geographical areas providing data. We plotted the proportion of weekly above-baseline measures in participating care homes as a time series against the weekly number of care home deaths due to COVID-19 and all-cause mortality (excluding COVID-19) occurring in the matched geographical areas present in our data.

We calculated the cross-correlation between the two time series (above-baseline NEWS and component scores, and daily registered all cause deaths including COVID-19) for time lags between 0 and 7 weeks. We combined the individual physiological observations that anticipated COVID-19 mortality trends to see if a 'minimum panel' could be useful for collection instead of the full NEWS panel. This makes our findings relevant to care home settings where NEWS is not calculated, or where all component physiological measures are not performed. Measurement of fewer components is expected to reduce contact time between carers and residents and decrease spread of COVID-19 infection.

All data management and analyses were conducted using R V.3.6.3.[15] We used the ccf function in the stats R package to calculate cross-correlations.

Patient and public involvement

This was a study in response to a Public Health Emergency of International Concern. Patients or the public were not involved in the design, conduct or reporting of this rapid response research.

RESULTS

Care home population

Care home data were available from 6464 individuals, 2007 men (mean age 80.1 years, SD=12.6) and 3373 women (mean age 83.0 years, SD=12.9). Information on gender was missing from 1086 (16.8%) people, and age information was missing for 116 (1.8%) people. 441 biologically implausible NEWS component scores were removed from the dataset (online supplemental table 1).

Geographical variation in reporting

29 656 NEWS recordings were made across 46 local authority (LA) areas, from 480 unique care home IDs (identifiers for the device used to record the measurement, representing a care home or a distinct unit within a care home). Most recordings were made in two LAs in the north east of England (n=11 029 and n=10 347), and in one London borough (n=3411).

Deaths in care homes

There were 10 407 registered deaths in care homes in the 46 LA and Clinical Commissioning Group (CCG) areas between 29 December 2019 and 10 May 2020. The first death from COVID-19 was registered in week commencing 23 March 2020. From 23 March 2020 to 10 May 2020, there were 5753 deaths of care home residents—1532 with an underlying cause of COVID-19 and 4221 due to causes excluding COVID-19.

Baseline news centile scores

Table 1 contains information on NEWS taken from 9586 (70% subset of 13 694) recordings made before 1 March 2020. Table 1 also contains thresholds for NEWS 20th centile scores, and 80th and 20th centile scores for NEWS components calculated in this subset, and the proportion of observations exceeding these values in the 30% validation dataset.

NEWS measurements and care home deaths

The proportion of above baseline NEWS observations was stable from week 1 (30 December 2019–5 January 2020) until week 12 (16 March 2020 to 22 March 2020) and week 13 (23 March 2020 to 29 March 2020) when there was a marked increase. This increase happened in the weeks before the majority of COVID-19 and non-COVID-19 deaths began to occur (from week 15 (6 April to 12 April). The proportion of above baseline NEWS scores peaked in week 15, before beginning to decline again from week 16 (13 April to 19 April) onwards (figure 1). The highest correlation was observed for a 2 week lag (r=0.82, p≤0.05, online supplemental figure 1).

Individual NEWS component measures and care home deaths

The proportion of above baseline measures of high respiratory rate (r=0.73, p≤0.05 for a 2 week lag) and low oxygen saturation (r=0.80, p≤0.05 for a 2 week lag) appear to follow the pattern of COVID-19 and non-COVID-19 deaths more closely than other component measures (online supplemental figure 1). The proportion of above baseline measures of temperature appeared to be decreasing between week 0 and week 10, before rising slightly to plateau until week 15 before declining again.

Combination of NEWS component measures

Figure 2 shows paired combinations of above baseline respiratory rate and temperature and below baseline oxygen saturation. All increase just before peaks in COVID-19 and non COVID-19 deaths (figure 2).

DISCUSSION

This study suggests that NEWS could make a useful contribution to COVID-19 disease surveillance in care homes during the pandemic. A rise in the proportion of above-baseline NEWS was observed from the middle of March 2020, when the incidence of COVID-19 was believed to be rising in the UK. The proportion of above-baseline

Table 1 NEWS values before March 2020 in the development data set, cut points for baseline measurements and proportion of above baseline measurements in the validation data set

	Development data set						Validation data set	
Measurement	Median	Min	Max	IQR	20th centile	80th centile	% below 20th centile	% above 80th centile
NEWS	2.0	0.0	15.0	3.0		>4		14.7
Temperature (°C)	36.5	32.0	40.0	0.6	<36.2	≥36.9	18.4	25.8
Pulse rate (beats/min)	76.0	22.0	212.0	19.0	<66	≥89	19.6	20.0
Systolic BP (mm Hg)	123.0	50.0	235.0	26.0	<109	≥143	20.5	19.4
Respiratory rate (breaths/min)	19.0	6.0	60.0	3.0	<17	≥22	19.4	18.3
Oxygen saturation (%)	95.0	47.0	100.0	4.0	≤92		17.6	

BP, blood pressure; NEWS, National Early Warning Scores.

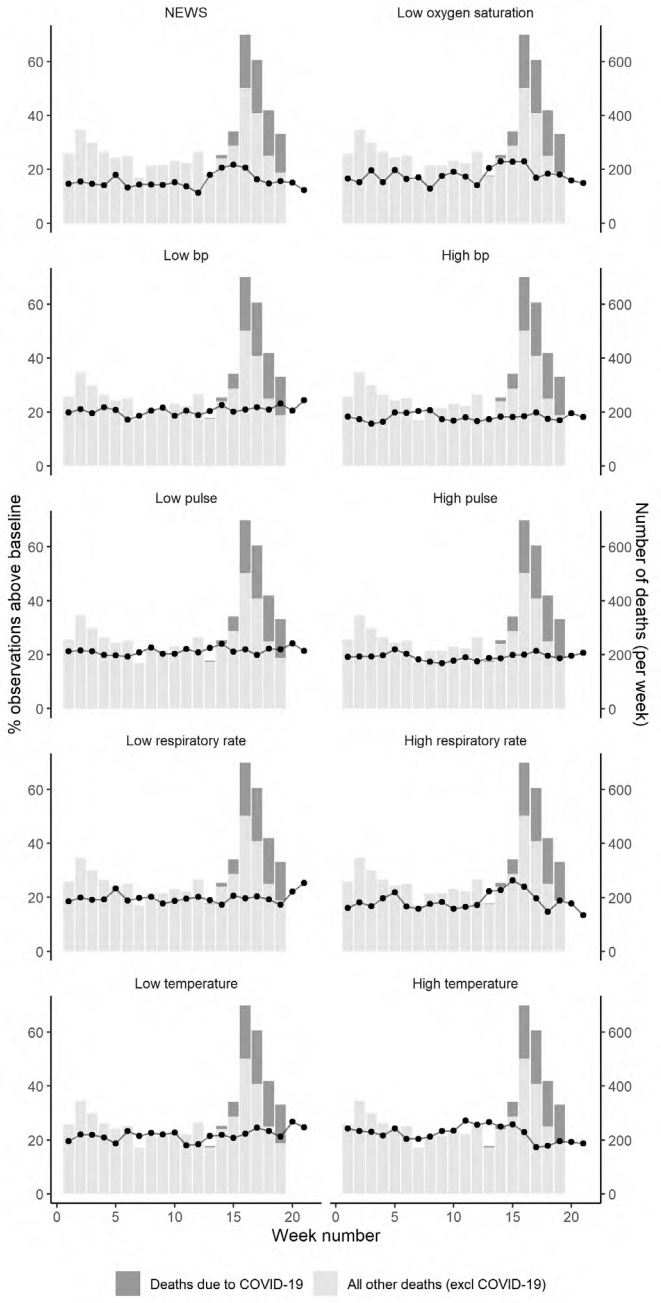

Figure 1 The proportion of above baseline NEWS and component measurements from December 2019 to May 2020 (lines), compared with care home deaths in corresponding geographical areas in England (bars). NEWS, National Early Warning Scores.

measurements of oxygen saturation, respiratory rate and temperature also increased approximately 2 weeks before peaks in care home deaths in corresponding geographical areas. Oxygen saturation and respiratory rate appear to signal rise in mortality almost as well as total NEWS and may be safer and more practical to measure during a pandemic.

In this study, we observed a 2-week time lag between peaks in NEWS measures and deaths. This is similar to the observed time between symptom onset and

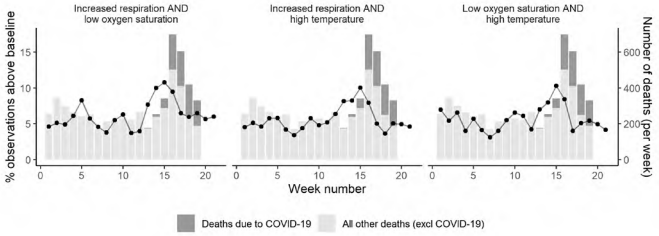

Figure 2 The proportion of above baseline NEWS component combinations December 2019 to May 2020, compared with care home deaths in corresponding geographical areas in England. NEWS, National Early Warning Scores.

COVID-19 death in other settings.[16 17] Evidence for the role of NEWS in acute illness in community settings is growing,[11 18–22] but to date, only one descriptive study has provided empirical data on NEWS in care homes.[8] A recent systematic review on the use of NEWS in assessing unwell COVID-19 patients in primary care suggested that enthusiasm for its use may be premature.[12] Limitations of this study mean that we cannot draw direct conclusions about the role of NEWS (or its component parameters) in the care of individual residents: further study would be needed to address this question. However, it suggests a role for NEWS in COVID-19 disease surveillance at a care home population level in the pandemic. Measurement and monitoring of some NEWS components may be useful in detecting future waves of COVID-19 infection in care homes. Emerging evidence suggests that up to half of care home residents do not have symptoms at the time they test positive for COVID-19.[23] Whether NEWS measurement could signal impending illness in any of these residents at the individual level is unclear, and we do not believe it should substitute for a comprehensive programme of testing in care homes. Recent work has shown the value of routinely collected information to target resources during the COVID-19 pandemic,[24] and our study strengthens the case for further work to evaluate the role of NEWS in the care of individual residents.

Strengths and limitations

To the best of our knowledge, this is the first study to examine variation in NEWS in care homes over time. We have described trends over time in NEWS recorded using a specific software system used to collect data on NEWS in some care homes. This means that the distribution of care homes within and between areas is not systematic, as it reflects the market share of the software company and local support for digital data collection in care homes. Most recordings were drawn from the north east of England, and a London borough, but we have no information on the proportion of care home residents in each area that are represented in our data set. All data were anonymised, and without individual outcome data, we examined patterns in and simple correlations between NEWS and area-level weekly registered death information. We were not able to independently assess or verify

the accuracy of NEWS measurements made by care home staff using the specific commercial software, and acknowledge that even where training is sufficient, the accuracy of vital sign measurement such as respiratory rate can be suboptimal.[25] However, our approach using 20th/80th centile scores will have ameliorated some of the impact of potential inaccuracies, and we caution against using single observations in isolation. Furthermore, we removed a small number of biologically implausible values and provide a summary of the number of values removed in online supplemental table 1. This study design was a pragmatic approach that made best use of available data, but it is not a causal study, nor a study of diagnostic accuracy and it is liable to the ecological fallacy.

CONCLUSIONS

The recording of the NEWS, and the component physiological measures, may make a useful contribution to COVID-19 disease surveillance during the pandemic. Use of a shortened NEWS could be recommended for care home population surveillance where COVID-19 is of primary concern (but not for individual care due to the risk of underestimating the severity of non-respiratory illness). Oxygen saturation, respiratory rate and temperature provide a similar signal to the complete NEWS. The omission of some components of NEWS, such as blood pressure, minimises contact time between residents and care home staff, potentially reducing infection risk where this is of primary concern. Data on mortality and diagnoses, linked to NEWS, are required to evaluate the role of NEWS in assessing individual residents with suspected COVID-19 infection. Collection and aggregation of data from care homes would facilitate disease surveillance; we argue that introduction of a care home minimum dataset should be a priority for the UK.

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Contributors BH and ROB conceived the study. BH, ROB and DS acquired and managed the data. DS analysed the data and created the figures. DS, ROB, FEM and BH interpreted the results. DS, BH and ROB drafted the first version of the manuscript. BH and FEM supervised the work. DS is the guarantor and accepts full responsibility for the work and the conduct of the study, had access to the data and controlled the decision to publish. All coauthors provided critical comments and approved the final version of the manuscript. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

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Competing interests None declared.

Patient consent for publication Not required.

Ethics approval This study was approved by Newcastle University Research Ethics Committee (Ref. 3297/2020) and was conducted under the Secretary of State's directions under the Control of Patient Information Regulations, following advice from the Health Research Authority.

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Data availability statement Data are available in a public, open access repository. Data are available upon reasonable request. Information on the deaths of care home residents is feely available from the source cited (https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/articles/deathsinvolvingcovid19inthecaresectorenglandandwales/deathsoccurringupto1may2020andregisteredupto9may2020provisional). Other data may be available upon reasonable request from barbara.hanratty@newcastle.ac.uk.

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BMC Health Services Research

SYSTEMATIC REVIEW Open Access

Which acute deterioration tools are used in long-term care facilities and how have they been evaluated? A scoping review

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Abstract

Background Acute deterioration describes a rapid decline in health due to short-duration illnesses. This is an important topic for older adults living in long-term care facilities (LTCF). Signs of acute deterioration are often subtle, and there is no standardised system to manage it. The aim of this review is to scope the range of deterioration tools used in LTCFs, and to describe how they have been evaluated.

Methods A scoping review was conducted in accordance with the Joanna Briggs Institute methodology. Searches of five (MEDLINE, APA PsycInfo, Embase, CINAHL, HMIC) electronic databases (2013–2023, updated 2025) and relevant websites were followed by title/abstract (by two authors independently) and full-text screening. Eligible studies involved tools used to manage acute deterioration for adults > 65 years in LTCFs. Experimental and observational study designs were eligible, including quality improvement projects. No country or language restrictions were imposed. A narrative synthesis was conducted.

Results Twenty-six studies were included (23 peer-reviewed articles, two conference abstracts, one dissertation) after screening 5958 articles. A majority were from the UK ($n=10$) and USA ($n=9$), with small numbers from other high-income countries ((Australia ($n=2$), Canada ($n=2$), Sweden ($n=2$), Switzerland ($n=1$)). Studies employed a wide range of methodologies, with only one randomised study, and tools were frequently evaluated as part of multi-faceted interventions. The majority of studies described an intervention in which SBAR (situation-background-action-recommendation) ($n=15$), National Early Warning Scores ($n=7$) or STOP AND WATCH ($n=4$) were a component. Studies used quantitative ($n=21$) and qualitative ($n=9$) methods to evaluate tools. Outcome measures were heterogeneous, with no data on resident experience. The majority of studies concluded potential benefit from using deterioration tools. There is some evidence that LTCF staff perceive tools, especially SBAR, as improving confidence in managing acute deterioration and aiding communication with external healthcare professionals.

Conclusion Despite policy drivers to use deterioration tools in LTCFs, there is no robust evidence to support this. Direct benefits for resident care have not been demonstrated. Further research is required to compare tools to standard care, measure the impact on resident experience, and to determine if deterioration tools should become part of routine care in LTCFs.

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Keywords Long-term care facilities, Deterioration tools, Acute illness

Background

Residents living in long-term care facilities (LTCF) represent a large and important population in our society. Approximately 420,000 people live in care homes in the United Kingdom (UK) [1], representing a bed base three times that of the hospital sector [2]. LTCFs are institutional settings where older adults live and receive long-term social and health care. Older adults in LTCFs are living with complex care needs, high levels of frailty, dependence and complex multimorbidity [3–5]. LTCF residents are susceptible to severe forms of acute illness. This is a term used to describe illnesses of short duration, either an exacerbation of a pre-existing problem, or the rapid onset of a new condition [6], for example infections like pneumonia. Acute illnesses can cause rapid deteriorations in the health of residents living in LTCFs, and they experience high rates of emergency hospital attendance and admission [7]. A significant proportion of emergency admissions to hospital may be avoidable [8–10]. Improving how LTCF and healthcare staff work together to respond to acute deterioration is a key component of enhancing care for residents living in LTCFs, as it may signal illness requiring active treatment in the LTCF or in hospital, or a need to consider end-of-life care.

Acute deterioration poses a challenge for both LTCF staff, and healthcare professionals external to the care home. External healthcare professionals who respond to concerns from LTCF staff depend on the specific healthcare setting, but may include general practitioners, specialist doctors (with training in geriatrics), or specialist nurses [11]. The main challenges for LTCF and health staff are that signs of acute deterioration are often subtle or absent [12], and deterioration trajectories are frequently unpredictable [13]. Older adults have a tendency to under-report symptoms to their caregivers [14]. Therefore, LTCF staff often rely on informal observations (e.g. reduced mobility), and their intuition, to alert them to an evolving illness that could deteriorate rapidly. Objective indicators of acute deterioration, such as vital sign measurement, may also contribute to the initial assessment, especially when on-site nurses are part of the LTCF care team.

When LTCF staff are concerned, they are required to decide how and when to communicate concerns within the LTCF, or whether to escalate their concerns to external healthcare professionals. When escalation occurs, healthcare staff frequently receive information from LTCFs that lacks objective data on which to base treatment decisions. This complicates the next stage in the response to acute deterioration, during which healthcare professionals work with care home staff and residents (or their friends/family) to formulate a care plan that is consistent with resident wishes. The stages in the response to acute deterioration described above are shown in Fig. 2.

There is not a standardised system for LTCF and healthcare staff to identify and respond to acutely deteriorating residents [15]. Therefore, policymakers are widely implementing interventions/tools that aim to improve the management of acute deterioration but without evidence on how they impact resident care and the experiences of staff working in LTCFs. There is a strong policy incentive for deterioration tools to be implemented in LTCFs, such as the National Early Warning Score (NEWS) in the UK [16]. Up-scaling of remote monitoring in LTFCs and the implementation of interventions to enhance the response to deterioration have also been accelerated by the COVID-19 pandemic [17].

The evidence base about acute deterioration in LTCFs is evolving. Hodge et al. conducted a scoping review to describe how acute deterioration is identified by care home teams [18]. They concluded that this is a complex process, 'context sensitive,' also depending on factors external to care homes. However, deterioration tools were not the subject of this review. Subsequently, Daltrey et al. conducted a review of evidence from peer-reviewed journals about models of care and 'clinical patterns of deterioration' in residential aged care facilities [15]. This included some coverage of deterioration tools to support registered nurses in responding to deterioration. However, no previous reviews have focused solely on the role of deterioration tools or how they have been evaluated, despite the policy drivers to increase the use of tools. Our review builds on the current evidence base by focusing specifically on deterioration tools. The aim is to scope the current evidence base about which deterioration tools are being used in LTCFs and what outcome measures have been used in their evaluation, as well as the implementation challenges. Consequently, this review aims to extend the evidence base identifying promising tools for future development, and proposing outcome measures necessary to evaluate their impact on resident care and effectiveness in future work.

Aim

The aim of this review is to scope the range of deterioration tools employed in LTCFs, and to describe how they have been evaluated in this setting.

Objectives

Evidence will be synthesised on the current tools used in managing LTCF resident acute deterioration:

(1) To identify the range of tools employed to identify and manage resident acute deterioration in LTCFs.
(2) To describe the outcomes used to evaluate deterioration tools in LTCFs.
(3) To determine if existing evidence suggests that one tool(s), or particular component(s) of composite tools, should be preferred over any other(s) for future development.

Methods

A scoping review was conducted as the body of evidence for deterioration tools in LTCFs was expected to be complex and heterogenous [19]. This review was conducted in accordance with the Joanna Briggs Institute (JBI) scoping review methodology [19].

Search methods

The search strategy was developed in MEDLINE (OVID) and combined MeSH terms, keywords, and synonyms for the type of facility, such as 'long-term care facility,' 'nursing home,' and 'care home,' with a set of terms related to specific tools, for example 'Early Warning Score,' 'Stop and Watch,' and 'SBAR' as well as more generic terms for deterioration tools. Searches were translated to APA PsycInfo (OVID), Embase (OVID), and HMIC (Health Management Information Consortium) and CINAHL (EBSCOhost). Searches were restricted to 2013 to 'current' where the database allowed and carried out on the 4th of April 2023. The searches were updated on the 7th of January 2025, starting from January 2023 (which may mean that there is a small degree of overlap with the initial search). This search strategy aimed to capture the majority of evidence which has emerged in the last decade. The records from each database searched were imported into EndNote 21 where they were combined and deduplicated. Specific websites were scrutinised, including The Health Foundation, The King's Fund, the British Geriatrics Society, the Nuffield Trust, and the International Long-Term Care Policy Network. Consultation with the academic and professional networks of the study team was undertaken, including targeted emails to academics and clinicians working in this field. Full details of the searches undertaken along with the search strategies are given in the Supplementary materials.

Inclusion and exclusion criteria

Participants Eligible studies focused on older adults (> 65 years) living in LTCFs. Residents living in facilities with registered nurses on-site (for example nursing homes), and those without were eligible for inclusion.

Intervention For the purpose of this review, the intervention was defined as a tool used by LTCF staff and/or healthcare professionals to identify and/or manage residents who may be experiencing a deterioration in health due to an acute (short-duration) illness [6], in the LTCF setting. There is no specific definition for acute illness/deterioration in the setting of LTCFs.

To be eligible, studies were required to, (a) describe a deterioration tool being used in the delivery of resident care in LTCFs (studies reporting on training on tools only were excluded), and (b) measure outcome(s) that relate specifically to deterioration tool use in LTCFs. Models of care and multi-modal interventions that incorporated deterioration tools but did not report outcomes specific to the tool itself were excluded.

Study designs Experimental and observational study designs were eligible for inclusion, including quality improvement projects and service evaluations. Unlike previous reviews, eligible sources of evidence were not limited to papers published in peer-reviewed journals, as the authorship team were aware that evidence about deterioration tools in LTCFs is also likely to be found in reports and service evaluations. Conference abstracts were included if they contained sufficient data to describe an intervention and measured outcomes. There was no restriction in terms of publication country or language. Previously published reviews were not eligible for inclusion but bibliography searches of these studies were conducted.

Exclusions Younger adults (< 65 years-old) living in LTCFs and Deterioration tools used in hospitalised residents of LTCFs were excluded. Studies not reporting outcomes to evaluate tool use (for example a description of a tool only) or studies in which tools had not been used to influence resident care (for example deterioration tools used retrospectively to assess quality) were excluded. Outcomes that assessed staff knowledge following training (even if focused on a deterioration tool) were excluded.

Study selection

The selection process consisted of two levels of screening, (a) the title and abstract, and (b) full-text papers. For the first level of screening, the titles and abstracts of all retrieved studies were screened against the inclusion criteria by two reviewers. Rayyan, an online screening tool [20], was used for title and abstract screening, with the author blinding function enabled. Any disagreements were discussed between the two authors, or with input from a third author, to achieve a consensus. In the second step, the full text was assessed against the inclusion/exclusion criteria by the primary author and all selections were checked by a second author to ensure consistency.

Data extraction

Data were extracted from included studies into a Microsoft Excel spreadsheet, which had been jointly developed by two authors. Data extraction was performed by the primary reviewer and checked by a second author. Data on the following variables were extracted:

1) Study information- author, year of publication, type of publication.
2) Study design – as stated by study authors.
3) Study setting - country of study origin, type of LTCF.
4) Description and type of deterioration tool (and co-interventions if relevant).
5) Outcome measures relating to deterioration tool use.
6) Key findings/conclusions.

Data synthesis

A descriptive summary with data tables was produced to summarise the literature using a narrative synthesis, as the data were not suitable for pooling. Data were grouped according to the deterioration tool type/point at which they are intended to act on the deterioration response pathway.

Results

A total of 5958 titles and abstracts were screened from database searches, resulting in full-text screening of 73 studies from database searches. Full text review was also conducted for 21 studies retrieved through hand/bibliography searching. The reasons for exclusion following full-text screening are displayed in the PRISMA diagram (Fig. 1). The commonest exclusion category was tools/interventions with an alternative focus to resident deterioration ($n = 16$), followed by studies of deterioration tools with no eligible, empirical outcome data specific to the tool itself ($n = 15$). Authors were contacted on four occasions to aid decisions about eligibility. Overall, 26 studies were eligible for inclusion, twenty [17, 21–39] from database searches and six from hand/bibliography searching [38, 40–44]. A total of 23 studies were from peer-reviewed journals [17, 21, 22, 24–32, 35–45], with two conference abstracts [33, 34] and one dissertation [23]. Figure 1 shows the study selection process.

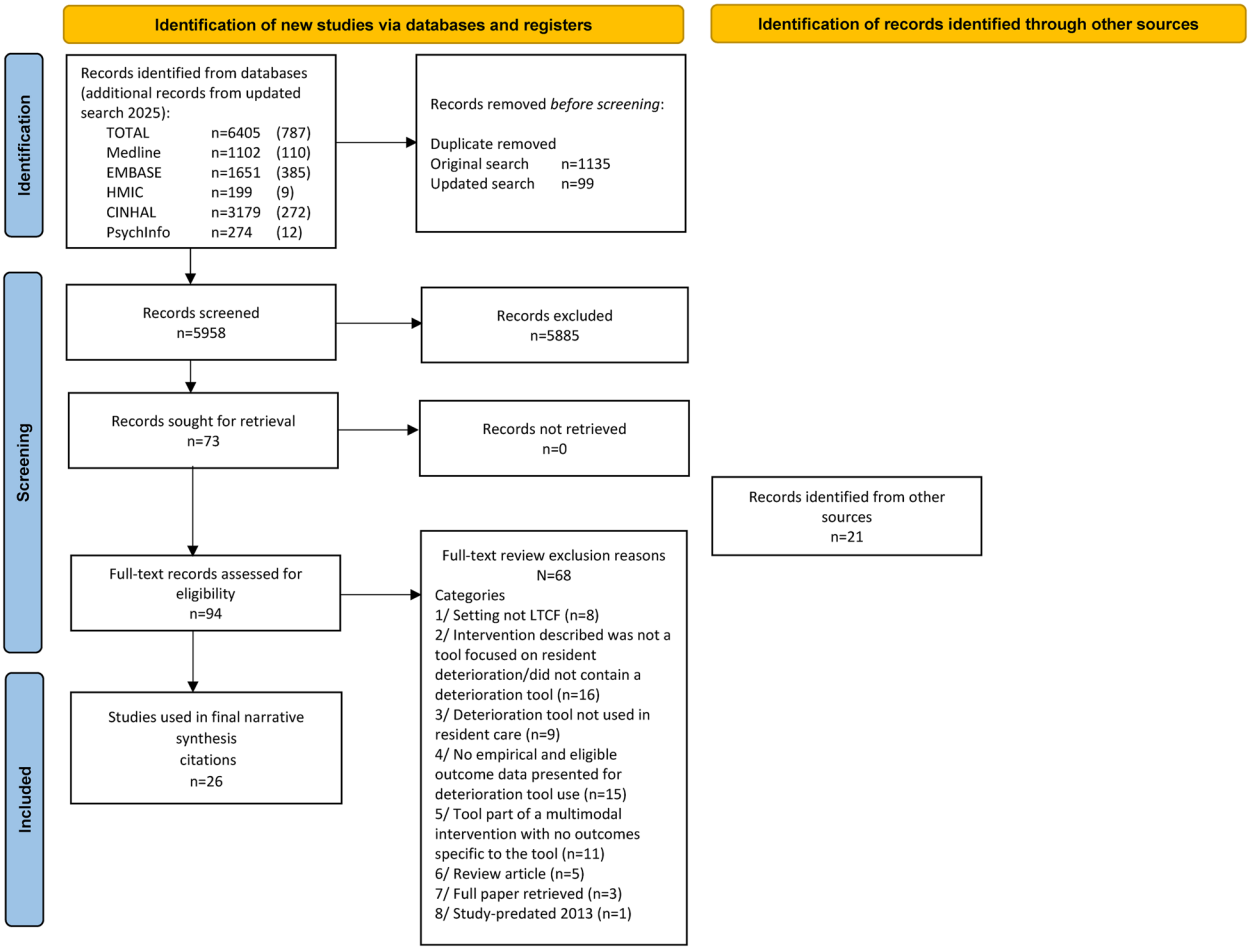

Fig. 1 PRISMA diagram showing study selection (adapted from PRISMA diagram - https://www.prisma-statement.org/prisma-2020-flow-diagram)

Study setting and design

The majority of studies ($n = 20$) presented data on the impact of tool use [17, 21–24, 27–34, 36, 39–41, 43–45], with others addressing tool validation [25, 35, 37, 38, 42]. None of the identified studies presented outcomes for deterioration tool use compared to standard care (with no deterioration tool use). One study compared a two different deterioration tools (a customised version of SBAR with standard SBAR) within different LTCFs [30]. There was a high degree of heterogeneity in study design. One was a randomised study but there was insufficient intervention uptake to assess effectiveness [45]. A significant number of studies ($n = 10$) of included studies were conducted at a single-site LTCF [23, 28, 29, 31, 32, 34, 36, 37, 41, 43].

A majority of studies were conducted in the UK ($n = 10$) [17, 21, 22, 25, 26, 28, 35, 39, 44, 45] or the USA ($n = 9$) [23, 29–34, 36, 40], with other studies from LTCFS in Australia ($n = 2$) [24, 41], Canada ($n = 2$) [37, 43], Sweden ($n = 2$) [38, 42], and Switzerland ($n = 1$) [27].

Deterioration tools used in LTCFs

Characteristics and key findings of included studies are described in Table 1 and summarised in Table 2. Most studies described an intervention in which the SBAR (situation-background-action-recommendation) tool [17, 22, 23, 27, 29, 31, 32, 34, 36, 40, 41, 44, 45] or a tool based on SBAR [24, 30] ($n = 15$) was a component. The National early Warning Score (NEWS), a 'track and trigger' systems using vital sign measurement, was a component of interventions in seven studies based in the UK [17, 21, 22, 25, 26, 39, 44]. The STOP AND WATCH tool was a component in four studies [27, 29, 33, 45], delirium screening tools [35, 37] and the Early Detection of Infection Scale (EDIS) [38, 42] the subject in two papers, Practical Routine Elder Variants Indicate Early Warning for Emergency Department (PREVIEW-ED) [43] and Significant Seven [28] in one study.

Nine studies evaluated an intervention incorporating more than one deterioration tool [17, 22, 24, 25, 27, 29, 41, 44, 45], and/or deterioration tool use as part of a multicomponent intervention ($n = 8$) [17, 21, 27–29, 33, 41, 45] such as additional personnel [27, 41], training beyond education specific to deterioration tool implementation [28, 29, 33] or enhanced clinical care pathways [45].

Deterioration tool description and categorisation

Overall, deterioration tools aimed to facilitate, 1) the prompt recognition of acute deterioration by providing a system for care staff to, (a) observe changes in resident condition that may indicate deterioration [24, 27–29, 33, 35, 37, 38, 41–45] (including delirium screening tools [35, 37]) and/or, (b) by measuring vital signs as an objective measure of acute illness severity [17, 21, 22, 24–26, 29, 39, 42, 44], and/or 2) structured communication by LTCF staff with external healthcare professionals about acute deterioration [23, 24, 27, 30–32, 34, 36, 40, 41, 44, 45]. Deterioration tools are targeted towards the care staff response to acute deterioration, as opposed to supporting healthcare staff in managing acute illness.

SBAR is a communication tool, widely used in the hospital setting, providing a structure (situation-background-action-recommendation) to improve communication between care providers [46]. Two studies described tools based on SBAR [24, 34], including the Clinical Handover Assessment Tool (CHAT) which was used in conjunction with the Residential Aged Care Facility Emergency Decision Index (REDI) tool [24]. The REDI is a clinical decision guide for LTCF staff, which uses a combination of vital sign measurement and care staff observations (such as changes in resident activity level) to guide an escalation plan. This tool consists of 10 scenarios, including respiratory distress, urinary tract infection and delirium.

The National Early Warning Score (NEWS), modified to NEWS2 in 2017 [16], is advocated by UK policy makers for adoption in care homes [25]. NEWS is a standardised system initially designed for use in hospitals to recognise and communicate about acute illness. It is proposed that NEWS can act as a 'common language' for sharing information about resident deterioration between UK care homes and primary care/emergency services [16]. NEWS requires the measurement of temperature, pulse, systolic blood pressure, respiratory rate, oxygen saturation and level of consciousness. The overall NEWS triggers a response, ranging from continued monitoring to emergency service involvement [16].

Other tools captured changes in resident health and wellbeing, which would be observed by LTCF staff in their daily interactions with residents, as opposed to a reliance on the measurement of vital signs. STOP AND WATCH is used when a person is 'not their usual self.' There are 12 categories of observations such as 'seeming different to usual' (S), talking less (T), overall needing more help (O), and pain (P) [47]. The Significant Seven tool addresses seven similar signs of deterioration - confusion, mood, pain, hydration, skin, breathing changes and bowel habit [48]. The EDIS tool is the subject of two studies [38, 42]. This tool also uses changes in resident status observed by carers, such as confusion and changed appetite, which may indicate acute illness. The single vital sign of temperature is also included. The PREVIEW-ED [43] tool prompts Personal Support Workers to identify whether their resident is their 'normal' self, and the score indicates whether registered staff should be informed. The tool then prompts action by registered staff to complete an assessment and undertake further actions. RESTORE2 (Recognise Early Soft Signs,

Table 1 Study characteristics, outcome measures and findings

Author, publication year	Publication type	Country	LTCF type	Study type/ design – author reported (deduced if not stated)	Intervention, co-interventions	Outcomes reported	Key findings reported relevant to resident care	Author conclusions
O'Neill 2017 [41]	Peer-reviewed journal	Australia	Nursing home (*n*=1 with 94 beds))	(Qualitive service evaluation)	Residential Acute Deterioration Detection Index (RADD) (traffic light system) and SBAR Co-intervention– deterioration tools were part of a broader hospital avoidance programme, including other decision-support tools such as clinical management guidelines. Other facets to the intervention included advanced clinical skills training, specialist clinical support and medical equipment.	Qualitative– focus groups with LTCF staff. Outcomes were specific to the deterioration tools.	It was not clear how often SBAR was used, but its benefits were acknowledged, specifically that it helps to give a structure for communicating concern about deterioration that is 'to the point.' Benefits reported of using SBAR and the traffic light system to increase LTCF staff confidence, for example 'I think that traffic light thing does give you the confidence to deal with it, even if the RN can't get down there you know you're only talking on the phone explaining, doing the SBAR thing so you're basically following that until it gets to the stage where you definitely need some more help, so I think that's a critical part I like.'	LTCF welcome the hospital avoidance programme, including reporting benefit from the deterioration tools. However, staffing and a 'shift in workload' are potential barriers**.**

Table 1 (continued)

Author, publication year	Publication type	Country	LTCF type	Study type/ design – author reported (deduced if not stated)	Intervention, co-interventions	Outcomes reported	Key findings reported relevant to resident care	Author conclusions
Russell 2020 [22]	Peer-reviewed journal	UK	Care homes (*n*=47)	'Service evaluation' (qualitative evaluation)	NEWS	Qualitative interviews (*n*=21)– care home staff, healthcare professionals, healthcare manager	Themes from qualitative interviews: 1/ The benefits of NEWS, including 'backup' of care home staff judgements. 2/ 'Inhibitors to engagement' (1/3 of care homes used NEWS regularly), including the variation on skills and expertise within different care homes. 3/ 'Shortfalls in communication,' and deficiencies in training and implementation and support. Mapping to Normalisation Process Theory constructs, the authors had identified 'may real world barrier in its (NEWS) implementation' according to these constructs.	NEWS 'could enhance' the care of acutely deteriorating residents, improve staff (care home) confidence and improve communication. The implementation strategy did not account for the complexity of the intervention. Challenges to engagement including 'competing priorities' (for care home staff) and training. The appropriateness of NEWS in care homes requires further study and implementation requires greater involvement from care home staff and primary care services.
Sampson 2020 [45]	Peer-reviewed journal	UK	Nursing homes (*n*=14, 7 control, 7 intervention)	'Pilot cluster randomised controlled trial'	Stop and Watch SBAR Co-intervention– care pathways– a 2 step clinical guidance and decision-support system. The pilot ran for 10 months.	The study aimed to collect data on multiple domains including unplanned hospital admission, resident quality of life (using EQ-5D-5L), and qualitative data (to understand barriers and facilitators to implementation).	None of he of the nursing homes implementation tools as planned. Across the 5 participating LTCFs, only 16 STOP and Watch forms were completed (11 from one single site)– median of one per month. It was challenging to collect data on hospital admissions (as well as ambulance service and primary care contacts).	Successful recruitment and retention of residents, staff and family carers. There was limited engagement with the intervention tools. No LTCF implemented the tools as expected. There was no evidence of harm. This particular complex intervention does not warrant a future definitive trial as it was not implemented.

Table 1 (continued)

Author, publication year	Publication type	Country	LTCF type	Study type/ design – author reported (deduced if not stated)	Intervention, co-interventions	Outcomes reported	Key findings reported relevant to resident care	Author conclusions
Stocker 2021 [17]	Peer-reviewed journal	UK	Care homes (*n*=7, approximately 280 beds)	'Service evaluation' (qualitative evaluation)	NEWS Co-intervention: education and support, enhanced features e.g. clinical picture taking	Qualitative– care home (*n*=10) and health service staff across 7 care homes.	The intervention was thought to have enhanced the response to acute deterioration in care homes during the COVID-19 pandemic. Healthcare professionals saw the benefit of NEWS assisting in remote monitoring and clinical assessment. Care home staff felt that NEWS supported and 'empowered' the decisions they were making about acutely unwell residents, provided a 'common language,' and acted as an 'adjunct to staff intuition.' Themes from the qualitative interviews were: >> 'NEWS intervention during the pandemic: an adjunct to COVID-19 identification.' >> 'Use of individual physiological observations to identify COVID-19.' >> 'Using the NEWS intervention to remotely monitor health.' >> 'Empowerment of care home staff with the National Health Service agenda and language.' >> 'Centrality of training relationships and clinical support for accelerated implementation of NEWS during a pandemic.' >> 'Training and implementing the NEWS intervention in care homes during the pandemic.' >> 'Ongoing clinical support for care homes during the pandemic.'	NEWS (and associated education and support package) had a useful role during the COVID-19 pandemic, enhancing remote clinical assessment and offering care home staff reassurance and 'structure in their role.'

Table 1 (continued)

Author, publication year	Publication type	Country	LTCF type	Study type/ design – author reported (deduced if not stated)	Intervention, co-interventions	Outcomes reported	Key findings reported relevant to resident care	Author conclusions
Porter 2021 [29]	Peer-reviewed journal	USA	Skilled-nursing facility (*n*=1, 45 beds)	'Quality improvement, one-group pretest-post-test'	1/ Sepsis screening tool (uses the SIRS criteria) 2/ Stop and Watch 3/ SBAR Co-intervention– sepsis education.	Quantitative– sepsis screening frequency Outcomes related to staff knowledge changes pre and post education programme were not eligible for inclusion	2068 sepsis screens were conducted over a 3 month period (*n*=30 not completed/ lacked information). Over a 3-month period, 2,068 sepsis screens were performed and 1.5% ($n = 30$) of screens were either not completed or lacked sufficient documentation. Amongst the 2,038 sepsis screens, 0.2% ($n = 4$) screened positive for sepsis. 'Three (75%) of four positive screens for sepsis resulted in timely notification of the charge nurse and physician followed by transfer to an acute care hospital.' (timely communication measured by charge nurse notification within one hour).	There is value in providing staff with a sepsis screening tool (SIRS criteria), as well as cognitive changes with STOP AND WATCH (and value in providing sepsis education). SBAR supports staff's findings that could indicate sepsis. The authors assert that sepsis screens resulted in timely resident treatment and avoided hospitalisations.
Montgomery 2023 [24]	Peer-reviewed journal	Australia	Residential Aged Care Facilities (RACF) (*n*=8)	'Quasi-experimental pre-post design' (before-after study)	1/ RACF Emergency Decision Index (REDI) 2/ Clinical Handover Assessment Tool (CHAT), based on SBAR.	Survey data before (T0) and after (T1, 6 months post- implementation)– self-confidence RACF staff in the management of acutely unwell residents	254/284 (90%) responded at T0, 20% (51 respondents) response rate at T1. Significant increase in confidence to assess and manage acutely unwell residents following implementation of the REDI and CHAT ($p = 0.003$ and $p = 0.006$, respectively) tools. Baseline Confidence in Assessment Scale and Confidence in Management Scale scores differed significantly post-implementation of the REDI and CHAT tools ($p < 0.001$). Improvement was shown across all communication domains. The greatest improvement in confidence was in communicating with the hospital outreach service from mean 3.37 (SD = 0.94) to mean 3.86 (SD = 0.61) (max. score 5). Participants reported 'sometimes' using the REDI and CHAT tools 52% and 44% respectively.	Both tools increased confidence of RACF in assessing and managing acute deterioration, and communicating about acute illness. The tools could increase staff competence. The authors state that they 'cannot infer that self-efficacy leads to improved performance.'

Table 1 (continued)

Author, publication year	Publication type	Country	LTCF type	Study type/ design – author reported (deduced if not stated)	Intervention, co-interventions	Outcomes reported	Key findings reported relevant to resident care	Author conclusions
Basinska 2022 [27]	Peer-reviewed journal	Switzerland	Nursing homes (*n*=11)	'Convergent mixed-method design within a hybrid type-2 effectiveness-implementation study.' (mixed-methods service evaluation)	1/ ISBAR (Introduction, Situation, Background, Assessment, Recommendation) 2/ Stop&Watch Co-intervention: Third intervention element - nurses providing on-site geriatric support (INTERCARE nurse)	Quantitative– uptake, acceptability (Acceptability of Intervention Measure, AIM) and feasibility (Feasibility of Intervention Measure, FIM) Qualitative– 22 focus groups with care home staff– tools and implementation.	1/ Acceptability/feasibility measures from 573 care workers from 11 nursing homes. STOP&Watch Acceptability 68% (registered nurses, licensed practical nurses, nurse aides) Feasibility 79% (registered nurses, licensed practical nurses, nurse aides) Uptake 78% (nurse aides) ISBAR Acceptability 74% Feasibility 85% Uptake 77% 2/ Qualitative results (108 care workers, 22 focus groups) specific to ISBAR and STOP&Watch ISBAR– RNs and LPNs found the instrument understandable and requiring few changes to their normal routine. They perceived it be straightforward to use when evaluating resident and communicating with healthcare professionals. RNs and LPNs described increased confidence during conversations with healthcare professionals, 'leading to well-informed, timely decisions' for resident care. STOP&Watch– nurse aids found it hard to use and difficult to understand, and some forgot to take with them when documenting resident observations. Nurse aids initial resistance to using STOP&Watch changed as they became more aware of the changes they needed to look for, and saw that these were being taken seriously. STOP&Watch and ISBAR– daily practice was adapted to facilitate use. Different settings mean that care teams needed to work out how to use these deterioration tools, and they appreciated adaptations that responded to their views. There was initial scepticism about the tools' relevance and potential to increase workload. In some cases, scepticism lessened but those who didn't recognise the practical value didn't use the tools.	Considerable variations in the acceptability, feasibility and uptake of interventions. Qualitative findings 'highlight differences in the nursing homes ' internal implementation processes,' and various 'individual barriers and facilitators to implementation.' ISBAR (and INTERCARE nurse role) considered acceptable and feasible, taken up by > 70% of care workers. Lower levels of acceptability, feasibility and uptake with STOP&Watch compared to ISBAR (and INTERCARE nurse).

Table 1 (continued)

Author, publication year	Publication type	Country	LTCF type	Study type/ design – author reported (deduced if not stated)	Intervention, co-interventions	Outcomes reported	Key findings reported relevant to resident care	Author conclusions
Nwolise 2024 [44]	Peer-reviewed journal	UK	Care homes (*n*=35)	'Mixed-methods approach, semi-structured interviews and online survey.'	RESTORE2 is a composite deterioration, including 1/ 'soft signs,' 2/ NEWS, 3/ SBARD	Quantitative– online survey (20 respondents) Qualitative– semi-structured interviews (*n*=15)	35 care home staff participated. Findings were grouped according to three main themes: 1) RESTORE2 training and use > Implementation of RESTORE2 was low; components of RESTORE2 were often used as opposed to all elements. > RESTORE2 use was mainly by nurses. > 3/20 survey respondents had never heard of RESTORE2; 5/20 had heard of RESTORE2 but never used it; 2/20 stopped using RESTORE2; 2/20 used RESTORE2 occasionally, 8/20 regularly. > Training roll-out was 'slow and patchy,' but most staff found it 'helpful' and were satisfied with its delivery. 2) Benefits of RESTORE2 > From the qualitative interviews, RESTORE2 was perceived to have benefited residents and their family/friends, through prompt responses to acute deterioration. Views were mixed about the impact on healthcare utilisation. > Lack of agreement with survey data about the impact of RESTORE2 on care provision and the management of deterioration. However, there was some agreement that RESTORE2 improved staff confidence. 3) Implementation challenges and 'moving forwards.' > Multiple implementation challenges highlighted e.g the belief that RESTORE2 was 'medically oriented' and more suitable for use in nursing homes than residential homes; perception that residential homes lack training and sufficient staff levels to measure NEWS2. > Residential care staff perceived the use of NESWS2 to be 'complicated.' Some survey respondents described SBARD as 'time-consuming' and RESTORE2 as 'lengthy.'	RESTORE2 has potential benefits e.g. improved confidence to identify acute deterioration and to escalate/communicate concerns. The authors state that RESTORE2 has the potential to reduce healthcare use, such as hospital admissions. The 'myriad of challenges that affect use and successful implementation' need to be considered. Further quantitative and qualitative research (including exploration of the resident perspective) is required.

Table 1 (continued)

Author, publication year	Publication type	Country	LTCF type	Study type/ design – author reported (deduced if not stated)	Intervention, co-interventions	Outcomes reported	Key findings reported relevant to resident care	Author conclusions
Renz 2013 [31]	Peer-reviewed journal	USA	Skilled-nursing facility (*n*=1)	'Repeated measure, quality improvement'	(INTERACT II) SBAR	Questionnaire (pre and post) administered to care home and healthcare staff (with free text comments)– 1) nurse satisfaction with nurse-medical provider communication 2) medical provider perception of nurse/ medical provider communication 3) adherence to SBAR.	Nurse satisfaction with nurse-medical provider communication demonstrated improvement (not statistically significant) in the majority of questionnaire items. 87.5% of nurses (*n*=28) found SBAR helpful. 69% (*n*=22) found no limitations but 28% (*n*=9) found SBAR to be time-consuming. 5 out of 7 healthcare professionals reported that the quality of communication with LTCF staff (nurses) had improved post-SBAR implementation. 6 reported that nurses were consistently providing adequate information about residents who were deteriorating and that the information influences decision making about hospital transfer. 65 SBARs completed over a 3 month period. 78% (*n*=51) complete documentation, 22% (*n*=14) had missing documentation. SBAR was completed in a timely manner and only one resident change of condition lacked SBAR completion (98% compliance).	Implementation of SBAR 'suggests improvement in nurse satisfaction with communication.' Study findings support the use of SBAR to help address the issues of complete documentation and time constraints.

Table 1 (continued)

Author, publication year	Publication type	Country	LTCF type	Study type/ design – author reported (deduced if not stated)	Intervention, co-interventions	Outcomes reported	Key findings reported relevant to resident care	Author conclusions
Renz 2015 [32]	Peer-reviewed journal	USA	Skilled-nursing facility (*n*=1)	'Single-site repeated measures design, quality improvement'	SBAR	Quantitative– rate of hospital transfer, cost-benefit analysis.	SBARs completed for all unplanned hospital transfers - timeliness of the SBARs was 72% during the first month. In the 2nd to 3rd months, 90% completed in a timely manner, and 100% completion was sustained. The authors present a table entitled 'effect of SBAR implementation on hospital transfers,' and state that this shows that the 'total number of hospital transfers declined over the 'early period of SBAR implementation.' An overall reduction in avoidable hospital transfers (*n*=10) over a 4 month period. Avoidable hospital transfers remained constant across the 4 months of implementation (mean = 1.75 transfers per month). The number of 30-day hospital readmissions steadily declined over 4 months. Total project cost = $4,355.00 (including material costs, staff replacement, data analysis, and medical record review time) Potential cost savings (resulting from an overall reduction in avoidable hospital transfers (*n*=10) over a four month period) = $109,350 (based on an average cost of $10,935 for hospital admissions from nursing homes).	SBAR was completed thoroughly with timeliness and 'high-quality clinical data.' SBAR is a 'feasible method to provide structured communication between nurses and medical providers.' There is the potential for SBAR to positively influence decision-making to hospitalise residents. The interdisciplinary project 'can be implemented at low cost in any long-term facility.'
Jarboe 2015 [23]	Dissertation	USA	Skilled-nursing facility (*n*=1)	'Before and after'	(INTERACT) SBAR (Situation– Background– Action -Recommendation)	Quantitative– unplanned hospital transfer	Pre and post-SBAR implementation, there was no significant difference in overall resident transfers (p=0.482). There was no significant difference in the preventable transfers (p=0.927),'discretionary care' (p=0.547),'emergent' (p=0.565),'admitted to hospital' (p=0.662),'not admitted' (p=0.468) groups. However, there was a significant difference'futile care' group (p=0.041).	No significant decrease in unplanned hospital transfer.

Table 1 (continued)

Author, publication year	Publication type	Country	LTCF type	Study type/ design – author reported (deduced if not stated)	Intervention, co-interventions	Outcomes reported	Key findings reported relevant to resident care	Author conclusions
Ashcraft 2017 [30]	Peer-reviewed journal	USA	Nursing homes (n =2, 1 control + 1 intervention)	'Pre-post, quasi-experimental' (with a control and intervention nursing home)	Standard SBAR Customized SBARc using a 'formal process and guided by Sensemaking.'	Quantitative–nurse-clinician communication, resident transfer Qualitative– Two focus groups (n=5 control, n=7 in intervention)	Quantitative - Significant difference in the use of the SBARs versus the SBARc tool. - More frequent use of SBAR tools in the control site (x^2= 42, $p < 0.0001$). - Completion of SBAR (used as a measure of quality of communication) was greater at the control site (t =–0.50, p= 0.62). - 8.55% of reported communication events at the experimental site were recorded using SBARc, compared to 43% with SBAR at the control site. - Transfer rates between experimental and control sites similar (SBARc-7.53% versus SBARs-6.85%; X2 = 0.04, p = 0.84). Qualitative SBAR was not used consistently at either facility. Staff saw it as 'an expectation of management as well as institutional policy.' Reasons for non-use included, a) use of an alternate documentation location (e.g. transfer documents, '(b) faxing of notes to clinicians, (c) placement of notes on the chart, (d) phone calls already documented in physician orders, and (e) use of SBAR to document only acute change in resident status.' SBAR was perceived to help when resident deterioration meant they may require hospital transfer. When this happened, nurses used the SBAR form to directly record features of deterioration. Nurses felt they 'thought about problems in the SBAR format and did not need a form.'	The SBAR format did not influence nursing communication with healthcare professionals. SBAR customisation did not improve usage. SBAR usage alone was not significantly related to hospital transfer. There was a 'weak but significantly positive relationship' between completion of the recommendation or request sections of SBAR and the risk of resident hospital transfer. Communication about residents was 'best captured using multiple approaches, including SBAR, Prover Logs, and face-to-face meetings.'

Table 1 (continued)

Author, publication year	Publication type	Country	LTCF type	Study type/ design – author reported (deduced if not stated)	Intervention, co-interventions	Outcomes reported	Key findings reported relevant to resident care	Author conclusions
Devereaux 2016 [34]	Conference abstract	USA	Skilled nursing/ post-acute care facility (*n*=1, 139-bed)	'Quasi-experimental one group pre/post-Test' (before-after study)	Condition specific SBAR	Quantitative– 3 month pre/post implementation– total transfers, unplanned hospital admissions and 30-day readmissions.	3 months after implementation, it was observed that there was a significant reduction in rates of 1) total hospital transfers (0.44 vs. 0.24, $p<.001$), 2) all hospital unplanned admissions (0.36 vs.0.18, *p*-value unclear from the manuscript), 3) 30-day readmissions (0.12 vs. 0.04, $p=0.012$), 4) avoidable hospital transfers (0.26 vs. 0.09, $p<0.001$), 5) avoidable hospital admissions (0.15 vs. 0.05, $p=0.007$), 6) transfers due to pneumonia (0.52 vs. 0.17, $p=0.018$).	Using condition-specific SBARs as a deterioration tool reduced unplanned hospital transfers, hospitalisations, and 30-day readmissions. When these occurred, they were more likely to be unavoidable. Limitations of small sample and single facility study.
Owen 2019 [36]	Peer-reviewed journal	USA	Nursing home (*n*=1)	'Exploratory sequential mixed method with a pre/post quasi-experiment'	SBAR	Qualitative– Nurse and physicians	Six aspects of the communication process: (a) Nursing Knowledge and Information Presentation; (b) Focused Communication; (c) Sustaining Conversation; (d) Shared Meaning; (e) Event Resolution; and (f) Documentation Nurses perceived that SBAR helped communication with physicians, helping nurses to organise their thoughts prior to calling physicians and to provide the necessary information.	'Shared meaning and training in SBAR use as a means of communication (versus documentation) has the potential to provide for the development of stronger interventions with structured communication.'
Luna 2023 [40]	Peer-reviewed journal	USA	Nursing homes (*n*=2)	'Qualitative, descriptive study'	SBAR was a theme that emerged in this qualitative study that aimed to 'assess the different features of interprofessional nursing home relationships and communication between nurses and providers (e.g. physicians and nurse practitioners) to understand how they could impact unnecessary rehospitalisation decisions.'	Qualitative– two focus groups.	SBAR was one of the 5 main themes In the theme of 'interprofessional communication,' nurses were aware of SBAR but 'did not always reference it explicitly.' They viewed it as a routine tool for assessment of residents and communicating with healthcare providers external to the LTCF. They used SBAR when there was a change in a resident's condition. When providers and nurses use SBAR, there is increased shared understanding. Providers were less familiar with SBAR, emphasising vital signs, clinical examination and knowledge of the individual resident. They listened to the SBAR components, alongside and changes in resident condition from baseline reported by nurses.	SBAR was seen as facilitating 'timely and accurate communication,' but some nurses 'stated that they did not feel welcome to engage in the problem-solving process.' Trust and mutual respect enhanced the impact of tools like SBAR. SBAR is a way to facilitate communication between nurses and 'providers,' but it is not used consistently. Nurses may informally follow the components of SBAR, without using the exact structure.

Table 1 (continued)

Author, publication year	Publication type	Country	LTCF type	Study type/ design – author reported (deduced if not stated)	Intervention, co-interventions	Outcomes reported	Key findings reported relevant to resident care	Author conclusions
Barker 2019 [25]	Peer-reviewed journal	UK	Care homes (*n*=46)	'Cross-sectional study'	NEWS	Quantitative– Comparison of NEWS measured as a baseline measure and when carer concern.	A total of 19,604 NEWS analysed from 2,424 residents. Overall median NEWS = 2 (interquartile range (IQR) 3 and range 0–13) Median NEWS at baseline = 1 (IQR2 and range 0–12) Median NEWS if carer concern = 2 (IQR 4 and range 0–12). The proportion of low NEWS (0-2): 76% for routine measurements, 62% for carer concern. Intermediate category scores (NEWS 3–4): 18% for routine measures, 21% in the staff concern group. Overall, only 9% of NEWS measurements were in the high range (NEWS 5 or 6) and 4% critically high (NEWS ≥7). High and critically NEWS were more common in the staff concern group (11% high, 6% critically high), compared with the routine group (5% high, 2% critically high).	Measurement of NEWS in care homes appears to be feasible, and the majority of scores were not elevated at baseline. Scores were higher when there was carer concern (about a change in resident health status). The distribution of NEWS measurements was with other settings.
Stow 2021 [26]	Peer-reviewed journal	UK	Care homes (it was not possible to ascertain care home numbers– see key findings column)	'Ecological time-series study'	NEWS	Quantitative– Association between NEWS, and its components, and COVID-19 deaths	29 656 NEWS recordings across 46 local authority areas, 480 unique care home identifiers (representing an individual care home or a 'distinct unit' within a care home) 6,464 care homes residents with at least one NEWS. Between 23rd of March 2020 and 10th of May 2020: 5753 deaths (1532 involving COVID-19 and 4221 other causes). A rise in the proportion of above-baseline NEWS was observed for week beginning 16th of March 2020. This was 'followed 2 weeks later by an increase in registered deaths (cross-correlation of r=0.82, p<0.05 for a 2 week lag) in corresponding local authorities.''The proportion of above-baseline oxygen saturation, respiratory rate and temperature measurements also increased approximately 2 weeks before peaks in deaths.'	The authors stated that NEWS could 'contribute to COVID-19 disease surveillance' and asserted that 'oxygen saturation, respiratory rate and temperature could be prioritised as they appear to signal rise in mortality almost as well as NEWS.'

Table 1 (continued)

Author, publication year	Publication type	Country	LTCF type	Study type/ design – author reported (deduced if not stated)	Intervention, co-interventions	Outcomes reported	Key findings reported relevant to resident care	Author conclusions
Hodgson 2022 [21]	Peer-reviewed journal	UK	Care homes (*n*=4)	'Two-strand convergent parallel design' (mixed-methods)	National Early Warning Score (NEWS) digitally recorded on a Bluetooth device. Co-intervention: the digital device also recorded Barthel Index for Activities of Daily Living, and Rockwood frailty score.	Quantitative (276 residents, 4 care homes), admission rate. Qualitative– Care home staff experience of using NEWS.	Baseline NEWS was recorded. Following subsequent measures, 66.2% (*n* =233) of residents were 'referred to another service,' 73.4% (*n*=174) to their own GP, 81.0% (*n*=192). 9.91% (*n*=31) NEWS readings for 26 residents led to hospital admission (22 residents admitted hospital once, 3 residents twice, 1 resident three times) A 'statistically significant link between NEWS score and hospital admissions (chi-square=0.573, $p<0.0001$, Cramer's V=0.405)' was reported. Themes from qualitative interviews– NEWS as: 1/ measurements as "proof" 2/ efficient diagnosis 3/ empowering communication 4/ empowering role 5/ decision-making processes	NEWS benefits the care provided, has the ability to highlight the need for hospital admission, improves communication, and empowers staff.
Siriwardena 2024 [39]	Peer-reviewed journal	UK	Care homes (number not stated)	Retrospective cross-sectional study	NEWS2 (measured by ambulance staff)	Quantitative– emergency conveyance to hospital.	170,612 ambulance attendances to care homes over a 4 year period (2018 to 2021). A higher NEWS2 was associated with significantly increased conveyance to hospital (RRR 1.23, 95%CI 1.22–1.24, $p<0,001$)	Higher NEWS2 resulted in significantly increased emergency conveyance to hospital.
Voyer 2015 [37]	Peer-reviewed journal	Canada	Nursing home (*n*=1)	'Validation study'	RADAR– an acute delirium screening tool.	Quantitative– sub-group analysis for nursing home residents re: sensitivity and specificity Survey– Feasibility questions but no sub-group analysis specifically for care home residents	Sensitivity decreased for residents of nursing home residents, compared to other groups. The prevalence of delirium for nursing home resident was low so caution required when interpreting sensitivity and specificity. Residents (nursing home), (*n*=40) Sensitivity % [95% CI] = 100.0 [2.5-100.0] Specificity % [95% CI] = 43.6 [27.8-60.4] Positive, predictive value, % [95% CI] = 4.3 [0.1-21.9] Negative, predictive value, % [95% CI] = 100.0 [80.5-100.0] Data were presented separately for the nursing home compared to patients receiving acute hospital care.	The RADAR tool is effective and accepted by nursing staff, and is an option for delirium screening in nursing homes.

Table 1 (continued)

Author, publication year	Publication type	Country	LTCF type	Study type/ design – author reported (deduced if not stated)	Intervention, co-interventions	Outcomes reported	Key findings reported relevant to resident care	Author conclusions
Tingström 2015 [38]	Peer-reviewed journal	Sweden	Nursing homes (*n*=6)	(Validation study)	Early Detection Scale of Infection (EDIS)	Quantitative– relationship between the components of the EDIS for suspected infection, and the presence or absence of infection (determined by two physicians)	204 residents. Of 388 events of suspected infection, 49% were assessed as infection, 20% no infection and 31% as possible infection. EDIS instrument correctly predicted residents with 'no infection' and 'infection' in 67 and 84% of cases. However, it 'did not have precision' in predicting possible infection. Results also presented for the content validity of the 13 items of EDIS. Temperature, respiratory symptoms and 'general signs of symptoms of illness' were significantly related to infection.	In relation to the validation of EDIS, authors conclude that non-specific signs of deterioration ("general signs and symptoms of illness" and he/she is not as usual") made by LTCF staff (nursing assistants) should be given high importance in the LTCF population.
Hockman-McDowell 2018 [33]	Conference abstract	USA	LTCFs (*n*=2)	'Quality improvement, longitudinal study design'	Stop and Watch (from Interventions to Reduce Acute Care Transfers, INTERACT) Co-interventions– Nurse champions and staff education	Chart review 11 months pre-Stop and Watch and 3 months post (staff survey of skills acquired not included)	'Reporting patient change pre and post Stop and Watch statistically significant ($Z = -3.000$, $p = 0.003$).' Comparisons were made pre and post-Stop and Watch: - 'reduction of falls 90.4%.' - decreased falls with injury ($Z = -2.840$, $p = 0.005$) - 'paired samples t-test decreased falls, pre mean 0.7753 (SD 1.42) to post mean 0.0851 (SD 0.28)'– 'statistically and clinically significant ($t(93) = 4.610$, $p = 0.000$).' - 'positive correlation with statistical significance ER visits decreased ($n = 94$, correlation 0.308, p=.003)."	Stop and Watch INTERACT improved staff ability to report resident changes. Decreases in falls leading to injury and unplanned hospital transfer were observed.

Table 1 (continued)

Author, publication year	Publication type	Country	LTCF type	Study type/ design – author reported (deduced if not stated)	Intervention, co-interventions	Outcomes reported	Key findings reported relevant to resident care	Author conclusions
ElBestawi 2018 [43]	Peer-reviewed journal	Canada	Pilot site 1 - one long-term care facility (LTCF) Pilot site 2 - 4 LTCFs	'Pilot study' (mixed methods service evaluation)	Practical Routine Elder Variants Indicate Early Warning for Emergency Department (PREVIEW-ED)– focusing specifically on pneumonia, urinary tract infection, congestive heart failure and dehydration.	Quantitative– including rate of 'tool-sensitive transfers.' Feedback from LTCF staff and healthcare professionals.	Pilot site 1 (P1), one facility, *n*=66 Pilot (P2), four facilities, *n*=176 >> Decrease in tool- sensitive transfers P1 = 57% P2 = 71% >> Tool completion rate P1 = 95.5% P2 = 94% >> Average time to complete tool per resident P1 = 8-15 seconds P2 = 10 seconds >> Average number of residents triggering tool/week P1 = 1 in 10 P2 = 1 in 20 >> Number of residents triggering the tool at least once P1 = 53% P3 = 37% Feedback (outside of a qualitative interview): >> LTCF staff feedback was positive: 1/ Staff feeling more valued, and having a 'voice.' 2/ Helps LTCF to judge when discussion with healthcare providers is necessary. >> Physicians perceived that PREVIEW-ED gave staff a better 'grasp' of the deterioration scenario, but did not increase the number of calls to healthcare providers. >> Management staff described enhancing communication with families. >> Unintended benefits, 1/ helps for deteriorations due to other causes e.g. in an Influenza outbreak, 2/ more time for staff to inform families of a dying trajectory >> The 'amount of paper generated,' as the tool was completed daily, was highlighted as a drawback.	The deterioration tool has had a positive impact in reducing hospital transfers (for the four specific conditions). The authors suggest that this is likely to improve quality of life. A provisional economic evaluation suggests potential benefit.

Table 1 (continued)

Author, publication year	Publication type	Country	LTCF type	Study type/ design – author reported (deduced if not stated)	Intervention, co-interventions	Outcomes reported	Key findings reported relevant to resident care	Author conclusions
Teale 2018 [35]	Peer-reviewed journal	UK	Residential and nursing care homes (*n*=9)	'Prospective observational study'	Delirium Observational Screening Scale (DOSS)	Quantitative– diagnostic test accuracy and test–retest reliability of the DOSS to detect delirium (as part of routine care) in LTCFs.	216 residents participated. Half of the expected number of DOSS assessments occurred (30,201), out of which 11,659 (39%) were complete. 'A cut point of 5 or more on the DOSS maximised sensitivity (0.61 95% CI: 0.39–0.80) and specificity (0.71 95% CI: 0.70–0.73); area under the ROC was 0.66 (95% confidence interval 0.58–0.80).' Inter-rater reliability 'good' (ICC = 0.71, 95% CI: 0.61–0.78). Positive and negative predictive values 1.6 and 99.5% respectively.	Routine administration of the DOSS by care home staff was feasible. The 25-item DOSS has low sensitivity, limiting its clinical utility, but 'acceptable' specificity for delirium detection in care homes.
Little 2019 [28]	Peer-reviewed journal	UK	Care home, residential facility) (*n*=1)	'Quality improvement project' (before-after study)	Significant 7 early warning tool Co-intervention - training programme about deterioration recognition. Training sessions used the PDSA (plan, do, study, act) cycle.	Survey - Staff confidence Quantitative - Falls incidence Pressure ulcer incidence	Staff questionnaire at three time points: 12 reported using Significant 7 daily, 3 at least weekly. 22 residents participated. Falls frequency before and after intervention. The authors presented graphs showing the incidence of pressure sores and falls per week, at different points within the implementation / PDSA cycle.	Tool introduction resulted in positive benefits for staff and residents. Following Significant 7 introduction, there was a reduction in pressure ulcer and falls frequency. Staff reported increased confidence in responding to resident deterioration.

Table 1 (continued)

Author, publication year	Publication type	Country	LTCF type	Study type/ design – author reported (deduced if not stated)	Intervention, co-interventions	Outcomes reported	Key findings reported relevant to resident care	Author conclusions
Tingstrom 2023 [42]	Peer-reviewed journal	Sweden Nursing home (n=1)– different cohort than in Tingström et al. 2015[22]		'Longitudinal cohort exploratory design'	Early Detection Scale of Infection (EDIS), composed of 12 domains.	Quantitative– outcome = infection verified by GP +/- c-reactive protein. Factor analysis and logistic regression.	45 residents– 15 diagnosed with infection, 31 experienced 72 events of suspected infection. 189 observations were recorded from these events. Factor analysis 1: five components ('change on cognitive/physical function,''general signs of symptoms of illness,''increased tenderness,' 'change in expression/food intake,''change in emotions') explained 61% of the of the variance. Factor analysis 2, included dichotomous variable of temperature >1.0 °C from baseline temperature: five components ('change in physical function/food intake,''confusion/ signs and symptoms from respiratory/urinary tract,''general signs/symptoms of illness and fever,''increased tenderness,' and 'change in emotions') explained 59% of the variance. From 72 episodes of suspected infection, 2 logistic regressions using the components from the 2 factor analyses conducted (infection the primary outcome): - Multivariate logistic regression 1: statistically significant as a model (p=0.032), with 2 components statistically significantly associated with infection– 'increased tenderness' (p=0.008) and 'change in eye expression and food intake' (p=0.008). - Multivariate logistic regression 1: overall p-value was not statistically significant (p=0.109) but 3 components were statistically significantly associated with infection– 'change in physical function and food intake' (p=0.022), 'general signs and symptoms of illness and fever' (p=0.018), and 'increased tenderness ($p > 0.012$).	The EDIS tool has the potential to aid first-line caregivers to assess health deteriorations, helps to standardise communication and ensure that decisions are 'not being taken at the wrong level.' The purpose of EDIS is to act as a decision support tool, to 'facilitate the step before diagnosis,' not to determine medical treatment. Fever of >1.0°C (higher than baseline temperature for the individual) is a valuable parameter to add into the EDIS tool.

Table 2 Summary table (*unplanned hospital attendance incorporates ED attendance and hospital admission)

Publication author, year	Peer-reviewed publication	Deterioration tool				Co-interventions	Quantitative outcomes (unplanned emergency hospital attendance*)	Data from qualitative interviews		Implementation challenges described	Authors conclude potential benefit
		National Early warning score	SBAR	STOP AND WATCH	Other			LTCF staff perspective	Healthcare staff perspective		
O'Neill 2017 [41]	X		X		X	X		X		X	X
Russell 2020 [22]	X	X	X					X	X	X	X
Sampson 2020 [45]	X		X	X		X	X			X	
Stocker 2021 [17]	X	X	X			X		X	X	X	X
Porter 2021 [29]	X		X	X	X	X	X (X)				X
Montgomery 2023 [24]	X		X		X		X				X
Basinska 2022 [27]	X		X	X	X	X	X	X		X	X
Nwolise 2024 [44]	X	X	X		X		X	X		X	X
Renz 2013 [31]	X		X				X				X
Renz 2015 [32]	X		X				X (X)			X	X
Jarboe 2015 [23]			X				X (X)				
Ashcraft 2017 [30]	X		X				X (X)	X		X	X
Devereaux 2016 [34]			X				X (X)				X
Owen 2019 [36]	X		X					X	X		X
Luna 2023 [40]	X		X					X	X	X	X
Barker 2019 [25]	X	X					X				X
Stow 2021 [26]	X	X					X				X
Hodgson 2022 [21]	X	X				X	X (X)	X			X
Siriwardena 2024 [39]	X	X					X (X)				
Voyer 2015 [37]	X				X		X				X
Tingstrom 2015 [38]	X				X		X				X
Hockman-McDowell 2018 [33]				X			X (X)				X
ElBestawi 2018 [43]	X				X		X			X	X
Teale 2018 [35]	X				X		X				
Little 2019 [28]	X				X	X	X				X
Tingstrom 2023 [42]	X				X		X				X

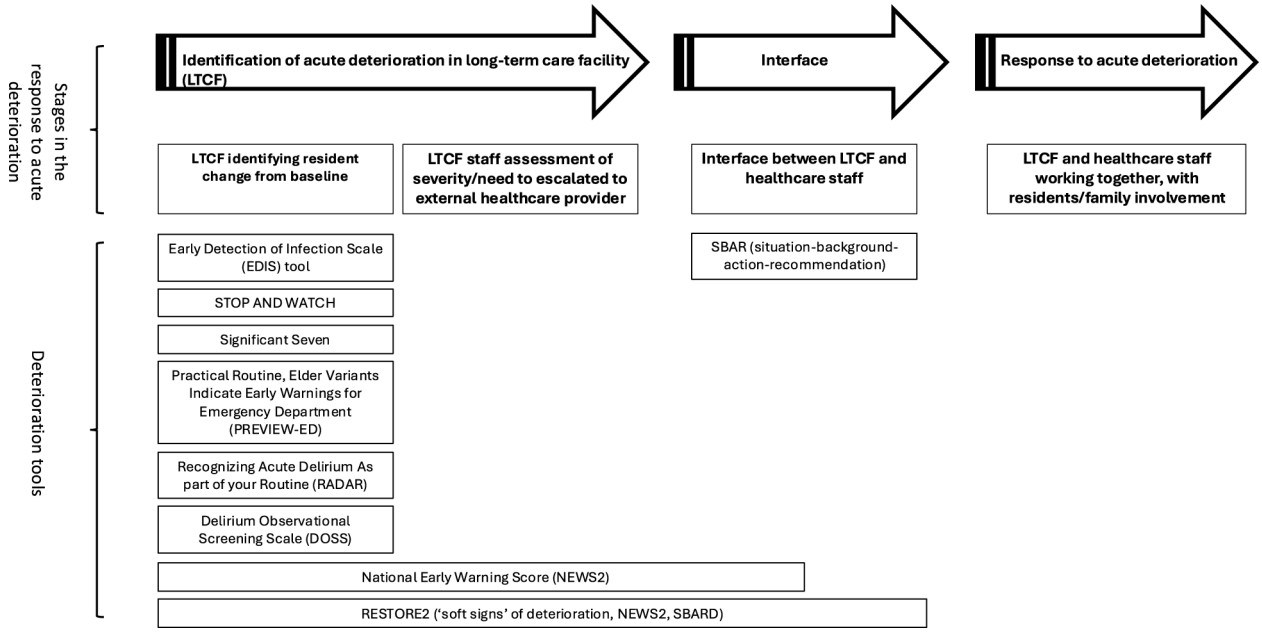

Fig. 2 The process of responding to acute deterioration and at which stage deterioration tools are intended to act

Take Observations, Respond, Escalate) [44] is a composite deterioration tool, incorporating the 1) 'soft signs' of deterioration (informal observation by care staff about a deterioration in resident health, 2) NEWS2, 3) SBARD (situation-background-assessment-recommendation-decision).

All but five [29, 34, 38, 42, 43] studies described a tool intended to assess all causes of acute deterioration– three studies focused on infection/sepsis identification [29, 38, 42] and two studies on specific 'conditions' [34, 43] resulting in deterioration. Two tools specifically aim to assist LTCF staff in identifying signs of acute delirium, which is an important sign of acute deterioration in older adults [49] - the Delirium Observational Screening Scale (DOSS) [35], and Recognizing Acute Delirium As Part Of Your Routine [RADAR] [37].

The main point at which the deterioration tools are intended to act in the process of responding to acute resident deterioration tool is shown in Fig. 2. The majority of tools aim to assist LTCF staff to detect early signs of acute deterioration, which may be subtle. NEWS2 also aims to assist LTCF staff in assessing illness severity, and to act as a 'common language' [16] when communicating concerns with healthcare staff. SBAR, the most frequently used tool, is the only deterioration tool that is designed specifically to facilitate the exchange of information between LTCF and healthcare staff. RESTORE2 [44], as a composite deterioration tool, aims to act across multiple stages of the process. None of the deterioration tools identified were designed to be used jointly by healthcare and LTCF staff to respond to acute deterioration.

How deterioration tools have been evaluated

The majority of studies ($n = 21$) used quantitative outcomes [21, 23–35, 37–39, 42–45] to evaluate deterioration tool use, with nine studies using qualitative outcomes [17, 21, 22, 27, 30, 36, 40, 41, 44] (excluding surveys with free-text responses [31] or feedback outside of a formal qualitative interview [43]. Only four studies [21, 27, 30, 44] used a combination of these outcomes. There was a high degree of heterogeneity in quantitative outcomes measured; unplanned hospital attendance was the commonest outcome measured [21, 23, 29, 30, 34, 35, 39, 43] ($n = 8$). Only three studies aimed to collect economic evaluation data [32, 43, 45]. The most frequent source of qualitative data was from LTCF staff [17, 21, 22, 30, 36, 40, 41, 44], with only four studies collecting data from healthcare staff in separate qualitative interviews [17, 22, 36, 40]. None of the studies assessed the impact of deterioration tools on residents' (or relatives') experience of being acutely unwell. Only one study attempted to collect quality of life data, but there was insufficient uptake of the intervention (incorporating STOP AND WATCH and SBAR tools) [45] to assess impact.

Reported impact of deterioration tools

All but four [23, 27, 35, 45] of the included studies reported or concluded potential benefit from deterioration tool use. The most frequently reported benefit was increased staff confidence in managing acute deterioration [17, 21, 22, 24, 27, 28, 41, 44], including aiding communication about acute illness [17, 21, 22, 31, 36, 40, 44]. None of the papers reported significant negative impacts of tool use on LTCF care. However, implementation

challenges of deterioration tools were highlighted in a significant proportion of studies in which qualitative data were collected ($n = 10$) [17, 22, 27, 30, 32, 40, 41, 43–45]. Important examples included deficiencies in the training on deterioration tools, staffing shortages in LTCFs, and the carer time required to use deterioration tools. Most notably, one paper described the abandonment of a cluster randomised study as no LTCFs (UK care homes in this case) adopted the complex intervention (incorporating two deterioration tools), which was aiming to decrease avoidable hospitalisation [45].

Discussion

This review demonstrated that a variety of deterioration tools are being implemented in LTCFs, across a wide range of health and social care systems worldwide. Important gaps in the evidence base have been identified, limiting the assertions that can be made about deterioration tool use in this setting.

The most widely used deterioration tools are based on interventions transferred from the hospital setting, such as SBAR and NEWS, whilst others have been designed for use in LTCFs, such as STOP AND WATCH and the EDIS tool. It is commonplace for deterioration tools to be used in conjunction with one another, other co-interventions, or as part of wider programmes of care, as described in a previous review [15]. This limits the reliability of assertions that can be made about the specific impact of individual tools.

This review identifies SBAR as the most frequently used deterioration tool in LTCFs. SBAR, generally categorised as a deterioration tool, aims to structure communication between health and care providers. Hence, it is often used in conjunction with another tool. In the hospital setting, there is an established evidence base showing that SBAR improves communication between healthcare providers and improves patient safety [50]. The same assertions could not be made for the LTCF setting on the basis of evidence in this review.

The overriding majority of studies reported or concluded potential positive impact of deterioration tool use in LTCFs, offering evidence that deterioration tools are generally acceptable by LTCFs teams, and can increase confidence in responding to acute deterioration. There is some evidence to suggest that LTCF staff perceive that deterioration tools, especially SBAR, aid communication with external healthcare professionals. However, there was insufficient evidence to know if this matches the perspective of healthcare staff. Some studies suggested that deterioration tools may be associated with decreases in unplanned hospital transfer (but without assessment of appropriateness), but these studies did not have robust study designs, and were conducted across small numbers of LTCFs.

Although it was not within the specific aims of our scoping review (or the individual studies retrieved), the implementation challenges associated with deterioration tools were frequently described. The competing demands on care home staff are an important barrier to implementation. Failure to address implementation challenges in future work may result in inconsistent uptake of deterioration tools in LTCFs.

Comparison with other work

Although there is a paucity of evidence about managing acute deterioration in care homes, our review builds on the findings of other studies [15, 18], and supports the assertion that this is a complex topic area. Our findings align with a previously published scoping reviewing showing that deterioration tools have frequently been evaluated as part of a multi-faceted model of care in Residential Aged Care settings [15]. This creates challenges in understanding the individual effects of the components of such interventions – the "black box effect" [51].

Limitations

This review has identified important gaps in the evidence base, meaning that there is not sufficiently strong evidence to support the use deterioration tools in LTCFs. Most notably, the impact on the wellbeing and quality of life for residents has not been evaluated, meaning that there is insufficient evidence to know if tools improve resident care outcomes. The impact on community healthcare and emergency services is also unknown. Despite most authors concluding the positive impact of deterioration tools, especially LTCF staff confidence in managing acute illness, it is not known if deterioration tools facilitate staff and healthcare professionals to deliver proactive care, according to resident wishes. Within the body of evidence, there was insufficient information to understand the potential unintended consequences of deterioration tool use, such as the time taken for LTCF carers to use these tools [52].

The study designs that make up the body of evidence also limit the strength of the conclusions that can be drawn. Quality appraisal was not undertaken given the scoping nature of this work, but studies were low on the Hierarchy of Evidence. The majority of studies were conducted at a small number of LTCFs, with nearly half of included studies being single-site. This is a key deficit in the evidence base given the unique context of individual care facilities, and the potential implementation challenges that the studies in this review highlight. Studies in the current evidence synthesis did not have sufficiently long follow-up timeframes to know if deterioration tool uptake is sustainable in the longer term. Furthermore, the body of literature for deterioration tool use in LTCFs has a high degree of heterogeneity; studies have employed a

wide range of methodologies, and there is little consistency in the outcomes used to evaluate the impact of tool use.

Grey literature searching did not identify any deterioration tools which had not already been identified during database searching. However, grey literature searching was confined to known relevant sources, as opposed to a wider searching strategy. In addition, four studies published by members of the authorship team were identified, relating to the use of NEWS in the same region of England.

Implications

The gaps in the evidence base mean that no specific tool has been shown to improve resident care, but tools that support carer judgement about acute deterioration should be encouraged. There is evidence that LTCF staff find SBAR acceptable and its use intuitive, so this should be prioritised for future development and evaluation. The overriding majority of tools used in the retrieved studies aim to assist carers in identifying the subtle signs of deterioration and/or communicate these concerns to healthcare professionals (using the SBAR tool). Future tool development should focus on helping LTCF staff to assess illness severity and to judge how/when to escalate their concerns to external healthcare providers.

Further research is required to explore the experiences of acute deterioration for residents living in LTCFs, to measure the impact of tools on resident experience/health outcomes and to understand if deterioration tools align with their priorities of care. Further studies that explore the perspectives of healthcare professionals of interacting with LTCFs to manage acute deterioration are also required.

Implementation challenges and inconsistent deterioration tool uptake, both across LTCFs and within individual facilities, is a challenge to be considered in future work. There are important differences in staff skillset across different LTCFs in different settings. To ensure the adoption, implementation, and long-term effectiveness of tools, the unique context of individual LTCFs must be appreciated, and tools are required to be adaptable to the needs of individual LTCFs and the healthcare services they interact with. Tools transferred from the hospital setting should be adapted to the LTCF setting. Implementation theory and frameworks would help to ensure successful adoption of tools in LTCFs, and to ensure that the uptake is not inconsistent across the LTCF sector.

This review makes an important contribution to the evidence base about managing acute deterioration, and specifically about the use of deterioration tools and how they have been evaluated. This is an important step in helping to ensure that the potential spread of deterioration tools is grounded in evidence-based good practice, by informing a future systematic review or studies of effectiveness. The benchmark for investigating the effectiveness of deterioration tools would be randomised study designs that allow tools to be compared to standard care. However, given the challenges of this approach in LTCFs and the accelerated introduction of deterioration tools in this sector, 'natural experiments' [53] may be a suitable approach.

Conclusion

This scoping review has identified emerging evidence that deterioration tools may have a role in assisting staff in LTCFs to identifying acute deterioration. Important evidence gaps, and limitations in the nature of the evidence base, mean that direct benefits for resident care have not been demonstrated. Despite strong policy drivers advocating the use of deterioration tools in LTCFs, there is not currently robust evidence to support the use of deterioration tools in LTCFs. This should be a focus for future research.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12913-025-12534-x.

Supplementary Material 1.

Authors' contributions

All authors confirm that they have no conflicts of interest and meet criteria for authorship as stated in the Uniform Requirements for Manuscripts Submitted to Biomedical Journals. • Study concept and design: Barker, Hanratty, Craig. • Search strategy: Barker, Easthaugh, Wallace. • Study selection: Barker, Hanratty, Searle. • Data analysis: Barker. • Drafting of the manuscript: Barker.• Critical revision of the manuscript: Barker, Hanratty, Easthaugh, Wallace, Searle, Craig.

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Data availability

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

This study was approved by a University Faculty of Medical Sciences Research Ethics Committee.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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EDITORIAL

COVID-19 testing during care home outbreaks: the more the better?

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Key Points

- More than a year into the pandemic, COVID-19 testing remains of vital importance in care homes.
- When to initiate mass testing and robust infection prevention/control measures for suspected care home outbreaks is not clear.
- Earlier triggering of rigorous outbreak control measures could benefit residents and staff, but creates opportunity costs.
- Failure to engage care homes in policy development can generate a mismatch between guidance and what is feasible.
- Without a system-wide approach to support care homes, more rigorous outbreak control measures may be a burden on staff and residents.

COVID-19 testing has been an important focus of the pandemic response in care homes. In a recent issue of Age and Ageing, Tang *et al*. [1] advocate mass testing following a single suspected or confirmed case of COVID-19 infection amongst residents, staff or visitors, in conjunction with robust infection prevention and control (IPC) measures, as a means to mitigate further COVID-19 transmission in UK care homes. Current UK policy considers that two or more positive or suspected cases of COVID-19 (within 14 days of one another) amongst residents or staff are required to constitute an outbreak [2]. In response, care homes are advised to contact the local Health Protection Team; polymerase chain reaction testing is required for residents and staff on day 1 of the outbreak, to be repeated between days 4 and 7 for those with an initial negative result [2]. A policy change to the triggering of rigorous outbreak control measures after one suspected or confirmed case would escalate the testing intensity for residents and staff.

Intensive testing regimens to identify COVID-19 outbreaks promptly could have an important public health role, benefiting care home residents and staff. Earlier triggering of rigorous COVID-19 testing protocols would give homes more time to respond. Anticipating workforce pressures, 'zoning' of COVID-19 positive residents in particular parts of the care home to minimise transmission and discussing advance care plans with residents and relatives all take time. Care home staff could be better placed to monitor COVID-19 positive residents closely for signs of deterioration.

Tang *et al*. [1] suggest that by the time the first resident is suspected of having COVID-19 or tests positive, the virus is already spreading silently within the care home. Even at this point, a high proportion of residents and staff are likely to have been exposed, and a surge of positive results may be inevitable. The authors propose that the mass testing of residents and staff after only one suspected or confirmed COVID-19 infection could help to minimise the impact of an outbreak [1]. However, even at this stage, the chance to prevent a significant outbreak may have been missed. An outbreak may be inevitable regardless of mass testing or enhanced IPC measures.

COVID-19 outbreaks in care homes can escalate rapidly. Soon after the first suspected or confirmed infection, care

home teams can find themselves facing a depleted workforce due to large numbers of staff obliged to self-isolate. At the same time, staff are caring for a high number of acutely deteriorating residents, as they are susceptible to severe COVID-19 disease [3, 4], and frequently require end-of-life care [5]. Mass testing and enhanced IPCs during an outbreak could put an impossible burden on care homes.

Tang *et al*. [1] argue that robust IPC measures during an outbreak could play an important role in mitigating further COVID-19 transmission. However, it is unclear how effectively such measures can be implemented in the care home sector, with homes varying in size, layout and resident population. For example, residents with dementia may 'wander with purpose,' making strict infection control measures, such as isolation and 'zoning,' impractical and ineffective [6].

For a policy of rigorous testing protocols at the early stages of a suspected outbreak to be effective, outbreak control measures need to be feasible for care home teams. The low levels of adherence to routine staff testing and the associated burden [7] may be magnified for residents. The practical reasons resulting in two out of four care homes not completing follow-up testing for residents in the study by Tang *et al*. [1] are not known. Residents may be resistive to testing and distressed by the process [6]. The time taken for carers to perform mass testing on residents and themselves [6] is also an important opportunity cost to mass testing.

The toll of the COVID-19 pandemic on care home residents, their families and staff has been immeasurable [5, 8]. The earlier triggering of rigorous outbreak protocols may result in unnecessary alarm and anxiety for residents and staff and lead to further visiting restrictions, which have already had a detrimental impact on the wellbeing of residents, families and staff during the pandemic.

During the early stages of the pandemic, guidance for care homes on COVID-19 outbreak management and the absence of widespread testing for residents and staff was an important problem [5, 8]. A coherent strategy to COVID-19 outbreaks in care homes could have made the difference between rapid, effective responses that are tailored to residents and staff, and the high rates of infection and mortality amongst residents that have been the hallmark of the pandemic.

More than a year into the pandemic, COVID-19 guidelines continue to evolve rapidly and the landscape of outbreak control, testing and IPC is changing with the widespread vaccination of residents and staff, lower COVID-19 incidence but emerging novel variants. Unfortunately, there is ongoing concern within the care home sector about the extent to which care home providers and senior staff are engaged with the development of such guidelines. This results in a mismatch between what is written in the guidance and what is feasible for care homes teams. Policies to date place excessive onus on care homes to implement their own policies and procedures for managing evolving COVID-19 outbreaks without additional support or financial resource. This leaves care providers with uncertainties [9] and a feeling of vulnerability to external scrutiny.

There is an important role for mass testing and IPCs as COVID-19 outbreak control measures, highlighted by Tang *et al* [1]. However, without political will, resources and a system-wide approach to supporting care homes to meet increased demands, advocating more extensive testing and IPC measures is unlikely to achieve the public health aims. It may even compound the distress already experienced by staff and residents. Going forward, care homes are searching for ways to live with COVID-19. It is more important than ever that policies place care homes at the centre of any changes, and interventions are consistent with the priorities of people who live and work in care homes.

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SUBMISSION BY STAFF CANDIDATES FOR THE DEGREE OF PHD BY PUBLISHED WORK

CO-AUTHORSHIP FORM

This form must accompany any submission of a joint authored publication for the degree of Doctor of Philosophy on the basis of published work.

A candidate should submit a separate form for each jointly authored work which is submitted for the degree.

TITLE OF PUBLICATION (article, book, chapter, monograph)

Changes in health and functioning of care home residents over two decades: what can we learn from population-based studies?

DATE OF PUBLICATION

May 2021

NAME AND VOLUME OF JOURNAL (where appropriate)

Age Ageing. 2021;50(3):921-927

PUBLISHER (for book, chapter or monograph)
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EDITORS (chapter only)
N/A

ISBN (where appropriate)

If the work has not been published but has been accepted for publication please attach a statement from the Editor or Publisher which confirms the intention to publish the work.

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4. Dr Sheena Ramsay / Newcastle University

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CONTRIBUTION OF THE CANDIDATE TO THIS WORK (%)

Design of investigation	60%	
Conduct of research	75%	
Analysis of outcome	70%	
Preparation for publication	85%	
TOTAL	70%	*(To be an average of, or at least consistent with, the above figures)*

This statement should be endorsed by all of the co-authors.

I confirm that the above is a true estimate of the candidate's contribution to this work.

Signature 1  2nd April 2025

Signature 2  2nd April 2025

Signature 3  2nd April, 2025

Signature 4  14th April 2025

SUBMISSION BY STAFF CANDIDATES FOR THE DEGREE OF PHD BY PUBLISHED WORK

CO-AUTHORSHIP FORM

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TITLE OF PUBLICATION (article, book, chapter, monograph)

Future-proofing the primary care workforce: A qualitative study of home visits by emergency care practitioners in the UK

DATE OF PUBLICATION

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ISBN (where appropriate)

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Design of investigation	70%	
Conduct of research	25%	
Analysis of outcome	40%	
Preparation for publication	60%	
TOTAL	50%	*(To be an average of, or at least consistent with, the above figures)*

This statement should be endorsed by all of the co-authors.

I confirm that the above is a true estimate of the candidate's contribution to this work.

Signature 1  9th April 2025

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Signature 3  2nd April 2025

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TITLE OF PUBLICATION (article, book, chapter, monograph)

Experiences of a National Early Warning Score (NEWS) intervention in care homes during the COVID-19 pandemic: a qualitative interview study

DATE OF PUBLICATION

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ISBN (where appropriate)

If the work has not been published but has been accepted for publication please attach a statement from the Editor or Publisher which confirms the intention to publish the work.

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Design of investigation	40%	
Conduct of research	10%	
Analysis of outcome	30%	
Preparation for publication	25%	
TOTAL	30%	*(To be an average of, or at least consistent with, the above figures)*

This statement should be endorsed by all of the co-authors.

I confirm that the above is a true estimate of the candidate's contribution to this work.

Signature 1  2nd April 2025

Signature 2  2nd April 2025

Signature 3  9th April, 2025

Signature 4  15th April 2025

Signature 5  15th April 2025

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TITLE OF PUBLICATION (article, book, chapter, monograph)

National Early Warning Scores and COVID-19 deaths in care homes: an ecological time-series study

DATE OF PUBLICATION

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Design of investigation	30%	
Conduct of research	25%	
Analysis of outcome	30%	
Preparation for publication	25%	
TOTAL	25%	*(To be an average of, or at least consistent with, the above figures)*

This statement should be endorsed by all of the co-authors.

I confirm that the above is a true estimate of the candidate's contribution to this work.

Signature 1  2nd April 2025

Signature 2  2nd April 2025

Signature 3  2nd April 2025

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TITLE OF PUBLICATION (article, book, chapter, monograph)

National Early Warning Scores Following Emergency Hospital Transfer: Implications for Care Home Residents

DATE OF PUBLICATION

May 2023

NAME AND VOLUME OF JOURNAL (where appropriate)

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ISBN (where appropriate)

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Design of investigation	70%	
Conduct of research	85%	
Analysis of outcome	80%	
Preparation for publication	90%	
TOTAL	85%	*(To be an average of, or at least consistent with, the above figures)*

This statement should be endorsed by all of the co-authors.

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Signature 3  Professor Barbara Hanratty, 2nd April 2025

Signature 4  Professor Daniel Lasserson, 2nd April 2025

SUBMISSION BY STAFF CANDIDATES FOR THE DEGREE OF PHD BY PUBLISHED WORK

CO-AUTHORSHIP FORM

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A candidate should submit a separate form for each jointly authored work which is submitted for the degree.

TITLE OF PUBLICATION (article, book, chapter, monograph)

Which acute deterioration tools are used in long-term care facilities and how have they been evaluated? A scoping review

DATE OF PUBLICATION

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ISBN (where appropriate)

If the work has not been published but has been accepted for publication please attach a statement from the Editor or Publisher which confirms the intention to publish the work.

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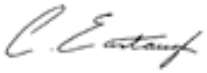
CONTRIBUTION OF THE CANDIDATE TO THIS WORK (%)

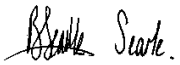
Design of investigation	75%	
Conduct of research	80%	
Analysis of outcome	85%	
Preparation for publication	90%	
TOTAL	85%	*(To be an average of, or at least consistent with, the above figures)*

This statement should be endorsed by all of the co-authors.

I confirm that the above is a true estimate of the candidate's contribution to this work.

Signature 1  9th April 2025

Signature 2  10th April 2025

Signature 3  10th April 2025

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TITLE OF PUBLICATION (article, book, chapter, monograph)

COVID-19 testing during care home outbreaks: the more the better?

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Design of investigation	85%	
Conduct of research	90%	
Analysis of outcome	80%	
Preparation for publication	85%	
TOTAL	85%	*(To be an average of, or at least consistent with, the above figures)*

This statement should be endorsed by all of the co-authors.

I confirm that the above is a true estimate of the candidate's contribution to this work.

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