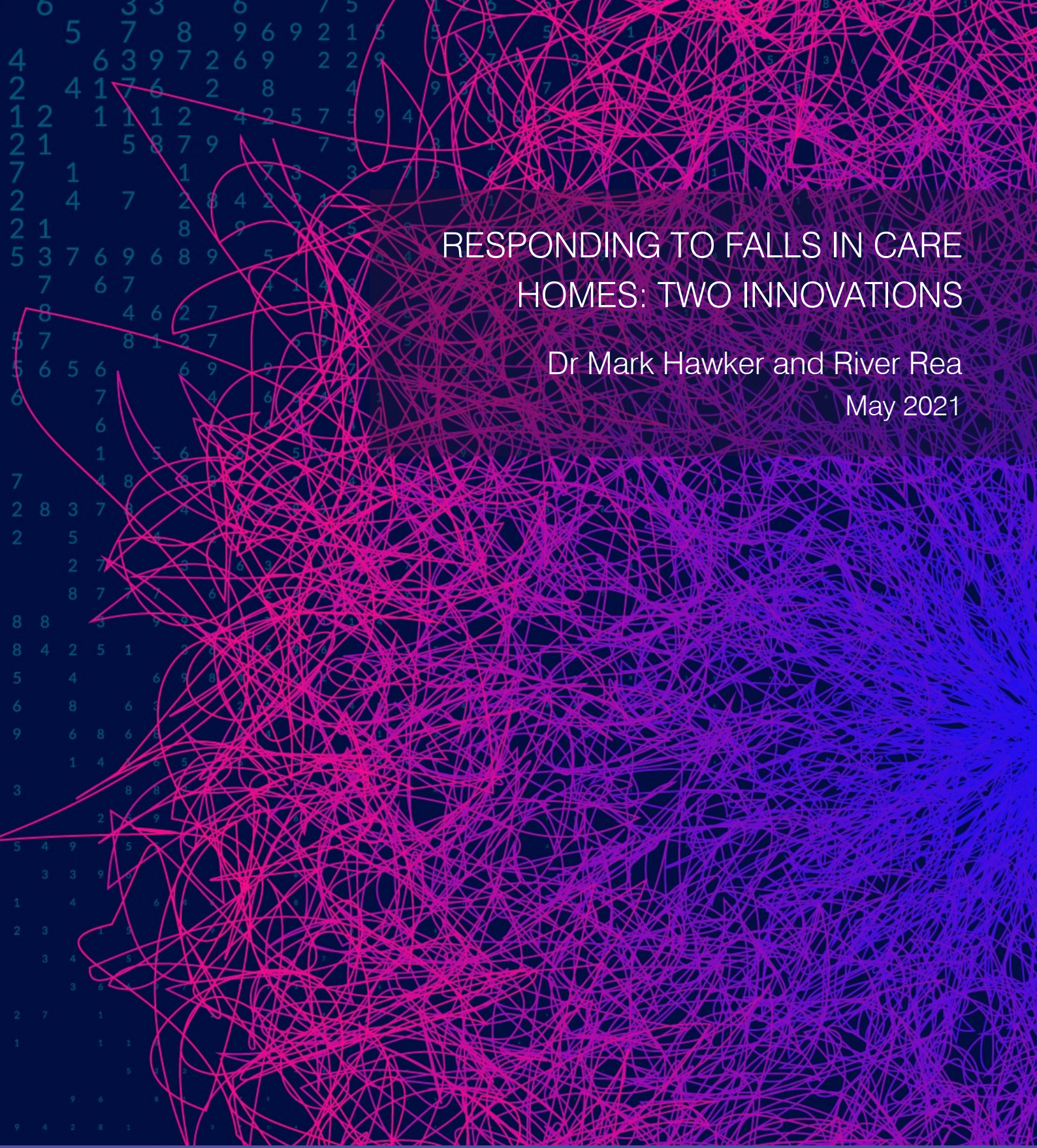

RESPONDING TO FALLS IN CARE HOMES: TWO INNOVATIONS

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RESEARCH REPORT

involve™

Responding to falls in care homes: two innovations

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Authorship

Our team

Dr Mark Hawker, Business Intelligence Lead at Involve, provided strategic insight and led the writing of the report. Mark has been at Involve since August 2020, having worked in the NHS for over four years. He completed his PhD in 2016 from the University of Sheffield, UK, which focused on developing an interactionist framework for understanding how health and care technologies are accepted, rejected and used by older people and stroke survivors.

River Rea, Research Consultant, provided valuable analysis and insight, and supported the writing of the report. River is studying for a PhD in brain structure and function in people living with Parkinson's disease.

David Butler (National Commissioning and Development Lead at Immedicare) and Mick Roach (Director of Strategic Health Alliances at Involve) provided content knowledge and critique.

Amy Redfearn (Digital Marketing Manager at Involve) provided presentation insight and support.

Potential conflicts of interest

Involve are one of the largest and most experienced technology providers to the NHS and private healthcare sector in the UK. As part of its portfolio of services, Involve partner with Airedale NHS Foundation Trust in a joint venture called Immedicare. Our organisations have been working together for over a decade and have been instrumental in both the service development and the success of several innovative telemedicine-based clinical services across the UK. With our experience of working with both public and private sector organisations, delivering our services into environments such as prisons, secure mental health facilities and, since 2012, nursing and residential care homes, we have gained extensive knowledge that has helped us to understand exactly what it takes to deliver a successful video-enabled clinical project for organisations and their patients, wherever they may be.

Summary of terms used in this report

Care home is used to refer to any organisation whose services are registered by the Care Quality Commission (CQC) with nursing (CHN) or without nursing (CHS).

Falls are defined as "an event whereby an individual comes to rest on the ground or another lower level with or without loss of consciousness" (American Geriatrics Society, British Geriatrics Society and American Academy of Orthopaedic Surgeons Panel on Falls Prevention, 2001).

Resident is used as shorthand for those living in a care home.

Telemedicine is used to describe a health or social care service delivered remotely via a video-enabled device such as a laptop computer.

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Acknowledgements

The authors would like to thank representatives at Immedicare and Mangar Health for providing them with access to activity and impact data that enabled us to develop case studies of their innovations. Without their data, it would not have been possible to compile our report.

We would also like to thank the wider team at Involve for providing some valuable insights into the contents and structure of this report, which was welcomed throughout the writing process.

Aim and objectives

The aim of this report is to share analysis of data related to the activity and impact of two post-fall innovations used in care homes.

The objectives of this report are to:

1. Synthesise the evidence from publications on falls in care homes
2. Present case studies of post-fall innovations used in care homes
3. Consider the future development and deployment of post-fall innovations in care homes.

Initial ideas for future analysis are shared in the report but we welcome thoughts from readers of this report on any subsequent analyses they think would add value.

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Using this report

Use of 'flawed, uncertain, proximate and sparse' (FUPS) data

There is growing interest in the possibilities posed by the analysis of routinely collected administrative data for the assessment and improvement of health and social care services (Coulter et al., 2014; Raghupathi and Raghupathi, 2014, McIntosh et al., 2016). While there has been debate about the challenges of finding the best metrics to use, or which analyses are the most appropriate (Lilford et al., 2004; Black, 2010), the academic literature is generally premised on an assumption to use high-quality, routinely collected data as a requirement.

The reality is that routinely collected datasets are often of low quality. Data is frequently flawed, uncertain, proximate and sparse (FUPS): a term coined by Wolpert et al. (2016) in their analysis of mental health services.

Data are *flawed*: due to missing or erroneously recorded data (often by resource-challenged clinical staff); *uncertain*: due to differences in how data items are rated and/or variation in case mix; *proximate*: in that they are a proxy for an indication of the impact of the service provided; and, *sparse*: in that even within complete datasets the low volume of cases within a given sub-group often limits the applicability of statistical inference.

Use of such data is frequently contentious, with debates typically centring on the correctness of data and the analysis or statistical interpretation employed, rather than the utility of analyses (Lilford et al., 2004; Wolpert et al., 2014).

The data presented in this report meet the criteria for FUPS in the following ways:

- **Flawed**: there is a high level of missing data.
- **Uncertain**: measurement may be self-reported or extracted from systems with minimal validity checks.
- **Proximate**: metrics used are all proxies for impact and can't be causally linked to provision due to the complexity of the contexts in which products and services are embedded.
- **Sparse**: data for important individuals or groups may either be missing or involve small numbers.

Involve believes that many health and social care data sets may remain flawed, uncertain, proximate and sparse for some time—arguably long enough to warrant using the FUPS moniker as a foundation for analysis.

How we use and present FUPS data in our reports

This report could be (and very likely will be) criticised for reporting on data where there are so many questions about the quality and such a high degree of missing data. Some might well argue that it is inappropriate to even report findings as they may lead to fallacious conclusions based on flawed data and be used for unhelpful ends. There is much to support such an argument. However, our view is that analysis and sharing of such data is useful intelligence that can inform dialogue among key stakeholders. We recognise this is not an uncontentious position.

In order to support best use of such FUPS data. we have followed best practice principles suggested in relation to the use of FUPS data (Wolpert et al., 2014; Wolpert et al., 2016). However, all errors or infelicities of expression are the current authors' alone.

As analysts of FUPS data, we see our role as being to:

- Help build a conversation around the data rather than providing definitive answers
- Provide accessible descriptive analyses and only undertake statistical tests where there is a clear rationale
- Present data in such a way as to convey any limitations to the interpretation of data, stemming from the following: small volumes of cases, rare events and the partial nature of any risk adjustment.

In our analysis and interpretation, we have tried to:

- Use precise and neutral language, avoiding the use of terms such as "significance"

- Provide full and precise definitions for metrics used in all cases
- Include raw numbers that analyses are based on not just percentages and ratios in isolation
- Make explicit where cases have been removed from any analysis
- Remind ourselves and readers that analysis may be limited, may not account for subtle clinical points, and may contain mistakes that we have done our best to limit
- Avoid analytical 'black boxes'; for example, complex statistical analyses on very limited data.

Involve acknowledges the strong influence of the work of Wolpert et al. (2016) in this report and make reference to many of their words in the presentation of this section.

How you should consider using FUPS data in your conversations

Involve recommends that this report is used to inform facilitated stakeholder discussions involving practitioners, funders, service users, policy makers and others, along the lines outlined elsewhere and described as the MINDFUL approach (Wolpert et al., 2014). In particular, the principle: spend 25% of any allocated discussion time on 'the data' and how it was arrived at and 75% of time on what actions should be taken if we assume the data are correct.

It is recommended that the facilitator of such conversations should seek to help those present to:

- Challenge their own and colleagues' confirmatory biases (i.e., the tendency to favour information that confirms or strengthens their own beliefs)
- Maintain curiosity; do not intentionally shut down any conversations that they disagree with
- Apply the same standards of scrutiny to analytic findings that support prior beliefs as to analytic findings that are uncomfortable or not wished for
- Consider if any actions need to be taken in terms of quality assurance
- Consider possible initiatives that even if not definitively indicated, may do more good than harm
- Challenge the assumption that change is always more risky than status quo
- Help ensure agreed rules of engagement are adhered to throughout all discussions.

To do this the facilitator should:

- Determine which groups are best brought together in which combinations (e.g., commissioners of services, service users, members of the public, practitioners, policy makers and researchers).=
- Set clear ground rules for conversations (e.g., no point scoring, atmosphere of general interest, welcome critical thinking, focus on possible next steps and options that can aid best practice) with an agreed process for making a decision however imperfect that process is.=
- Ensure those considering the data have time to reflect and absorb the information.

Routinely collected outcome and experience data in health and social care are likely to remain FUPS for some time. If such data are to act as a form of intelligence to support thinking and decision-making, and as a springboard to improved data collection, it is essential to start to examine what data we have as well as argue for improved data—to walk the fine line between 'scientific rigour and scientific rigor mortis' (Bernard, 2016):

> "… decisions are necessarily made every day, whether or not there are good quality data to support them." (Wolpert and Rutter, 2018, p.2)

It is important to call for more and better data collection and higher quality data (see, for example, in the care homes sector: Burton et al., 2020; Musa et al., 2020). However, it is only through examination of such FUPS data that can we start to have more informed debates about what outcomes should be expected to be achieved. It is in this spirit that Involve present the findings in this report.

Executive summary

There are a wealth of data available to support our understanding of the risk factors and prevalence of falls in care homes. We know, for example, to expect between 600 and 3,600 falls per 1,000 care home beds. Research has largely focused on falls prevention initiatives such as multi-factorial assessments, educating care home staff, delivering podiatry interventions, and developing exercise programmes. While individual intervention studies may report a reduction in the number and/or severity of falls, effect sizes are typically small, and methodological quality is variable. Care homes are complex environments, which further adds to the challenge of developing evidence-based outcomes with adequate reliability and validity.

Relatively little research focuses on how best to support residents after a fall. If we assume that residents will continue to fall in care homes, despite the use of any falls prevention interventions, there is considerable potential to explore and understand how residents and care home staff can be supported to ensure the best possible outcomes.

Innovations such as those provided by Mangar Health (a post-fall decision-support tool for assessing injury and response, and safe patient lifting cushions) and Immedicare (a video-enabled clinical support service) can aid the post-fall management of care home residents and provide time and cost savings to the wider health and social care system. The Mangar Health solution can reduce avoidable ambulance service callouts, eliminate 'long lies' and help prevent work-related injury or illness, with a minimum cost saving of £189.50 and a maximum cost saving of £1,382.40 per event. The Immedicare telemedicine service can reduce avoidable contacts with primary and secondary care, with a minimum cost saving of £15.32 and a maximum cost saving of £3,911.00 per falls-related consultation. While results may vary, the analysis in this report demonstrate the benefits afforded by both innovations.

Taken together, the Mangar Health and Immedicare services provide a unique opportunity to combine the benefits of assistive lifting technology with video-based clinical support to assist and reassure residents and care home staff.

More investment and research are needed to support implementation-at-scale and to understand what 'success' looks like: for determining what works, for whom, in what circumstances, and why. This necessitates a 'whole-system' approach with collaboration across public, private, and voluntary sectors to ensure the best possible outcomes for care homes and their residents.

What we would like you to take away from this report

- There are a wealth of available data available to support our understanding of the risk factors and prevalence of falls in care homes.
- Relatively little research focuses on how best to support residents after a fall.
- Innovations such as those provided by Mangar Health and Immedicare can aid the post-fall management of care home residents and provide time and cost savings to the wider health and social care system.
- Taken together, the Mangar Health and Immedicare services provide a unique opportunity to combine the benefits of assistive lifting technology with video-based clinical support to assist and reassure residents and care home staff.
- More investment and research are needed to support implementation-at-scale and to understand what 'success' looks like.

1. Falls in care homes: literature overview

Falls are a common and serious concern for older people and their care givers. Around a third of people over the age of 65, and half of those aged 80+, fall at least once per year, with many experiencing recurrent falls (National Institute for Health and Care Excellence, 2013; Tian et al., 2013). The rate and risk of falls for care home residents is increased by up to three times that of their community-dwelling peers (Department of Health, 2009; Rapp et al., 2012); care home residents are ten times more likely to sustain an injury as a result (Cooper, 2017; Department of Health, 2009). In care homes, it is estimated that there are between 600 and 3,600 falls per 1,000 beds per year (Rubenstein et al., 1996).

Given there are over 450,000 care home beds across 15,000+ care homes registered by the Care Quality Commission, this equates to 270,000-1,620,000 falls per year: a very large number to manage[1]. As one of the most frequently reported accidents among residents, falls represent a pressing issue for providers of care as demand for places is expected to rise as the population continues to age (Competition & Markets Authority, 2017; Dow et al., 2013).

Risk factors for falls in care settings are diverse. Impairments to balance, muscle strength, gait and cognition are all contributors (Tinetti and Kumar, 2010; Montero-Odasso et al., 2012; Welmer et al., 2017), and are targeted in exercise programmes. Strong predictors of future falls include disability, neurodegenerative conditions such as Parkinson's and dementia, a history of falls, reliance on walking aids, and use of medications that result in dizziness or drowsiness (Deandrea et al., 2013). People living with dementia, for example, experience almost eight times more falls than healthy older adults (Allan et al., 2009). The mechanisms underpinning falls are complex and differ depending on intrinsic and environmental factors (Klenk et al., 2017). However, among those in long-term care, problems with weight-shifting while turning, or tripping due to inadequate foot clearance, have been identified as two common causes (Robinovitch et al., 2013), and have led to the development and evaluation of podiatry interventions (see, for example, Wylie et al., 2017). However, The multiplicity of factors influencing the likelihood of falls makes them incredibly difficult to eliminate entirely.

For an individual, the consequences of falling are numerous and distressing. They include injury, fear of falling, impaired mobility, and reduced independence (Downing, 2011). The increased propensity for falls among care home residents results in a greater prevalence of injury. Around one-third of falls are injurious and up to one-fifth result in hip fracture – accounting for 30% of all hip fracture hospital admissions (Department of Health, 2009; Oliver and Masud, 2004). However, even seemingly minor soft tissue injuries can cause significant functional impairment and anxiety, particularly in those who are frail. Furthermore, fear of falling among older adults is common and can often lead to an avoidance of activity, which, paradoxically, can increase fall risk (Friedman et al., 2002; Delbaere et al., 2004). Long term care residents who fear falling have shown more rapid decline in activities of daily living and in postural and gait performance, which are independent risk factors for falls (Franzoni et al., 1994). Given the high prevalence rates of residents who fear falling, between 40 and 70% (Lach and Parsons, 2013), care homes are faced with the substantial challenge of managing the perceived risk of falling, alongside the fall experience itself, if they are to offset future falls, and the negative consequences that follow.

Ensuring a timely response to falls is important, particularly for those who are unable to remobilise independently. 'Long lies', or spending more than an hour on the floor before getting up or being lifted, are common among care home residents. For an older person, long lies are associated with further consequences including tissue damage and pressure sores, dehydration, hypothermia, bronchopneumonia, and increased likelihood of hospital admission (Tinetti et al., 1993). Alongside physical complications, emotional and psychological harm may also be endured, including heightened fear of falling and loss of dignity.

It is estimated that 60% of individuals who experience a long lie are likely to fall again and be hospitalised within a year (Fleming and Brayne, 2008). Ensuring a resident is picked up off the floor, assuming they have no serious injuries, is therefore incredibly important practice, and one that is promoted through tools to support care home staff in managing falls such as the *React to Falls*[2] resource (Robinson et al., 2019). Such educational tools can be useful, when used effectively, particularly for reducing the variability of care between providers.

Responding to a fall may also present safety risks to care home and ambulance service staff. Moving and handling people (for example, lifting a resident after a fall) has long been acknowledged as a major contributor to the high incidence of musculoskeletal injury among health care staff (Smedley et al., 1995; Tullar et al., 2010). Musculoskeletal injuries occur when tissues are exposed to excessive loads. The persistent and recurrent nature of these injuries increases the risk for sickness absence (Demou et al., 2018). It is estimated that musculoskeletal symptoms account for approximately half of all sickness absence in NHS staff, the total cost exceeding £1.7 billion annually (Boorman, 2009). This presents a significant public health management and staffing challenge to overcome.

Various interventions have been introduced to mitigate against the risk of musculoskeletal injuries. These include the use of assistive devices for moving patients, employee education, and organisational policies (Tullar et al., 2010). The use of assistive lifting devices can reduce the risk of back injury among health care workers (D'Arcy et al., 2012; Andersen et al., 2014). However, understaffing presents a barrier to the use of such equipment (Kurowski et al., 2012). This is concerning, given that UK care homes continue to see a rise in staff vacancies (Age UK, 2019), and high staff turnover is associated with higher injury rates among staff (Lahiri et al., 2013). Reliance on agency staff accounts for approximately 8% of care home staffing costs, highlighting an apparent financial implication (Knight Frank, 2021). Moreover, it is plausible that temporary staff would be less familiar with resident handling needs, policies on patient handling, and use of lifting equipment. In this scenario, current employees experience increased pressure, and quality of care provided to residents is compromised. Minimising caregiver exposure to overloading, when assisting non-injured fallers to an upright position, therefore has far reaching implications for the employer, employees, residents, and healthcare system at large.

Understanding who may be at risk of falling, and how falls can be prevented continues to be a key public health priority. The National Institute for Health and Clinical Excellence (NICE) clinical practice guideline for the assessment and prevention of falls in older people recommended that multifactorial risk assessment and interventions should be undertaken (National Institute for Health and Care Excellence, 2013). A variety of these services have been introduced throughout the UK, with varying success. A review of 62 multi-factorial trials involving 19,935 older people living in the community provided evidence for reduced rates of falls compared with usual care, but little effect on other fall-related outcomes (e.g., fall-related injuries, risk of recurrent falls, hospital admissions, quality of life). Meanwhile, a similar review conducted in care facilities revealed little or no evidence for reducing the risk or rate of falls (Cameron et al., 2018). Reducing the number of falls among older adults to zero is therefore an unlikely outcome. However, optimising post-fall management, to minimise physical and psychological distress and improve the efficiency and safety of care post-fall, is an important, yet under-developed, area.

The physical and psychological impact of falls is complex. Distress and fear experienced by those who fall will inevitably extend to those who are responsible for their care, and this can be problematic. A longitudinal study in long-term care facilities found that care givers' fall concern for residents with dementia was predictive of restraint use, decline in functional ability, and increased injurious falls (Dever Fitzgerald et al., 2009). Falls management in care homes therefore requires a consideration of organisational and staff-specific factors: ensuring that care givers have sufficient education and training and are equipped with appropriate resources to respond to fall incidents is critical.

Key statistics for care homes

- Residents are up to three times as likely to fall as those living in the community.
- There are between 600 and 3,6000 falls per 1,000 beds.
- One third of falls will result in injury of varying severity.
- 10-20% of falls will result in a fracture of some form.
- 60% of residents who experience a 'long lie' will have a falls-related hospital admission within a year.

2. Mangar Health: safe resident lifting

Introduction and innovation

Mangar Health is a leading designer and manufacturer of inflatable moving and handling equipment that are used in many locations across the world. The organisation has won many awards and demonstrated a clear commitment to enabling people to retain their independence and dignity, while reducing the risk of injury to care givers and healthcare professionals.

From their safe patient lifting range of products, the ELK and Camel lifting cushions provide a practical and efficient solution to lifting an individual who has fallen. Both cushions are lightweight, portable, and easy-to-use, and can be inflated using a hand control and battery-powered compressor. They are used predominantly in four settings:

- **Care homes**: Mangar work directly with the social care workforce to reduce staff sickness and associated costs, while at the same time encouraging greater staff productivity during a fall.
- **Emergency services**: Mangar supply lifting cushions to ambulance services to ensure paramedics and other professionals have the right moving and handling equipment to reduce the risk of workplace injury.
- **Hospitals**: Mangar products are used on wards to enable healthcare professionals to come to the aid of a patient without delay and without putting themselves at risk.
- **Community**: Mangar work closely with organisations to supply a range of assistive technology equipment for independent living at easy, convenient locations.

In the care homes sector, Mangar Health has collaborated with the Welsh Ambulance Services NHS Trust to develop ISTUMBLE, an algorithm and app used to determine the appropriate course of action in the occurrence of a fall. The algorithm provides care home staff with clear instructions on when to call for an ambulance or use aids and manual handling to lift residents from the floor. This is beneficial to residential homes who may not have clinical staff available as is the case with nursing homes. Residential care staff may also lack the confidence and/or skills to assess a resident for injury in a systematic way safely and effectively. ISTUMBLE offers a tool to supplement the existing knowledge and skills of staff.

ISTUMBLE has been adopted and used in over 20 locations across the UK, with more than 2,000 downloads of the app. Importantly, the algorithm has been demonstrated to reduce the length of time that residents are on the floor. The algorithm has clinical support, with an emergency medicine consultant stating:

> *The reason I became involved with the ISTUMBLE project is that it is so profoundly positive for residents of care homes and those who care for them. In 20 years of emergency medicine, I have never seen an exacerbation of damage to a broken femur of an elderly patient who has been carefully lifted with an appropriate lifting device. Other than in the exceptionally unlikely possibility of a neck injury – not lifting the patient who has fallen as a result of any cause I believe is both unacceptable and unkind.*
>
> *The ISTUMBLE flow chart and procedure document represent a genuinely impressive attempt to address morbidity and mortality increases associated with falls. This is ground-breaking practice and should be encouraged across all elderly care providers.*

Education and use of ISTUMBLE, in conjunction with lifting cushions, are all part of the Mangar 'post falls management solution' for care homes, and the health and social care organisations that support them.

For more information, visit: www.mangarhealth.com

Activity and impact

Mangar Health have partnered with many NHS Clinical Commissioning Groups (CCGs), ambulance trusts and care homes across the UK. The aim of these partnerships has been to safeguard residents who fall, support care home staff in their decision-making and to reduce the cost of post-fall responses to the NHS and the wider health and social care system. ELK and Camel lifting cushions have been used alongside 'post fall assessment pathways' and ISTUMBLE algorithm to support care home staff with residents who have fallen.

Data illustrating the outcomes of these projects are summarised in the following table:

Project	Overview	Achievements	Challenges
Aneurin Bevan Health Board and Welsh Ambulance Service Trust	Six-month evaluation across 12 care homes.	High number of care home staff using ISTUMBLE (91%); three using ISTUMBLE for 100% of falls. ISTUMBLE and Camel lifting cushion used for 401/521 falls (77%). Reduction from 58% of ambulance callouts requiring conveyance to 35% (from 120 callouts).	None reported
NHS Mid Essex CCG and ambulance service	Evaluation of the ISTUMBLE algorithm and Camel lifting cushion in 10 care homes.	ISTUMBLE used 101/110 times (92%). Camel lifting cushion used 21/110 times (19%). 19 ambulance service callouts for 110 falls (17%): benchmark was 50%.	Relatively low usage of Camel lifting cushion although no training was provided.
NHS Norfolk and Waveney CCG (formerly Norwich, North Norfolk and South Norfolk CCGs)	Evaluation of the ISTUMBLE algorithm and ELK lifting cushion in 8 care homes.	High proportion of care home staff utilising ISTUMBLE appropriately. Ambulance service callouts only attending injurious falls. Average time an uninjured resident was on the floor was 12 minutes vs. 76 minutes for an injured resident and ambulance service intervention. Four care homes saw reductions in non-conveyed ambulance service callouts; 26% overall absolute percentage reduction. Positive care home staff feedback.	Three care homes saw increases in non-conveyed ambulance service callouts, but this was only from 0 to 2, 4 to 6 and 1 to 2. A care home reported increased paperwork. Scheduling training for care homes.
NHS North Manchester CCG	Evaluation of the ISTUMBLE algorithm and ELK lifting cushion in 10 care homes.	Positive resident and care home staff feedback. ISTUMBLE and ELK lifting cushion used for 123 falls where an ambulance would have been called; scaled to 295 per annum.	None reported
Wales Care Home Project: Welsh Government, Welsh Ambulance Service Trust and the National Collaborative Commissioning Unit	Preliminary and six-month evaluation across 600 care homes (33 with outcome data).	Preliminary evaluation:- ISTUMBLE used 90/125 times (72%). Camel lifting cushion used 70/125 times (56%). 35 ambulance callouts for 125 falls (28%). Number of care homes changing their lifting policy from 'no lift' to 'lift with ISTUMBLE and appropriate lifting equipment'. Six-month evaluation:- ISTUMBLE used 453/711 times (64%). Camel lifting cushion used 221/711 times (31%). 81 ambulance service callouts for 711 falls (11%). WAST recorded a reduction of 1,000 callout hours over 10 weeks from a sample of care homes post pilot introduction.	Relatively low uptake of ISTUMBLE and Camel lifting cushion although no data available on why this may have been the case.

Table 2.1: Overview of the achievements and challenges of Mangar project evaluations to date.

There is a level of consistency in the outcomes reported across these projects. In the North Manchester CCG Care Home Project (involving 10 care homes), the ELK lifting cushion was used 123 times instead of calling an ambu-

lance over the five-month trial period. In the Aneurin Bevan Health Board and Welsh Ambulance Service Trust initiative (involving 12 residential and nursing homes), 401 (77%) of the 521 recorded falls were safely managed by care home staff using ISTUMBLE and the Camel lifting cushion. Similarly, in The Wales Care Home Project an ambulance was not required for 90 (72%) out of 125 falls during the 10-week evaluation period. The data assessed demonstrates the benefits of introducing dignified and appropriate falls equipment to support care home staff in moving uninjured residents, reducing the need to call an ambulance for assistance.

There are also unanswered questions within the evaluation data outlined above. For example, there is limited reporting on the process of introducing the Mangar service into care homes, and the experiences of staff and residents in this introduction phase. Once introduced, how does the service become embedded within the routines and practices of the care home? Does it fit within the complex environment or get abandoned? Frameworks such as NASSS (Greenhalgh et al., 2017; Greenhalgh et al., 2018; Greenhalgh et al., 2020), discussed in the final section of this report, are useful in exploring key questions related to the introduction and adoption of technologies, and would provide a better understanding of what challenges are faced by care homes and how they may be alleviated. Addressing the issue of documentation on what factors lead to the adoption of the technology would provide Mangar Health, commissioners and the wider health and social care system with valuable information to ensure a more consistent and impactful return on investment.

The data show that Mangar Health products can serve to alleviate some of the human and economic costs associated with non-injurious falls in care homes. Assessing the outcomes data available, the impact and potential benefits of using ISTUMBLE and lifting cushions can be categorised into four themes:

- Reducing the risk of spreading infectious diseases by eliminating avoidable contacts
- Reducing time and resources spent on ambulance callouts for non-injurious falls
- Avoiding the physical and psychological consequences of long lies
- Reducing musculoskeletal injury to care home and ambulance service staff.

These themes are discussed in more detail in the remainder of this section.

Reducing the risk of spreading infectious diseases by eliminating avoidable contacts

There are clear benefits of using technologies that reduce the number of external social contacts such as those that would be required to pick a resident up following a fall. Enabling care home staff to safely pick up residents independently ensures that health and social care professionals are only called upon to enter care homes in essential circumstances, which is beneficial given the increased likelihood that they could have been exposed to the virus despite the provision and use of personal protective equipment. In addition, if staff sickness from musculoskeletal injury when lifting residents unaided can be reduced, the number of staff required to support a care home can be limited: a single cohort of staff supporting a care home is more beneficial than multiple members of staff covering more than one care home due to sickness absence. While difficult to quantify, the reduction in avoidable contacts and limiting of care home staff interacting with residents is seen as essential during a pandemic.

Reducing time and resources spent on ambulance callouts for non-injurious falls

Ambulances are routinely called to lift uninjured residents. The Welsh Ambulance Services NHS Trust (WAST) found that 50% of the 62,500 falls-related calls attended by their crews did not require hospital conveyance and were not related to serious injury[1]. Additionally, the South Western Ambulance Service found that 70% of non-injurious falls did not require an ambulance response[2]. Given the proportion of falls that do not require ambulance service intervention, there is clear potential for solutions that help care home staff to assess risk and assist a resident up safely following a fall.

Although a large proportion of falls are non-injurious, avoidable use of emergency ambulance services for falls in the care sector is high. A study of 32 independent care homes in North West England revealed that the most common organisational response to a resident fall incident is to call emergency services for an ambulance, regardless of the level of sustained injury (Scott-Thomas et al., 2017). This is not surprising given that care home staff may lack the confidence and/or the skills to assess a resident for injury in a systematic way safely and effectively. In terms of management, a care worker may be allocated 1:1 to a resident on the floor and if the care home only has two or three staff on shift, this is a significant reduction in staff who are then available to meet the needs of remaining resi-

dents. Without adequate support and means to lift a resident quickly, an ambulance callout is inevitable.

Avoidable ambulance callouts represent a considerable time and cost burden that could be lowered using the ISTUMBLE algorithm and Mangar lifting equipment. A single use of a cushions to lift an uninjured faller could save the ambulance service 1.5 hours[1] per event. In addition, based on unit costs for health and social care resources (Personal Social Services Research Unit, 2011; 2020), minimum costs savings per fall amount to £214 for a see, treat, and refer response. Scaled to 1,000 non-injurious falls and based on a minimum reduction of 72% and a maximum reduction of 89% (using data on the number of ambulance callouts avoided), ISTUMBLE and a lifting cushion could help save between:

- 1,080 and 1,335 hours of ambulance service time
- £154,080 and £190,460 in costs (even if block-contracted, activity reductions mean that more people can be reached by the ambulance service if they are not attending non-injurious care home falls). If a follow-up online consultation is required with general practice post-fall, after a referral recommendation by the ambulance service, there is an additional cost of £49.20 per fall.

The multi-system **minimum saving from responding to a non-injurious fall using ISTUMBLE and a lifting cushion is £189.50** with a **maximum saving of £234.25** per non-injurious fall.

Avoiding the physical and psychological consequences of long lies

An uninjured resident who has fallen in a care home may be categorised as a low priority emergency response. Consequently, residents can lie on the floor for long periods of time until an ambulance arrives. Instructions may be given to staff to withhold food and drink during this time in case of serious injury. This may have significant adverse consequences for residents, such as dehydration, leading to hospital conveyance, even if uninjured by the fall. Residents who experience a long lie also have a 60% chance of having a hospital-required fall within the next year (Fleming and Brayne, 2008), which must be factored into cost savings projections.

Assuming a long lie requires emergency department attendance without admission, and a follow-up online consultation with a general practitioner, the following is an estimate of the cost per 1,000 long lies over a two-year period:

Event	Resource	Unit cost	Total cost saved
Primary fall and long lie	Ambulance service see, treat, and convey Emergency department attendance without admission Follow-up online consultation	£263.00 £106.00 £49.20	£263,000.00 £106,000.00 £49,200.00
Secondary fall and long lie (60%)	Ambulance service see, treat, and convey Emergency department attendance with admission Non-elective admission Follow-up outpatient attendance	£263.00 £147.00 £602.00 (short stay[3]) or £3,366.00 (long stay) £135.00	£157,800.00 £88,200.00 £361,200 (short stay) or £2,019,600.00 (long stay) £81,000.00
Total			£553,200.00 to £1,382,400.00 per year

Table 2.2: Cost savings for 1,000 residents who experience a long lie over a two-year period.

The multi-system **minimum saving from tackling the issue of long lies is £553.20** with a **maximum saving of £1,382.40** per long lie prevented.

Reducing musculoskeletal injury to care home and ambulance service staff

Impact on care home staff

UK care staff experience one of the highest rates of musculoskeletal injury (Health and Safety Executive, 2020). Care staff in nursing homes are particularly vulnerable, experiencing up to37 injuries per 100 staff (full-time equivalents) per year, of which musculoskeletal injury accounts for 73% (Alamgir et al., 2007). Data derived from Scottish healthcare employees revealed musculoskeletal injuries as one of the main causes of sickness absence, accounting for 27% of all days lost (Demou et al., 2018). In this study, 50% of those absent due to musculoskeletal injury returned to work within 10 days. However, the overall mean absence duration was approximately 29 days.

Staff absences are likely to increase time and workload pressures on existing staff members, with negative consequences for care continuity and quality for residents. Key indicators of reduced care staff injury have been identified as having lifting devices available when needed, and sufficient time to complete resident activities (D'Arcy et al., 2012). Failure to provide these resources could have consequences with regards to staffing levels and quality of care. For example, higher staff turnover can lead to an inappropriate skill mix in care homes (Royal College of Nursing, 2012). Agency staff may also be required, which may reduce measures of quality (Castle and Engberg, 2008). Taken together, these data highlight the importance of staff retention and injury avoidance.

From a financial perspective, annual staffing costs equate to £21,956 and £29,332 per resident for personal care and nursing care, respectively. Together, these costs consume a substantial proportion of total care home income (55.1% personal care and 59% nursing care) (Knight Frank, 2021). Mangar lifting cushions offer a practical solution to the issues outlined above. Regular use of these devices could serve to offset the rate of musculoskeletal injury and associated sickness absence among staff. This would subsequently reduce the need for replacement staff (and associated costs) by retaining regular staff while maintaining the appropriate standard of care afforded to residents.

The following table provides an indication of potential cost savings for care homes when Mangar lifting cushions are used and musculoskeletal injury is prevented. Gross cost savings are outlined for scenarios in which care homes provide employees with statutory sick pay (£96.35 per week excluding the first three 'waiting days') or full sick pay (as per average salaries outlined above), for a sickness absence of 10 or 29 days:

		Gross cost savings (current staff sick pay + new staff replacement)	
Type of care	**Sick days**	**Statutory sick pay**	**Full sick pay**
Personal	10 days	£134.89 + £844.46 = £979.35	£844.46 + £844.46 = £1,688.92
	29 days	£501.02 + £2,448.94 = £2,949.96	£2,448.94 + £2,448.94 = £4,897.88
Nursing	10 days	£134.89 + £1,128.15 = £1,263.04	£1,128.15 + £1,128.15 = £2,256.31
	29 days	£501.02 + £3,271.65 = £3,772.67	£3,271.65 + £3,271.65 = £6,543.29

Table 2.3: Gross cost savings for personal and nursing care staff working a 260-day year.

The **impact of sickness absence for personal and nursing care staff is between £2,949.96 and £6,543.29** (gross) for an average of 29 sick days.

Impact on ambulance service staff

Ambulance workers are at a relatively higher risk of health impairment and early retirement than other occupational groups (Sterud et al., 2006). A key job function of ambulance personnel includes lifting and transporting patients, which often demands awkward postures (Lavender et al., 2000). These tasks, when coupled with long shifts, may increase the risk for musculoskeletal injuries (Weaver et al., 2015). Musculoskeletal injuries are highly prevalent (Friedenberg et al., 2020), are a leading cause of early retirement on medical grounds (Rodgers, 1998), and often result in lost workdays (Maguire et al., 2005). The onset of chronic musculoskeletal disorders often entails long absences and increased risk of permanent work incapacity (Arial et al., 2014). Implementing sustainable preventative measures is therefore a key concern for the emergency services sector.

Many ambulance service staff experience injury at work. Personnel data show that ambulance trusts have the highest sickness absence rate in the NHS, at 7.3% (NHS, 2020). An average of 20 days of sickness absence per ambulance staff member has been reported; reducing this figure by 1% could save the NHS £15 million each year (Carter, 2018). Safe and frequent use of assistive lifting devices provide the means to alleviate the risk of injury and associated sickness absence among ambulance service personnel.

Supporting information comes from data provided by Surrey Ambulance Service NHS Trust, who surveyed staff on work-related injuries and the outcome of a trial period using the Mangar ELK lifting cushions:

- 97% of staff surveyed (n=184) had suffered a personal injury at work, with 65% experiencing ongoing issues
- 98% of staff surveyed (n=184) used painkillers on a regular basis to mask symptoms
- Lifts accounted for most work-related injuries, with most categorised as 'assist only'

- ELK lifting cushions were particularly useful in bathrooms where space was at a premium
- A staff member, a healthy 26-year-old, tore some of their lumbar region muscles during a lift and spent five months rehabilitating: the service estimated between £16,316.60 and £17,755.80 (using salary data from 2000/2001) additional costs were incurred.
- The ELK provided a solution to the problem of getting people from the floor to an elevated sitting position, often empowering the patient to assist the ambulance crew, rather than being dependent on them.

The average basic pay for ambulance staff is £29,863, which extends to an average total of £40,782 when considering additional earnings such as working unsocial hours or overtime (Department of Health and Social Care, 2021). The following table indicates the potential gross cost savings associated with preventing injury-related sickness absence of one staff member (and associated cost for staff replacement) for 5 days and 20 days:

		Gross cost savings (current staff sick pay + new staff replacement)	
Rate of pay	**Sick days**	**Statutory sick pay**	**Full sick pay**
£29,863	5 days	£38.54 + £574.29 = £612.83	£574.29 + £574.29 = £1,148.58
	20 days	£327.59 + £2,297.15 = £2,624.74	£2,297.15 + £2,297.15 = £4,594.31
£40,782	5 days	£38.54 + £784.27 = £822.81	£784.27 + £784.27 = £1,568.54
	20 days	£327.59 + £3,137.08 = £3,464.67	£3,137.08 + £3,137.08 = £6,274.15

Table 2.4: Gross cost savings for one member of emergency services staff working a 260-day year.

The **impact of sickness absence for ambulance service staff is between £2,624.74 and £6,274.15** (gross) for an average of 20 sick days.

3. Immedicare: video-enabled clinical support

Introduction and innovation

Immedicare is a video-enabled, clinical service linking care homes to the NHS, and is available 24 hours a day, seven days a week. The service is delivered via a secure, two-way video link, which gives residents and care home staff face-to-face access to the highly-skilled, multi-disciplinary clinical team based at Airedale NHS Foundation Trust.

In real-time, the clinical team monitor people on-screen and provide advice, assessment, and support (including liaising with local health and social care providers, if necessary). Access to full or summary care records is available via links to the resident's electronic patient record, which ensures safe and informed clinical decision-making. The clinical team is supported by the skills and knowledge of our hospital's wider team of senior doctors, consultants, and specialist nurses, if required.

Immedicare has supported over 1,000 care homes across multiple commissioners since its inception in 2013.

For more information, please visit: www.immedicare.co.uk

Activity and impact

Immedicare activity takes the form of a 'consultation': a secure video conversation between a care home and a member of the Immedicare clinical team, which is made up primarily of nurse practitioners who have a wide range of backgrounds and experiences including falls prevention and management. Consultation notes are documented using a template into an electronic patient record (TPP SystmOne) by the clinical team, which means that summaries are available to the resident's general practitioner after each interaction.

Several data items are recorded within the resident's clinical record:

- The clinical purpose of the consultation e.g., falls, head injury or a (suspected) fracture
- The plan, including any follow-up if required, for the management of the resident's issue
- Whether any onward referrals are required to support the resident to remain in the care home such as a district nurse, general practitioner, or rapid response team
- The outcome of the consultation such as whether the resident remained in the care home or an ambulance was called to further assess the resident and/or transport them to hospital
- What would the care home have done if they did not have the telemedicine service?

Activity from the telemedicine service was available for consultations made between 1st April 2017 and 31st March 2021: a total of four years. This included a total of **24,467 falls-related consultations** i.e., those marked as falls, head injury or a (suspected) fracture. There were no sizable differences between the weekdays that consultations occurred on and consultations were spread across all 24 hours of the day. There was a more pronounced increase in activity for residential homes between 9am and 9pm, which could be due to residents being more active during these times and at a greater risk of falling[1] (see Appendix A).

The telemedicine service has been successful in reducing avoidable contacts with the ambulance service and general practice. Data show that most falls-related consultations were not referred to a general practitioner (n=23,513; 96%) and resulted in the resident remaining in their place of residence (n=20,517; 84%).

These figures suggest that falls can be managed and supported via video consultation with appropriate escalation to general practice and the ambulance service, where required. Even when an ambulance is required, there are benefits of the telemedicine service in terms of supporting and reassuring care home staff, and communicating with ambulance crews in attendance: particularly in terms of alerting them to advance care planning and DNACPR decisions (Care Inspectorate and NHS Scotland, 2016). This is, of course, dependent on the accuracy of any initial assessments made via video consultation, and the knowledge and skills of those both triaging remotely and the staff who are in the care home.

In addition to the benefits to the resident, such as reducing 'long lies' and their psychological effects, the impact of the service on primary and secondary care can be illustrated in two ways:

- **12,181 (98%)** falls-related consultations **were not referred to a general practitioner** out of the 12,398 (51%) instances where a care home would have called them if telemedicine service was not available.
- **20,517 (84%)** of falls-related consultations **did not require an ambulance or emergency department attendance**, which could have been the outcome if care home policy dictated (Scott-Thomas et al., 2017).

For general practice, impact can be quantified in terms of time and direct care staff costs associated with triaging calls from care homes and providing a response. Using unit times and costs provided by the Personal Social Services Research Unit (2011; 2020), assuming each call is administered by a general practitioner-led telephone triage service and 50% require a home visit to conduct an appropriate assessment[2], time and cost savings are:

Activity	Time per activity	Cost per activity	Total time saved	Total cost saved
Telephone triage	4.0 minutes	£15.32	48,724.0 minutes	£186,612.92
Home visit (50%)	23.4 minutes[3]	£121.00	142,517.7 minutes	£736,950.50
Total			191,241.7 minutes or 3,187.4 hours	£923,563.42

Table 3.1: Time and cost savings for the 12,181 falls-related consultations that would have been managed by general practice over four years.

For ambulance services and secondary care, including primary care follow-up, impact can be estimated using the following hierarchy of resource use and unit costs based on severity (National Institute for Health and Care Excellence, 2013; Personal Social Services Research Unit, 2011; Personal Social Services Research Unit, 2020):

Fall severity	Resource	Unit cost
Low	Telephone triage Home visit	£15.32 £121.00
Moderate	Ambulance service see, treat, and convey Emergency department attendance without admission Follow-up online consultation	£263.00 £106.00 £49.20
Severe	Ambulance service see, treat, and convey Emergency department attendance with admission Non-elective admission Follow-up outpatient attendance	£263.00 £147.00 £602.00 (short stay[4]) or £3,366.00 (long stay) £135.00

Table 3.2: Unit costs for resource use per fall based on severity.

For every falls-related consultation that is not referred to general practice or does not require a hospital conveyance:

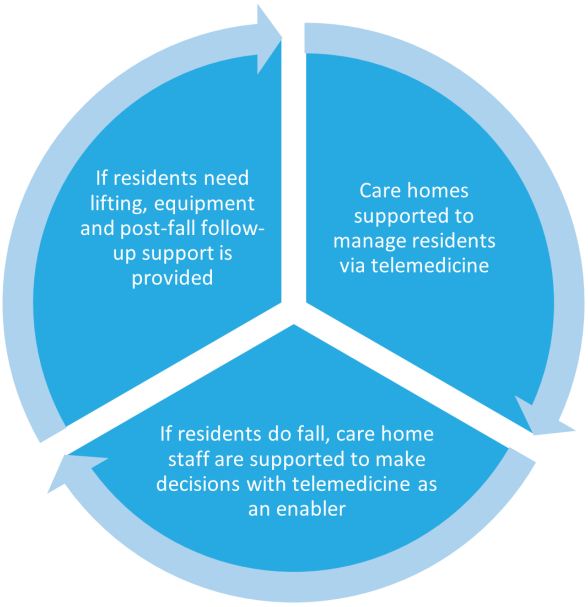
Fall severity	Primary care saves	Ambulance service saves	Secondary care saves
Low	£15.32 or £136.32 (with home visit)	Nil	Nil
Moderate	£49.20	£263.00	£106.00
Severe	Nil	£263.00	£884.00 (short stay[4]) or £3,648.00 (long stay)

Table 3.3: Savings associated with utilising the telemedicine service post-fall.

The multi-system **minimum saving is £15.32** with a **maximum saving of £3,911.00** per falls-related consultation.

4. Responding to falls in care homes: recommendations for a future care model

Falls are one of the most common and serious issues facing care home residents. Although there has been, and will continue to be, work conducted in the area of falls education and prevention, we believe that the possibility for falls occurring in a care home will remain high. This means that innovations such as those offered by Mangar Health and Immedicare could be essential in contributing to a care home's response to falls. In isolation, both innovations can demonstrate some real impact on the health and social care system from a time and cost perspective, which requires further exploration beyond this report. In addition, benefits may also be realised by a care home and their residents by reducing the time a resident spends on the floor and empowering care home staff to act quicker with supervision. But is there more that could be done to support a care home post-fall?



Independently, the Mangar Health and Immedicare innovations have the potential to transform health and social care. However, a hybrid solution that combines: the utility of an algorithm (or process flow diagram) to aid care home staff decision-making (where required); a safe lifting solution; and a video-based monitoring and support service could be beneficial in assisting care homes with residents who fall. The solution would provide full 360-degree help to care homes, with pre- and post-fall support via telemedicine and a means to lift residents off the floor. Lifting could be unaided, if care home staff felt able, or witnessed by connecting with a remote team who can offer advice and take over clinical responsibility for the fall. This type of solution would require sufficient funding, but if this means that the number of falls that require involvement from the ambulance service, primary and secondary care can be reduced (as in a 'moderate' or 'severe' fall severity scenario), then there is real potential in a hybrid model.

Embedding innovations that deliver lasting change is challenging. Care homes are complex environments and with the introduction of new processes and innovations, only become more dynamic and unpredictable (Greenhalgh and Papoutsi, 2018). In environments such as this, the chance of an innovation failing is relatively high. Fortunately, research into the evaluation of technology-supported innovations sheds some light on what factors can contribute to their eventual success (Greenhalgh et al., 2017; Greenhalgh et al., 2018; Greenhalgh et al., 2020).

The non-adoption, abandonment, scale-up, spread and sustainability (NASSS) framework can help explain the successes and failures of technologies with the aim of reducing complexity and/or manage programme complexity to take account of it. The framework draws attention to the following domains:

- **The condition**: ensuring the technology is 'suitable' for the end-user's clinical presentation.
- **The technology or technologies**: assessing the 'physical' aspects of the technology, the knowledge and support needed to use the technology, and how sustainable the technology is.
- **The value proposition**: defining whether a technology is worth developing and for whom it generates value.
- **The adopter system**: describing where the technology will be used and by whom.
- **The organisation**: analysing an organisation's capacity and readiness to embrace new technology, including finances and the extent to which existing routines will be disrupted. Planning should be scoped to ensure successful implementation.
- **The wider context**: describing the political, economic, regulatory, professional, and socio-cultural contexts that may limit technology rollout.

- **Embedding and adaptation over time**: determining the scope for adapting and 'co-evolving' the technology and service over time as demand changes.

The framework provides a set of questions to be addressed for each domain, which are necessary for understanding the impact of an innovation on the status quo (e.g., how much change is required to support the innovation). These questions could form the basis for co-design and co-production sessions with key stakeholders, with the aim of reducing the risk of failure from the outset of a new innovation project. As a starting point, research using the NASSS framework (James et al., 2021) and applied to video consultation services found:

- The presence of a care home 'champion' supported by leadership across all levels of seniority at the organisation was critical to the success of interventions
- The availability of reimbursement mechanisms (such as centralised funding) or incentives for use ensured interventions spread more rapidly at scale
- 'User-friendly' technology and services that allowed for adaptation over time were more successful than technologies that were difficult to use if staff lacked technical experience.

Using the NASSS framework and analysing associated case studies, our recommendations for the design of innovations to support care homes in responding to falls are to:

- Ensure the technology is easy to use and understand, and is easily accessible and storable when in the care home; the technology needs to be ready for use at all times
- Ensure that end users and key stakeholders understand and appreciate the value of the technology, and consider how 'value' may be interpreted by different groups
- Ensure staff are trained sufficiently and have confidence in their use of the innovation, with help being made available if and when required
- Ensure that key stakeholders are involved in implementation and roll-out as they will be essential in ensuring that innovations are adopted successfully and used over time
- Ensure that support is made available pre-, during and post-installation.

To support these recommendations:

- Ensure care home managers are involved in decision-making processes that may affect their staff including how the technology may change existing staff roles and practices; care home leadership has been shown to influence the update of a given innovation (Bunn et al., 2020)
- Ensure adequate data collection, analysis and dissemination processes are in place to report on successes and failures to aid quality improvement
- Ensure adequate funding is available at a local or national level to support implementation, which should be offset by anticipated activity reductions associated with innovations
- Ensure 'whole system' buy-in is established to ensure innovations are perceived of as fit-for-purpose, including recognition by regulatory bodies such as the Care Quality Commission.

Bringing these elements together will be challenging, requiring time, but will ensure the best possible outcome for all residents who experience falls.

Endnotes

1. Falls in care homes: a focus on prevention

[1] This may even be an understatement as Cooper (2017) identified a rate of approximately 50 falls per 1,000 occupied bed days, which would generate 6,163,594 falls per year assuming a 75% bed occupancy rate.

[2] Website available at: https://www.reactto.co.uk/resources/react-to-falls/

2. Mangar Health: safe resident lifting

[1] Data presented by James Gough, Falls Project Lead at Aneurin Bevan University Health Board and WAST.

[2] Presentation on Community First Responders Falls Training by the South Western Ambulance Service.

[3] A length of stay of fewer than two days.

3. Immedicare: video-enabled clinical support

[1] Data from Cooper (2017) found "that 75% of all falls occurred between 1200 & 2130 however the highest concentration of falls was within this period between 1230 & 1600 and accounted for 41% of the total number of falls".

[2] Assumes a multi-factorial risk assessment of the resident is required (National Institute for Health and Care Excellence, 2013).

[3] Includes 12-minute travel time (Personal Social Services Research Unit, 2011).

[4] A length of stay of fewer than two days.

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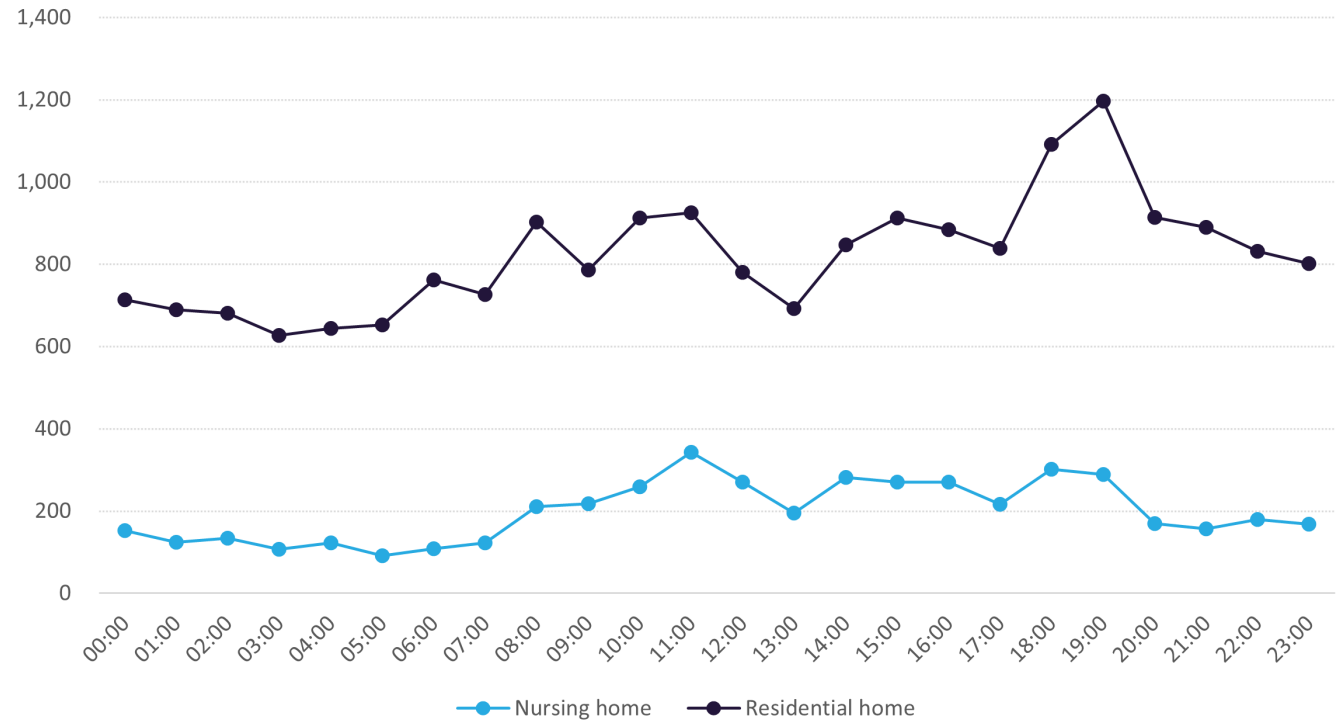
Appendix A

Number of falls-related consultations by hour



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