

This is an Open Access document downloaded from ORCA, Cardiff University's institutional repository: <https://orca.cardiff.ac.uk/id/eprint/181511/>

This is the author's version of a work that was submitted to / accepted for publication.

Citation for final published version:

Bowers, Ben, Gwyn, Sioned, Yardley, Sarah, Hellard, Stuart, Clarkson, John, McFadzean, Isobel, Pollock, Kristian, Barclay, Stephen and Carson-Stevens, Andrew 2025. Learning from end-of-life injectable medication patient safety incidents in the community: a mixed-methods analysis. *British Journal of General Practice* , BJGP.2025.0106. 10.3399/bjgp.2025.0106

Publishers page: <https://doi.org/10.3399/bjgp.2025.0106>

Please note:

Changes made as a result of publishing processes such as copy-editing, formatting and page numbers may not be reflected in this version. For the definitive version of this publication, please refer to the published source. You are advised to consult the publisher's version if you wish to cite this paper.

This version is being made available in accordance with publisher policies. See <http://orca.cf.ac.uk/policies.html> for usage policies. Copyright and moral rights for publications made available in ORCA are retained by the copyright holders.



Learning from end-of-life injectable medication patient safety incidents in the community: a mixed-methods analysis

Authors

Ben Bowers ^{1,2,5,6,7,8} *Corresponding author <https://orcid.org/0000-0001-6772-2620>

Assistant Professor of Primary Care and Honorary Nurse Consultant in Palliative Care. RN, BA (Hons), PG Cert, MSc, PhD

Sioned Gwyn ^{2,3}

General Practitioner. BSc

Sarah Yardley ^{2,4,7} <https://orcid.org/0000-0002-1645-642X>

Associate professor of Palliative Medicine. PhD, FRCP

Stuart Hellard ²

Specialist Data Manager.

John Clarkson ⁶ <https://orcid.org/0000-0001-8018-7706>

Professor of Engineering Design. PhD, FEng, CBE

Isobel J McFadzean ² <https://orcid.org/0000-0001-9766-2681>

Clinical Lecturer of Patient Safety and General Practitioner. BSc (Hons), MB, BCh, BAO, MRCGP, MSc FHEA

Kristian Pollock ⁵ <https://orcid.org/0000-0002-6836-8595>

Emeritus Professor of Medical Sociology. PGCHE, MA, PhD

Stephen Barclay ¹

<https://orcid.org/0000-0002-4505-7743>

Professor of Palliative Care and General Practitioner. MA, BM, BCh, MSc, FRCGP, MD, FHEA

Andrew Carson-Stevens ^{2,7}

<https://orcid.org/0000-0002-7580-7699>

Professor of Patient Safety and General Practitioner. PhD, FRCGP

¹ Department of Public Health and Primary Care, University of Cambridge

² Division Population Medicine, Cardiff University

³ Swansea University

⁴ Marie Curie Palliative Care, University College London

⁵ University of Nottingham

⁶ Department of Engineering, University of Cambridge

⁷ Marie Curie Research Centre, Division Population Medicine, Cardiff University

⁸ Queen's Institute of Community Nursing, London

Abstract

Background

Processes to implement injectable end-of-life symptom control medications in the community are complex and can adversely impact patient safety. Recurring patient safety incident types and their contributory factors remain under-recognised, inhibiting system-wide learning.

Aims

To understand injectable end-of-life symptom control medication incidents, their contributory factors and impact on patients/families; to identify priority areas for improving safe, effective and timely care.

Design and setting

Mixed-methods analysis of nationally reported injectable medication patient safety incidents involving adults in the community, between 2017-2022.

Methods

Mixed-methods: A stratified random sample of 2150 incidents from the National Reporting and Learning System was screened for eligibility. We included and analysed incidents that involved end-of-life injectable medications in the community. Coding was undertaken to classify incident types, the contributory factors involved, patient impact and harm severity. An iterative thematic analysis was then conducted to identify patterns between recurring incident types and contributory factors.

Results

419 patient safety reports detailed injectable medication-related patient safety incidents: 59.7% of incidents (250/419) described harm to patients. Frequently reported patient safety incidents included: medication administration issues (49.2%, 206/419); delayed and inadequate assessments (10.3%, 43/419); and prescription issues (8.6%, 36/419). Incidents often involved multiple services and delays. Recurrent, and often interacting, contributory factors included inadequate continuity of care, distractions and mistakes, poor equipment design and insufficient staffing levels.

Conclusion

Interventions to improve injectable end-of-life symptom control care should focus on ensuring timely access to assessments and prescriptions, enhancing continuity of care, and mechanisms to ensure rapid visits to administer medication.

How this fits in

The prescription and use of injectable end-of-life symptom control medications is a complex, risk-prone healthcare activity involving multiple services and actors. Yet, little is known about patient safety events involving these medications in the community. Our analysis highlights that reported incidents frequently involved delayed or inadequate assessment, prescribing, or medication administration issues. Key contributory factors included inadequate continuity of care, poor equipment design, insufficient staffing levels and cognitive issues. Targeted system-wide interventions to improve end-of-life symptom management should focus on addressing these safety critical areas.

Short sentence summarising the research

Patient safety incidents involving injectable medications in community end-of-life care are harmful and demand focused improvements in care standards.

Keywords

Drug safety, subcutaneous, injection, subcutaneous, end of life care, patient safety

Introduction

Effective, safe and timely end-of-life symptom control in the community is a priority and source of concern for dying patients, their family carers and healthcare teams.^{1–6} In 2023, 48.9% of all deaths occurred at home or in care homes in England and Wales.⁷ General practitioners (GPs) have a leading role in prescribing injectable medications in advance of need or in response to worsening symptoms, including

pain and breathlessness, nausea and vomiting, agitation and respiratory secretions in the last weeks and days of life.^{8–12 13,14} These medications include opioids and sedatives, and are stored in the patient's home with a 'permission to administer chart', enabling a degree of clinical discretion in which drugs and doses are administered. Injectable medications are commonly administered by visiting nurses or paramedics when oral medications are impractical or ineffective, both as background symptom control and 'as required' injections.^{15,16} This is recommended and widespread practice in several countries, including the United Kingdom.^{13,17–21}

The use of injectable medications at home is a risk-prone activity,^{3,9,19,22–24} involving several interacting components: decisions to prescribe; prescribing; dispensing; decisions to administer; administration; monitoring and adjusting treatment; post-death procedures and medication disposal.^{25,26} These processes are multifaceted and complex, and are prone to adverse patient safety events, particularly as multiple people and services are involved.^{9,12,15,19,27,28} Recurrent safety issues, including difficulties accessing timely assessments and medication-related incidents, have been attributed to human factors, including mistakes and insufficient clinician skills, and structural conditions such as ineffective communication tools and inadequate staffing.^{3,5,18,19,22–24,29} It is distressing for all when care is perceived to be unsafe or patients are harmed by failures to achieve adequate symptom control.^{5,22,23,29}

Patient safety incident reports provide valuable insights into how injectable medication-associated patient harms and near-misses occur, as perceived and reported by clinicians.^{30–32} The National Reporting and Learning System (NRLS) was launched in England and Wales in 2004 to collate and enable learning from patient safety incidents. This is one of the largest incident databases worldwide, with all community-based NHS organisations providing data until it was superseded in 2023 by the Learn from Patient Safety Events service. NRLS data remain notably underutilised as a research resource to learn from end-of-life injectable medication patient safety incidents occurring in general practice and the community.^{33,34}

Our study aims were to analyse NRLS incidents occurring in the community to:

1. understand injectable end-of-life symptom control medication incidents, their contributory factors and impact on patients/families; and
2. identify priority areas for improving effective, safe and timely care.

Methods

Study design

We carried out a mixed-methods analysis of nationally reported injectable medication patient safety incidents using the NRLS database for England and Wales.

Data sources

Data were sourced from patient safety incidents reported between April 2017 and April 2022, that met the definition of ‘an event or circumstance that could have resulted, or did result, in unnecessary harm to a patient during healthcare delivery’.³⁰ These can be reported by any healthcare staff providing NHS care, regardless of setting, when they deem an incident has occurred. Reports included incident location, brief patient and incident characteristics, perceived harm severity, and unstructured free-text clinician narratives of what happened and why, plus plans to minimise the risks of reoccurrence.³³

Study population, setting and sample

The population were adults (18 years+) receiving end-of-life care in the community in England and Wales. Settings included general practices, out-of-hours services, ambulance services, pharmacies, learning disability services, palliative care and nursing services. We searched the free-text narrative of primary safety incidents for this population using key search terms for palliative care and injectable end-of-life symptom control medications (Supplementary Table 1), building on a previous search strategy.³⁴ The search identified 45,590 potentially eligible incidents.

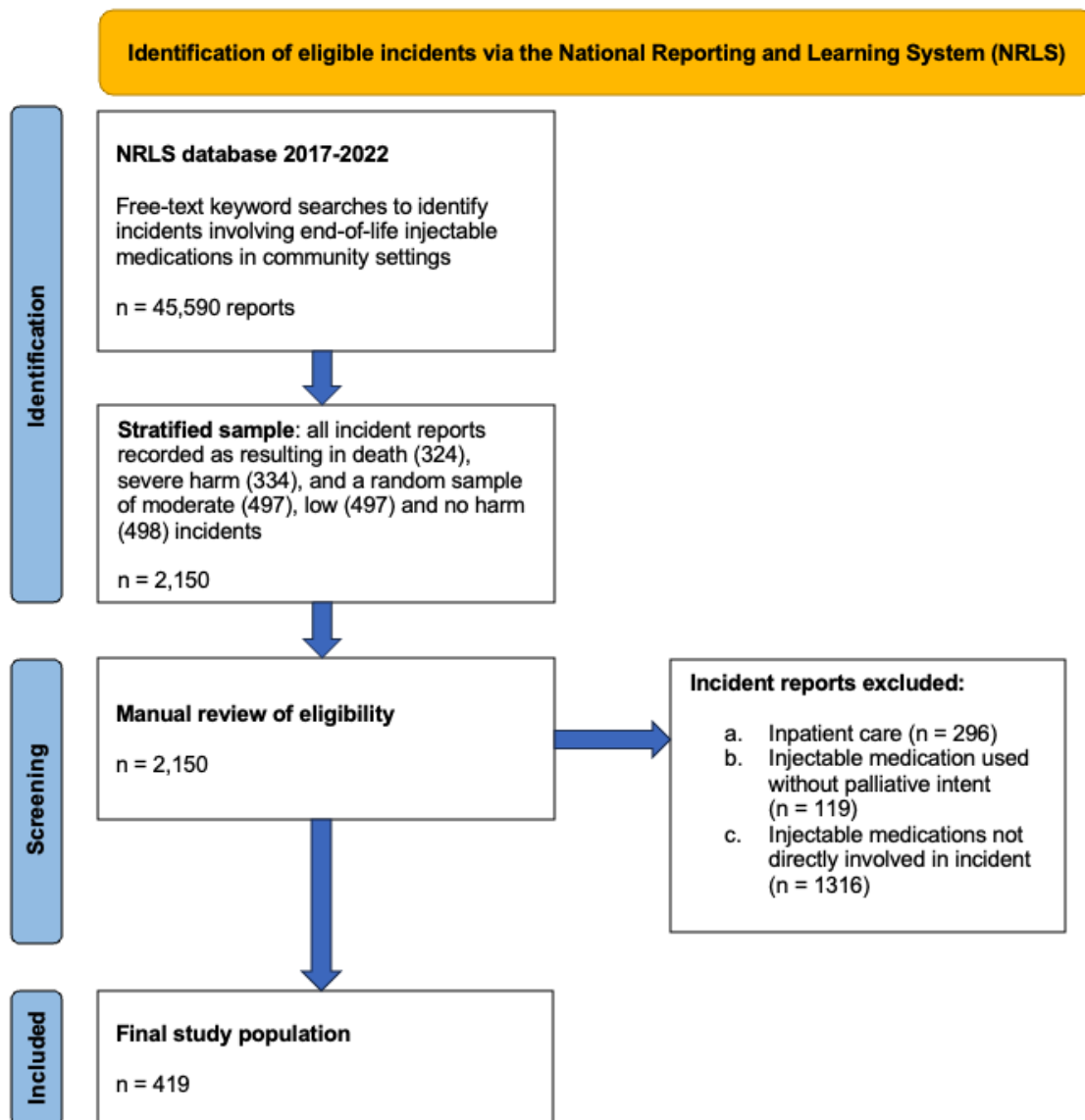
A stratified random sample of 2150 incidents was screened for eligibility. The sample size and composition were chosen to maximise understanding across a range of harm severities, within the capacity of the study resources. All incidents reported as resulting in death (324) and severe harm (334) were included (anticipating these may provide more detailed incident free-text narratives), along with a random stratified sample of moderate harm (497), low harm (497) and no harm (498) incidents.

Reports not describing patient safety incidents involving injectable end-of-life medications and those occurring in inpatient settings were excluded on manual review (Table 1). The first 20% of incidents were double screened by BB (clinical academic community nurse) and SG (clinical academic GP) with 94% concordance. Consensus decisions informed subsequent screening by BB (Figure 1).

Table 1. Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
- Incident directly involved injectable end-of-life symptom control medications - Patient aged 18+ years - Patient in last phase of life: report indicates that receiving (or should receive) palliative and end-of-life care - Incident occurred in community settings, including transitions between care settings	- Injectable medication used without palliative intent - Injectable medications not directly involved in incident - Patient aged under 18 years - Incident occurred solely in an inpatient care setting: hospital, hospice, mental health and learning disability inpatient units - Incident not related to patient care: did not describe a patient-level safety incident or near miss

Figure 1. Flowchart of sample identification and screening



Data analysis

Our mixed-methods analysis used the technique described as 'following a thread';³⁵ quantitative findings informed qualitative lines of enquiry.

Quantitative analysis

Incident reports were first analysed using the **Patient Safety (PISA)** classification system, a coding framework aligned to theoretical concepts for learning from incidents within patient safety science.^{30,33} Codes within the framework are used in a deductive and recursive model of incident analysis.³⁶ The PISA classification system was applied to categorise incident outcomes, primary incident types (most proximal to incident outcomes), contributory factors and any preceding incidents (i.e. the chains of events leading up to the primary incident) (Figure 2).

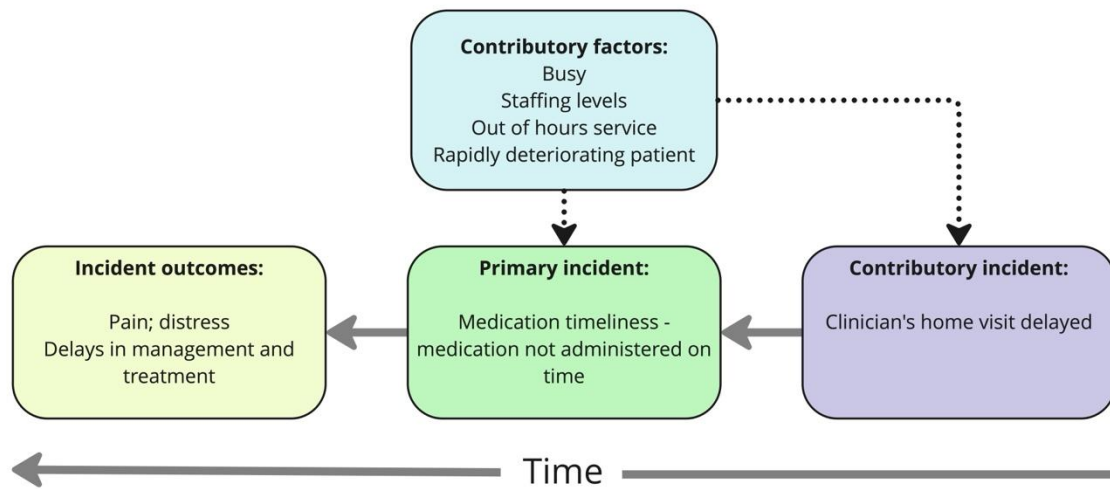
Harm severities were reclassified using the patient-safety incidents in primary care criteria for consistency (Supplementary Table 2).³⁷

The first 20% of eligible incidents were double coded by BB and SG, with consensus decisions informing subsequent coding by BB. Descriptive analysis was undertaken to assess the most frequently harmful outcomes, primary incident types and contributory factors. These findings informed the iterative qualitative analysis.³⁵

Figure 2. Recursive model of incident analysis example and definitions ³³

Description of incident: Patient distressed and in pain. Rapid response contacted at 6am but they were with another patient and could not respond so requested that the day service [community nursing team] visited. This resulted in a 3 hour delay in treatment for an end of life patient.

Study ID 10004. Location: patient's own home. Reported degree of harm: no harm; reclassified to low harm.



Definitions: **Incident outcomes** relate to the impact upon a patient which is wholly or partially attributable to an incident. **Primary incidents** are adverse events (the what) that occur most proximal to the incident outcomes. **Contributory incidents** are adverse events (the what/s) that precede primary incidents with a trajectory of events: there may be nil to several contributory incidents in a chain of chronological events. **Contributory factors** are the circumstances, actions or influences that are thought to have played a part (the why) in the development of an incident.

Qualitative analysis

An interpretive thematic analysis³⁸ was used to identify recurrent patterns across primary incidents and contributory factors. After data familiarisation and reviewing the initial descriptive analysis, nuanced patterns and differences across incident types and narratives were identified by BB. Memos were generated on recurring contexts and human and structural issues, along with how harms were presented and any evident key missing information.^{38–40} The reflexive, iterative decision was taken to group primary incidents by the most frequent clinical and medication management processes involved.²⁵ All grouped incidents with free-text narratives containing two or more of the top ten contributory factors were inductively coded using NVivo by BB, to identify and summarise relationships and interactions in incident contexts, contributing and mitigating factors. Thematic patterns and

variances across primary incidents and decisions in attributing significance to findings were discussed and refined with SG, ACS, KP, SB and JC.

Synthesis

Quantitative and qualitative findings were integrated to provided complimentary insights and identify priority areas for interventions.⁴¹ We used a driver diagram technique ⁴² to map priority areas for improving safe and timely injectable medication care, informed by existing evidence for targeted interventions.

Public involvement

The study was supported throughout by our Public and Clinician Advisory Group: four family carers and two community nurses. Group members met together three times to discuss our study and helped in refining our driver diagram and provided valuable, nuanced insights on the implications for practice.⁴³

Results

419 patient safety incidents were included. Incidents mainly occurred in patients' own homes (74.7%, 313/419) or residential care homes (11.5%, 48/419) (Table 2). Opioids (44.4%, 186/419) and sedatives (e.g. midazolam) (26.3%, 110/419) were the most commonly involved medications. Multiple medications were involved in 22.4% (94/419) incidents, although not all narratives indicated the drugs involved. Injectable medications were typically prescribed for use subcutaneously and 48.2% (202/419) of incidents involved syringe drivers (continuous subcutaneous infusions delivered via a portable machine over 24-hours).

Table 2. Patient and clinical characteristics of the 419 incidents

	n	(%)
Age range of patients involved		
18-65	91	(21.7%)
66-75	89	(21.2%)

76-85	117 (27.9%)
86+	122 (29.1%)

Place of incident occurrence

Home	313 (74.7%)
Residential care home	48 (11.5%)
Nursing home	20 (4.8%)
Transfer between care settings	16 (3.8%)
General practice surgery	8 (1.9%)
Ambulance-based care	3 (0.7%)
Community pharmacy	3 (0.7%)
Out-of-hours service base	3 (0.7%)
Other	5 (1.0%)

Medication involved*

Opioid	186 (44.4%)
Sedative / anxiolytic	110 (26.3%)
Antiemetic	59 (14.1%)
Antimuscarinic	51 (12.2%)
Non-opioid analgesia	2 (0.5%)
Other	14 (3.3%)

Syringe driver involved

Yes	202 (48.2%)
No	224 (53.5%)
Unclear	3 (0.7%)

Harm severity (reclassified)

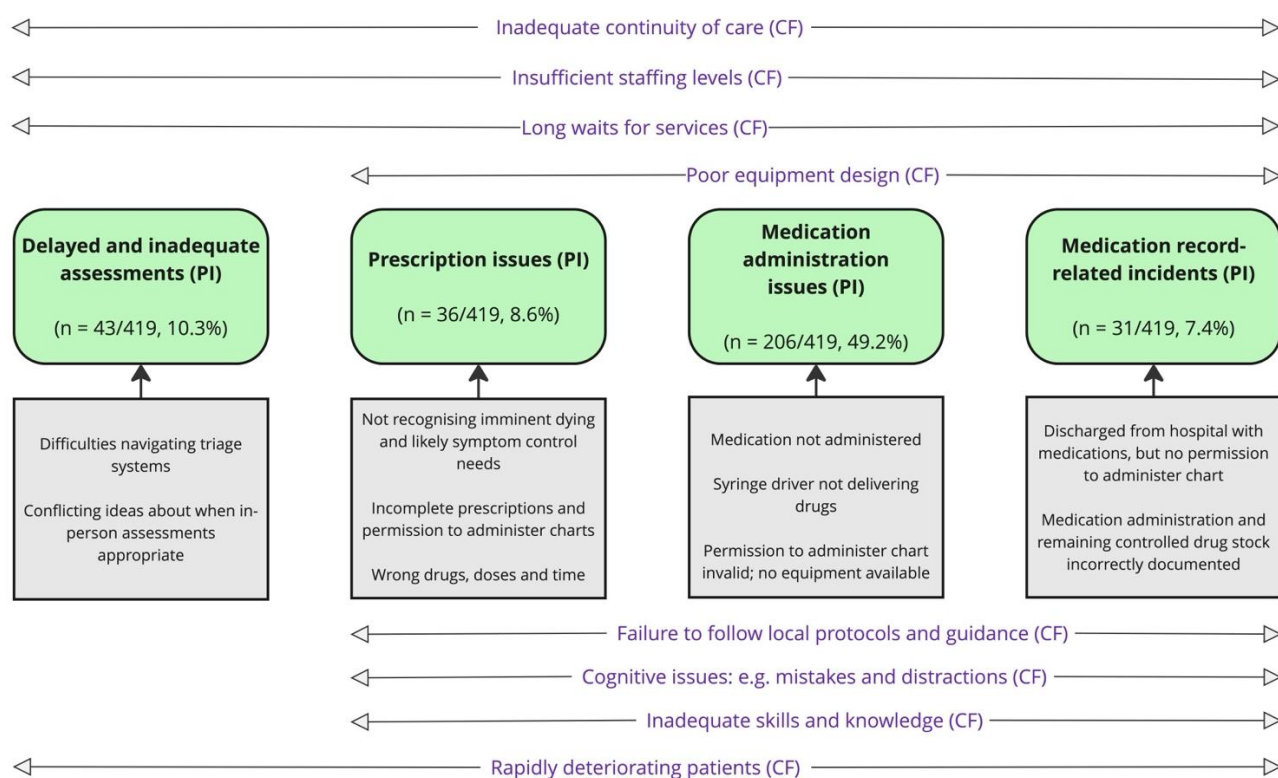
No harm / near miss	143 (34.1%)
Low harm	143 (34.1%)
Moderate harm	76 (18.1%)
Severe harm	23 (5.5%)
Death	8 (1.9%)
Insufficient details to classify	26 (6.2%)

*Two or more medications were involved in 94 incidents; 126 incidents did not indicate what drugs, if any, were involved.

59.7% (250/419) of reports described patient harm, 34.1% (143/419) detailed no harm or near misses, and 6.2% (26/419) provided insufficient detail to classify severity. 68 reports, were labelled by reporters as 'no harm' incidents, yet physical and psychological harms to patients and their families were evident and incidents were reclassified for the study accordingly. Only eight incidents resulting in death were included: most were excluded as they were not about incidents relating to injectable medications or simply reported expected deaths.

Four main types of recurring primary patient safety incidents were identified: medication administration issues (49.2% 206/419); delayed and inadequate assessments (10.3%, 43/419); prescription issues (8.6%, 36/419); and medication record-related incidents (7.4%, 31/419). The most identified contributory factors across all incidents were: inadequate continuity of care (58%, 247/419); cognitive issues (39.9%, 167/419); rapidly deteriorating patients (30.8%, 129/419); and failure to follow local protocols and guidance (15%, 63/419) (Figure 3).

Figure 3. Process map of the recurring primary incidents and contributory factors in injectable medication incidents



Key: PI = Recurring primary incident types (green), CF = Contributory factors (purple)

Note: Common examples of the four recurring primary patient safety incidents are provided. Key recurring contributory factors have been highlighted.

Medication administration issues

49.2% of primary incidents (206/419) were medication administration issues. Patient outcomes included missed medication doses (128/206), delays in treatment (127/206), pain and discomfort (90/206), agitation (53/206), and disturbed dying - where patients were recorded as dying in considerable distress (30/206).

Reports about medication not being commenced or administered in a timely way (135/206) often detailed rapidly changing situations where medication could not be administered by visiting nurses as valid 'permission to administer' charts, equipment or medication supplies were not available. Ineffective communication between healthcare teams was a frequent precursor to these primary incidents. Continuity of care and processes to check valid prescription charts and medication (re)supplies, where available, were compromised when multiple teams were involved and no single clinician/team led care. Families faced difficulties getting community nursing

and hospice at home services to visit at weekends and resorted to calling emergency services:

Community nurse report. "Family have been trying to get hold of a healthcare professional for palliative care and support. Family state that they were not able to access anyone for the past three days. They have watched their relative deteriorate and be in pain. They have rung 999 [emergency services] to give stat doses and [hospice team] refused to attend... Stat [injection] dose records were on [Ambulance Trust] follow up sheets for patients... Patient was clearly in last stages of their life".

[Study ID 41002. Location: patient's home] Reported degree of harm: no harm; reclassified as moderate harm.

Incident report narratives indicated unreliable processes for triaging and arranging urgent community nurse symptom control input visits; urgent messages were not given to the nurses allocated to visits. Further delays in symptom control care were mitigated when families or clinicians chased services:

Out-of-hours community nurse report. "Call placed at 5.00am as palliative patient was in pain and agitated. Care staff and [family] were unhappy as they reported that they placed a call at 2.30am and when no one had visited by 4.30am they made contact again and the call had not been logged. When I visited patient at 7.00am [as I] was held up with a previous visit, they informed me how long [they] had been waiting. Apologies given to both the [family] and care staff. Incident highlighted to call takers manager by email... Admin error."

[Study ID 23012. Location: residential care home] Reported degree of harm: no harm; reclassified as low harm.

Issues in physically administering injectable medications were detailed in 71/206 reports. These included the wrong dose (43/206) or wrong medication (7/206) being given, with charts being misread due to distractions. Reports highlighted that clinicians were often working in stressful situations, with limited information about

imminently dying patients. Not following local protocols and poorly designed 'permission to administer' charts contributed to incidents:

Agency community nurse report. "Call out to an end-of-life patient for a stat dose of pain relief by injection. I mistakenly took it from the dose stated for syringe driver which was [fentanyl] 50mcg. The dose should have been 25mcgs, I gave twice the amount [as an injection]". Manager adds to incident narrative: "Important that staff are extremely careful when administering controlled drugs... This is the second occasion recently when the administering of medication has been taken from the wrong part of the palliative drug chart."

[Study ID 17705. Setting: residential care home] Reported degree of harm: no harm; reclassified as 'insufficient details'.

Difficulties in delivering drugs via syringe drivers were commonplace (58/206) and typically resulted in under- or over-doses of medication. Recurring issues included syringe drivers being incorrectly renewed, or the machine turning itself off in-between visits. This equipment required technical skill to set up, appeared poorly designed and prone to settings being accidentally changed or malfunctioning silently:

Community nurse report. "Syringe driver replenished with patient's medications, all okay, pump delivering, patient settled. Visit again today to replenish syringe driver and it was turned off and had only been delivering medications yesterday for around 1-hour so patient did not have any of the medication in the driver. Asked staff if they heard the alarm and they stated no... Battery was replaced yesterday on visit and it was 100% and today it was down to 26%."

[Study ID 31890. Location: residential care home] Reported degree of harm: no harm; reclassified as low harm]

Contributory factors in medication administration incidents included poor equipment design, mistakes and distractions, services being busy and insufficient staffing, inadequate skills and knowledge, reliance on agency staff and inadequate continuity of care.

Delayed and inadequate assessments

10.3% (43/419) of incident reports described delayed and inadequate clinical assessments, often resulting in patients not receiving timely prescriptions of injectable medications. Patient outcomes included delays in management and treatment (30/43), treating without sufficient information (17/43), agitation (9/43), and pain and discomfort (8/43).

Insufficient referrals and communication between care providers, especially during out-of-hours periods and on hospital discharge, and difficulties navigating GP triage systems, frequently contributed to delays and inadequate assessments. Patient harms were mitigated when nurses advocated for clinical reviews or sourced alternative prescriber reviews. It was typical for these incidents to be reported by community nurses; narratives often presented nurses' frustrations about services not being accessible or responsive:

In-hours community nurse report: "Handover from night team to report that they had received a phone call from paramedics attending [patient]. Out-of-hours community nurse reported that she had requested a out-of-hours GP visit for [patient] for assessment and symptom management. Followed up on this request with a phone call to out-of-hours GP. [GP's initials] did not at this point in time believe a home visit was required by him. I disagreed with this... Further discussion with [another] out-of-hours GP in the central dispatch team who re triaged and allocated for home visit... The just in case [anticipatory] medications supplied previously were out of date so no available medications to give."

[Study ID 54400. Location: patient's home] Reported degree of harm: severe harm; left as severe harm.

Conflicting ideas about appropriateness of assessments occurred between families and clinical teams. One family reported that an out-of-hours nurse was reluctant to visit and lacked compassion while the patient was agitated. This led to family members voicing concerns about symptom management and assessments in the future:

In-hours community nurse report. “[spouse] and family were extremely distressed with the fact they had called out-of-hours as [patient] was extremely agitated. The [family] was called back 30 minutes later by who [they] think was a nurse, who stated that [patient’s address] is very far way, that [they] was all the way in [another town] and had [they] tried oramorph? ... [Family] explained that the oramorph had not worked.... In the end, the nurse stated [they] would visit, but the [family should] give the patient some oramorph, and if it calmed [them] down, to ring the out-of-hours back to cancel the visit. In the end, the [family] said forget it as [they] felt the nurse did not want to visit, and [they] did not want somebody [they] felt was not very compassionate to visit. Family extremely unhappy with how they were treated.”

[Study ID 80342. Location: patient’s home] Reported degree of harm: no harm; reclassified as low harm.

Contributory factors included inadequate continuity of care, rapidly deteriorating patients, insufficient staffing, services being busy with long waits for care, and disagreements amongst teams regarding priority and need for home visits.

Prescription issues

8.6% (36/419) of primary incidents related to prescription issues. Patient outcomes included delays in management or treatment (13/36), treating without sufficient

information (12/36), staff recognising mistakes and mitigating harms (10/36) and pain and discomfort for patients (6/36).

Anticipatory prescriptions were not completed appropriately in 24/36 incidents, often due to poor hospital discharge planning processes, or clinicians and teams not recognising likely symptom control requirements within the community:

Out-of-hours community nurse report. "Email received from Single Point of Access at start of night shift, sent at 3pm [regarding] a patient who urgently needed controlled drugs and symptom control at home ... There was no [permission to administer] chart and anticipatory medications in place for symptom relief ... The primary care team that includes the GP, palliative care, and community nursing services should have made better efforts to coordinate plans and put in place anticipatory medications, and not left to out-of-hours team."

[Study ID 36491. Location: patient's own home] Reported degree of harm: low harm; left as low harm.

Other reports (12/36) described prescription-related primary incidents. These included clinicians' prescribing inappropriate medication intervals, dangerously high doses of opioids and sedatives, or incorrectly completing 'permission to administer' charts. Conversely, when patients had previously been prescribed oral opioids, mistakes and omissions sometimes resulted in inappropriately low doses of injectable medications being prescribed. These were frequently identified and mitigated by clinicians before harm occurred. Patients experienced uncontrolled symptoms when prescription-related incidents were not prevented in time:

In-hours community nurse report. "Attended patient's home for a crisis call. Patient is end of life and syringe driver was commenced evening of [date: two days previously]. Whilst assessing patient for rescue dose of morphine sulphate I discovered that the patient had been taking 60mgs morphine

sulphate twice daily orally. But that the syringe driver was written up to commence at 5mg [by out-of-hours GP].”

[Study ID 20343. Location: patient’s home] Reported degree of harm: low harm; reclassified as ‘insufficient details’.

Recurring contributory factors included inadequate continuity of care, cognitive mistakes, inadequate skills and knowledge, failure to follow local protocols and guidance, rapidly deteriorating patients, inadequate staffing levels, and stretched services.

Medication record-related incidents

Medication record-related incidents were the primary incidents in 7.4% (31/419) of reports, often affecting continuity of care. Patient outcomes included treating without sufficient information (15/31), staff recognising mistakes and mitigating harm (14/31) and delays in management and treatment (7/31).

Eight primary incidents (8/31) reported situations where patients were discharged home from hospital with injectable medications prescribed and issued, but no permission to administer charts had been completed to enable their administration. Community nursing teams mitigated risks by contacting GPs and out-of-hours doctors to complete charts. Mistakes in documenting medications administered and remaining stock occurred in 10/31 incidents, especially when staff or services did not use cross-organisational shared records. These incidents were identified at subsequent community nurse visits and required internal investigations to identify if controlled medication had gone missing:

Community nurse report. “I visited a patient to administer end of life medication, upon looking at the paperwork there was 1 less vial of each morphine and midazolam... Controlled drug sheet not completed, nil vials missing... Training issue identified... New preceptee [nurse] made aware of correct paper documentation.”

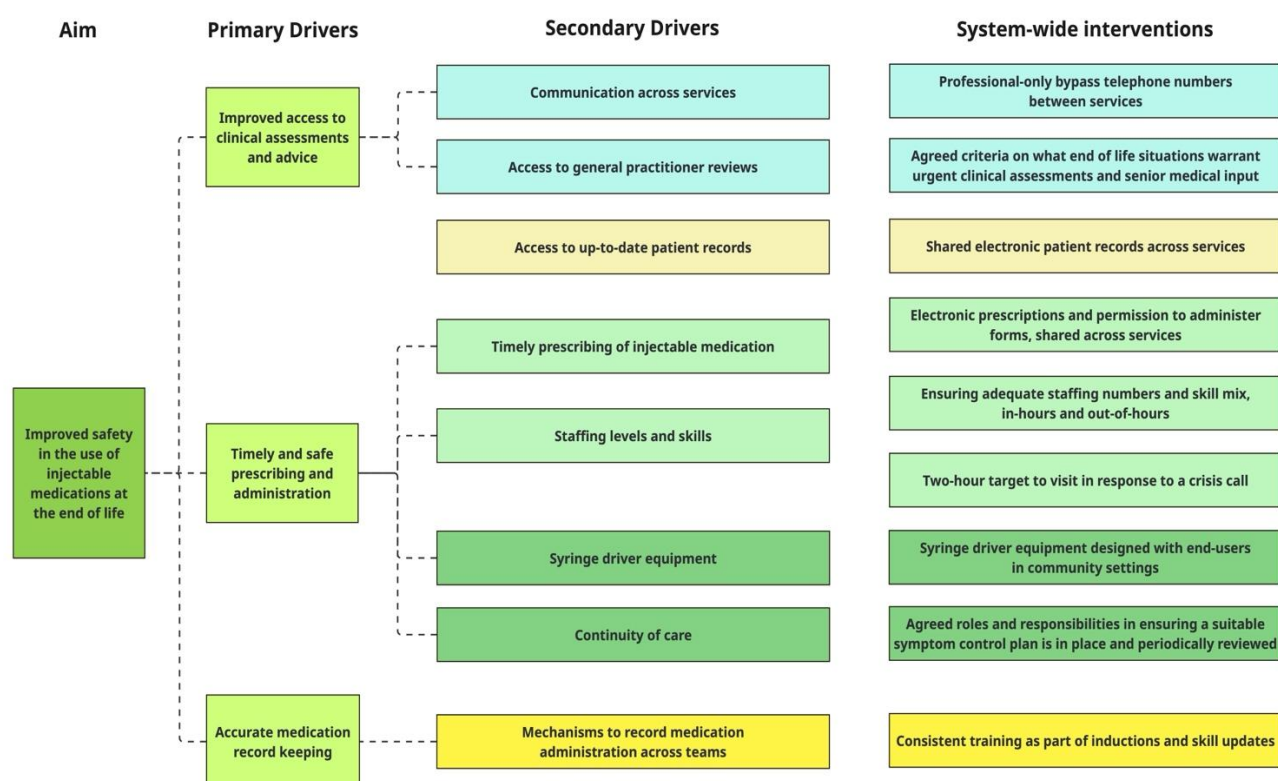
[Study ID 00286. Location: patient's home] Reported degree of harm: no harm; left as no harm.

Contributory factors often included failure to follow local protocols and guidance, mistakes and distractions, inadequate continuity of care, agency staff and new staff.

Driver diagram

We used our findings to identify priority areas for improving care: these were mapped into a driver diagram (Figure 4). This diagram highlights the data-driven primary and secondary drivers (improvement areas) requiring change, and evidence-informed system-wide interventions that could improve these elements (detailed on the right).

Figure 4. Driver diagram for system-wide improvement domains



Discussion

Summary

Injectable medication-related incidents in the community often involved opioids, sedatives and syringe driver equipment. Clinical assessment and prescribing issues, medication administration issues and medication record-related incidents were frequently involved. Incidents occurred during in-hours and out-of-hour periods, often involving multiple services. The recurring critical, and interacting, contributory factors were inadequate continuity of care, cognitive issues, poor equipment design, insufficient staffing levels and long waits for services, failures to follow local protocols and guidance, and rapidly deteriorating patients.

Our findings highlight that system-level interventions offer considerable potential for improving end-of-life symptom control care: ensuring support for timely access to assessments and prescriptions; enhancing sharing of information; implementing mechanisms to support timely clinician visits to administer medication; and using user-friendly and reliable syringe drivers.

Strengths and limitations

The stratified sampling approach enabled us to investigate a cross-section of incidents, reflecting a range of reported patient harms. Our mixed-methods analysis using national data provided nuanced insights into patterns and recorded contributory factors and mitigating actions that influence unsafe care, including across different healthcare organisations and teams. We identified recurring issues that can be hard to recognise and resolve at individual patient and service level.^{28,44,45,39}

Patient safety incidents are under-reported and any national incident database reliant upon self-reporting risks an unrepresentative sample of patient harms and near-misses.^{31,33} Report narratives reflect socially-constructed healthcare practices in what gets detailed and omitted, and are dependent on clinicians' interpretation of

events at the time. Certain incidents are more likely to be reported, including those resulting in serious patient harms and consequences including death. Consequently, we have not made inferences about absolute numbers of injectable medication incidents occurring in the community and their causes. Our analysis helps in identifying priority areas for improving care and possible targeted interventions. Our findings are informing our current longitudinal qualitative research investigating patients', family caregivers' and professionals' experiences of safe and effective injectable medication care.

Comparison with existing literature

Insufficient access to timely medical assessments have been repeatedly shown in qualitative studies to be a barrier to end-of-life prescribing.^{46–49} This is a key reason why the anticipatory prescribing of 'as required' injectable medications is advocated in research, international guidance, and expert consensus.^{11,12,18,48,50–53} Anticipatory prescriptions are frequently completed several weeks to months in advance of need, and require periodic review to ensure they remain clinically appropriate.^{3,8,20,54} Our study highlights that anticipatory prescribing is not always viable and (re)assessments can be significantly delayed. To facilitate timely reviews, community nurses require easy and rapid access to prescribers in-hours and out-of-hours.^{26,46,55,56} Two-way communication can be facilitated with professional-only bypass telephone numbers, reducing delays. The adoption of electronic prescribing and electronic permission to administer forms can also increase the efficiency, safety and transfer of information between services.²⁶ This is not yet standardised practice in the UK.

Inadequate continuity of care was a recurring contributory factor in many incidents, consistent with previous research.^{57–60} Harmful outcomes were mitigated when clinicians and teams identified and addressed missing or incomplete prescriptions, permission to administer charts and problems with record keeping. Informational continuity of care across services and between in-hours and out-of-hours care providers was a concerning issue contributing to patient harms. Previous studies have stressed the importance of informational and relational continuity in providing consistent, safe and effective end-of-life care.^{3,19,22,45,61–63} Despite increasing

adoption of shared electronic records, informational continuity of care remains fragile when multiple services are involved.^{28,45,57,61,64} Our findings emphasise the importance of cross-organisational structures to provide continuity of care, including clearly defined roles and responsibilities to ensure a suitable symptom control plan is in place and periodically reviewed.

The use of injectable medications relies on skilled professionals being available to administer them at short notice.^{12,15,16,21} We found the limited availability of staff, often covering large areas, contributed to delays. The skills and knowledge of visiting nurses alongside high workloads, insufficient staffing and continuity of care, contributed to medication administration-related incidents. Our findings support those of previous studies analysing palliative care patient safety incidents.²²⁻²⁴ The presence of anticipatory medications in the home does not compensate for over-stretched community services,^{65,66} if clinicians are not available to administer medications.^{15,52} Training willing and able family carers to give 'as required' injections, with access to phone advice at the time, is an alternative approach being increasingly adopted for a subset of patients in the UK;²⁷ this is routine practice in several countries.⁹

Staff factors (e.g. mistakes) alongside unintuitive and unreliable syringe drivers contributed to injectable medication underdoses and overdoses. Common problems encountered included settings being inadvertently changed or machines turning themselves off between visits. Syringe driver equipment has become more technically complicated to use, partly due to attempts to correct concerns highlighted in a series of medical device alerts.⁶⁷ As a result, users have to anticipate and mitigate several potential technical issues, often in stressful situations.²⁴

Implications for research and practice

Our research shows that injectable medication incidents in the community commonly involve assessment and prescribing issues, alongside medications not being administered in a timely way. Patterns in these primary incidents provide invaluable opportunities to learn from what goes wrong and why. The frequent under-estimation

of harm in reports, including notable delays in symptom relief going unreported or reported as 'no harm' incidents is problematic as this classification is less likely to get service providers' attention and stimulate system-wide learning.⁶⁸ We are conducting a separate study analysing reported 'no harm' incidents to explore potential learning.

System-wide targeted interventions are needed to address recurrent contributory factors and mitigate harms. Future syringe driver equipment requires designing in partnership with end-users in community settings. Community healthcare systems need to ensure adequate staffing numbers and skills across teams to provide safe and responsive end-of-life symptom control. One related potential intervention, suggested by our public and clinician contributors, is a two-hour system-wide target to visit to administer medication in response to a crisis end-of-life care symptom control care call. Like all targets, this may have desirable and also unintended consequences on wider care delivery and staff wellbeing. However, as providing timely and effective end-of-life symptom relief is a clinical and societal priority this potential lever warrants further research as a pilot intervention.

Acknowledgements

We would like to thank the members of our Public and Clinical Advisory Group for their invaluable input: Jenny Rough, Pretty Manyimo, Roberta Lovick, Julie Draper, Bella Madden, Alison Blackmore; Drs Paul Howard, Clare Finney, Tony Duffy, Sally Carding, Arjun Kingdon and Robert Brodrick for their expert input in devising the medication search terms; NHS England information analyst colleagues for their help in refining and running the search.

Funding

This work is supported by the Wellcome Trust [225577/Z/22/ZSB]. SB and BB are supported by the NIHR Applied Research Collaboration East of England (NIHR ARC EoE) at Cambridgeshire and Peterborough NHS Foundation Trust. SG was

supported by NHS Wales Shared Services Partnership. The views expressed are those of the authors and not necessarily those of the NIHR, the Department of Health and Social Care or GIG Cymru (NHS Wales).

Ethical approvals

The University of Cambridge Psychology Research Ethics Committee granted ethical approval [PRE.2022.127]. Data access was granted by NHS England as data custodians: this link-anonymised data was securely held for the duration of the study.

Data sharing

We are unable to share primary data. These data are held by NHS England and applications for using National Reporting and Learning System (NRLS) data are decided on a case-by-case basis. Permission was granted to Cardiff University through a data sharing agreement for the duration of our study.

Conflicts of interests

The authors have no conflicts of interest.

References

1. Mehta A, Chan LS, Cohen SR. Flying blind: sources of distress for family caregivers of palliative cancer patients managing pain at home. *J Psychosoc Oncol* 2014; 32(1): 94–111.

2. Wilson E, Caswell G, Pollock K. The 'work' of managing medications when someone is seriously ill and dying at home: A longitudinal qualitative case study of patient and family perspectives'. *Palliat Med* 2021; 35(10): 1941–1950.
3. Bowers B, Barclay SS, Pollock K, et al. GPs' decisions about prescribing end-of-life anticipatory medications: a qualitative study. *Br J Gen Pract* 2020; 70(699): e731–e739.
4. Johansson T, Pask S, Goodrich J, et al. *Better End of Life Care 2024. Time to care: Findings from a nationally representative survey of experiences at the end of life in England and Wales*. London: Marie Curie, <https://www.mariecurie.org.uk/globalassets/media/documents/policy/beol-reports-2024/beol-2024-time-to-care-report.pdf> (4 September 2024).
5. Independent Review of the Liverpool Care Pathway. More Care, Less Pathway: the independent review of the Liverpool Care Pathway, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/212450/Liverpool_Care_Pathway.pdf (2013).
6. Bowers B, Pollock K, Barclay S. Simultaneously reassuring and unsettling: a longitudinal qualitative study of community anticipatory medication prescribing for older patients. *Age Ageing* 2022; 51(12): afac293.
7. Office for Health Improvement and Disparities. Palliative and end of life care profile: December 2023 update. Statistical commentary, <https://www.gov.uk/government/statistics/palliative-and-end-of-life-care-profiles-december-2023-data-update/palliative-and-end-of-life-care-profile-december-2023-update-statistical-commentary> (2023).
8. Bowers B, Pollock K, Barclay S. Unwelcome memento mori or best clinical practice? Community end-of-life anticipatory medication prescribing practice: a mixed methods observational study. *Palliat Med* 2022; 36(1): 95–104.
9. Bowers B, Antunes B, Etkind S, et al. Anticipatory prescribing in community end of life care: systematic review and narrative synthesis of the evidence since 2017. *BMJ Support Palliat Care* 2024; 8(13 e3): e612–e623.
10. Scobie S, Julian S, Bagri S, et al. What primary and community services do people who die at home receive? Nuffield Trust blog, <https://www.nuffieldtrust.org.uk/news-item/end-of-life-care-blog> (2024).
11. Khalil H, Garrett M, Byrne A, et al. Mapping end-of-life and anticipatory medications in palliative care patients using a longitudinal general practice database. *Palliat Support Care* 2022; 20(1): 94–100.
12. Wilson E, Morbey H, Brown J, et al. Administering anticipatory medications in end-of-life care: a qualitative study of nursing practice in the community and in nursing homes. *Palliat Med* 2015; 29(1): 60–70.

13. Marvin R, Grove S, Spathis A, et al. P-42 Injectable medication at the end of life: a common task for generalist community clinicians. *BMJ Supportive & Palliative Care* 2017, 7: A15–A16.
14. Emanuel G, Verne J, Forbes K, et al. Community prescribing for cancer patients at the end of life: a national study. *BMJ Support Palliat Care* 2023; 7(13 e2): e361–e372.
15. Bowers B, Pollock K, Wilkerson I, et al. Administering injectable medications prescribed in the anticipation of the end of life in the community: A mixed-methods observational study. *Int J Nurs Stud* 2024; 153: 104734.
16. Lee C, Tran TT, Ross J. Anticipatory prescribing in community end-of-life care. *BMJ Support Palliat Care* 2024; 14(3): 353–357.
17. Bowers B, Ryan R, Kuhn I, et al. Anticipatory prescribing of injectable medications for adults at the end of life in the community: A systematic literature review and narrative synthesis. *Palliat Med* 2018; 33(2): 160–177.
18. Bowers B. *Understanding community end-of-life anticipatory medication care (Doctoral thesis)*. University of Cambridge, <https://doi.org/10.17863/CAM.83530> (2021).
19. Staats K, Tranvåg O, Grov EK. Home-care nurses' experience with medication kit in palliative care: *J Hosp Palliat Nurs* 2018; 20(6): E1–E9.
20. Wowchuk SM, Wilson EA, Embleton L, et al. The Palliative Medication Kit: An Effective Way of Extending Care in the Home for Patients Nearing Death. *J Palliat Med* 2009; 12(9): 797–803.
21. Khalil H, Poon P, Byrne A, et al. Challenges Associated with Anticipatory Medications in Rural and Remote Settings. *J Palliat Med* 2019(3); 22: 297–301.
22. Yardley I, Yardley S, Williams H, et al. Patient safety in palliative care: A mixed-methods study of reports to a national database of serious incidents. *Palliat Med* 2018; 32(8): 1353–1362.
23. Williams H, Donaldson SL, Noble S, et al. Quality improvement priorities for safer out-of-hours palliative care: Lessons from a mixed-methods analysis of a national incident-reporting database. *Palliat Med* 2019; 33(3): 346–365.
24. Brown A, Yardley S, Bowers B, et al. Multiple points of system failure underpin continuous subcutaneous infusion safety incidents in palliative care: A mixed methods analysis. *Palliat Med* 2025; 39(1): 7–21.
25. Ryan R, Bowers B, Spathis A, et al. 11 How is anticipatory prescribing in community end of life care governed in the UK? A content analysis of national and local guidance documents. *BMJ Support Palliat Care* 2020; 10(Suppl 1): A4–5.

26. Antunes BCP, Bowers B, Barclay S, et al. Community-based anticipatory prescribing during COVID-19: a qualitative study. *BMJ Support Palliat Care* 2022; 14: e2977–e2985.
27. Poolman M, Roberts J, Wright S, et al. Carer administration of as-needed subcutaneous medication for breakthrough symptoms in people dying at home: the CARiAD feasibility RCT. *Health Technol Assess* 2020; 24(25): 1–150.
28. Kurahashi AM, Kim G, Parry N, et al. Feasibility of prospective error reporting in home palliative care: A mixed methods study. *Palliat Med* 2025; 39(1): 22–30.
29. Payne S, Turner M, Seamark D, et al. Managing end of life medications at home—accounts of bereaved family carers: a qualitative interview study. *BMJ Support Palliat Care* 2015; 5(2): 181–188.
30. World Health Organization & WHO Patient Safety. *Conceptual framework for the international classification for patient safety version 1.1: final technical report January 2009*. World Health Organization.
31. Waring JJ. Constructing and re-constructing narratives of patient safety. *Soc Sci Med* 2009; 69(12): 1722–1731.
32. Cooper J, Edwards A, Williams H, et al. Nature of Blame in Patient Safety Incident Reports: Mixed Methods Analysis of a National Database. *Ann Fam Med* 2017; 15(5): 455–461.
33. Carson-Stevens A, Hibbert P, Williams H, et al. Characterising the nature of primary care patient safety incident reports in the England and Wales National Reporting and Learning System: a mixed-methods agenda-setting study for general practice. *Health Serv Deliv Res* 2016; 4(27): 1–76.
34. Yardley S, Francis S-A, Chuter A, et al. Mixed-methods study protocol: do national reporting and learning system medication incidents in palliative care reflect patient and carer concerns about medication management and safety? *BMJ Open* 2021; 11(9): e048696.
35. O’Cathain A, Murphy E, Nicholl J. Three techniques for integrating data in mixed methods studies. *BMJ* 2010; 341(1): c4587–c4587.
36. Hibbert P, Runciman W, Deakin D. *A Recursive Model of Incident Analysis*. Adelaide, Australia: Australian Patient Safety Foundation, 2007.
37. Cooper J, Williams H, Hibbert P, et al. Classification of patient-safety incidents in primary care. *Bull World Health Organ* 2018; 96(7): 498–505.
38. Richards L. *Handling qualitative data: a practical guide*. Fourth. Thousand Oaks: SAGE Publications, 2021.

39. Clarkson P, Bogle D, Dean J. *Engineering better care a systems approach to health and care design and continuous improvement*. Royal Academy of Engineering, <https://raeng.org.uk/media/wwko2fs4/final-report-engineering-better-care-version-for-website.pdf> (August 2017).
40. Carayon P, Schoofs Hundt A, Karsh B-T, et al. Work system design for patient safety: the SEIPS model. *Qual Health Care* 2006; 159(Suppl 1): i50–i58.
41. Urquhart A, Yardley S, Thomas E, et al. Learning from patient safety incidents involving acutely sick adults in hospital assessment units in England and Wales: a mixed methods analysis for quality improvement. *J R Soc Med* 2021; 114(12): 563–574.
42. Clinical Excellence Commission. Driver diagrams. *Driver diagrams*, <https://www.cec.health.nsw.gov.au/CEC-Academy/quality-improvement-tools/driver-diagrams> (2024).
43. Bowers B, Lovick R, Pollock K, et al. Patient and public involvement in general practice research. *Br J Gen Pract* 2020; 70(694): 220–221.
44. Carayon P, Wooldridge A, Hoonakker P, et al. SEIPS 3.0: Human-centered design of the patient journey for patient safety. *Appl Ergon* 2020; 84: 103033.
45. Papavasiliou E, Hoare S, Bowers B, et al. Out-of-hours services and end-of-life hospital admissions: a complex intervention systematic review and narrative synthesis. *Br J Gen Pract* 2021; 71(711): e780–e787.
46. Bowers B, Redsell SA. A qualitative study of community nurses' decision-making around the anticipatory prescribing of end-of-life medications. *J Adv Nurs* 2017; 73(10): 2385–2394.
47. Lawton S, Denholm M, Macaulay L, et al. Timely symptom management at end of life using 'just in case' boxes. *Br J Community Nurs* 2012; 17(4): 182–190.
48. Faull C, Windridge K, Ockleford E, et al. Anticipatory prescribing in terminal care at home: what challenges do community health professionals encounter? *BMJ Support Palliat Care* 2013; 3(1): 91–97.
49. Perkins E, Gambles M, Houten R, et al. The care of dying people in nursing homes and intensive care units: a qualitative mixed-methods study. *Health Serv Deliv Res* 2016; 4(20): 1–410.
50. National Institute for Health and Care Excellence. Care of dying adults in the last days of life, <https://www.nice.org.uk/guidance/ng31/resources/care-of-dying-adults-in-the-last-days-of-life-pdf-1837387324357> (2015).
51. McGlinchey T, Early R, Mason S, et al. Updating international consensus on best practice in care of the dying: A Delphi study. *Palliat Med* 2023; 37(3): 329–342.

52. Royal College of General Practice, Marie Curie. The daffodil standards: self-assessment evidence and guidance, <https://www.rcgp.org.uk/learning-resources/daffodil-standards> (2019).
53. Healthcare Improvement Scotland Right Decision Service. Anticipatory prescribing, <https://rightdecisions.scot.nhs.uk/scottish-palliative-care-guidelines/anticipatory-prescribing/?searchTerm=anticipatory%20prescribing> (2025).
54. Bowers B, Pollock K, Dickman A, et al. Anticipatory syringe pumps: benefits and risks. *BMJ Support Palliat Care* 2021; 11: 303–304.
55. Wilson E, Seymour J, Seale C. Anticipatory prescribing for end of life care: a survey of community nurses in England. *Prim Health Care* 2016; 26(9): 22–27.
56. Latter S, Campling N, Birtwistle J, et al. Supporting patient access to medicines in community palliative care: on-line survey of health professionals’ practice, perceived effectiveness and influencing factors. *BMC Palliat Care* 2020; 19(1): 148.
57. Hudson BF, Best S, Stone P, et al. Impact of informational and relational continuity for people with palliative care needs: a mixed methods rapid review. *BMJ Open* 2019; 9(5): e027323.
58. Maybin J, Charles A, Honeyman M. *Understanding quality in district nursing services: learning from patients, carers and staff*. London: The King’s Fund.
59. Green E, Knight S, Gott M, et al. Patients’ and carers’ perspectives of palliative care in general practice: A systematic review with narrative synthesis. *Palliat Med* 2018; 32(4): 838–850.
60. Seamark D, Blake S, Brearley SG, et al. Dying at home: a qualitative study of family carers’ views of support provided by GPs community staff. *Br J Gen Pract* 2014; 64(629): e796–e803.
61. Yardley S, Williams H, Bowie P, et al. Which human factors design issues are influencing system performance in out-of-hours community palliative care? Integration of realist approaches with an established systems analysis framework to develop mid-range programme theory. *BMJ Open* 2022; 12(1): e048045.
62. Bowers B, Roderick S, Arnold S. Improving integrated team working to support people to die in the place of their choice. *Nurs Times* 2010; 106(32): 14–16.
63. Wilson E, Seymour J. The importance of interdisciplinary communication in the process of anticipatory prescribing. *Int J Palliat Nurs* 2017; 23(3): 129–135.
64. Petrova M, Wong G, Kuhn I, et al. Timely community palliative and end-of-life care: a realist synthesis. *BMJ Support Palliat Care* 2024; 19(14 e3): e2423–e2437.

65. Rolewicz L, Palmer B, Lobont C. *The NHS workforce in numbers*. Nuffield Trust, <https://www.nuffieldtrust.org.uk/resource/the-nhs-workforce-in-numbers#toc-header-3> (7 February 2024).
66. Queen's Nursing Institute. District nursing today: the view of district nurse team leaders in the UK, <https://qni.org.uk/wp-content/uploads/2024/08/District-Nursing-Today-2024.pdf> (2024).
67. Medicines & Healthcare products Regulatory Agency. Medicine device safety bulletin: MDSB-20-02, <https://assets.publishing.service.gov.uk/media/5fa3bda0d3bf7f03a6550df0/MDSB-2020-02.pdf> (2020, accessed 29 August 2024).
68. Macrae C. The problem with incident reporting. *BMJ Qual Saf* 2016; 25(2): 71–75.