University of Sheffield

SDEC Study

Reducing Avoidable Admissions in Acute Hospital Care: The role and impact of Same Day Emergency Care Services

RESEARCH PROTOCOL
Version 1.1
03-October-2025

IRAS: 340043
FUNDING: NIHR HS&DR Research Programme (ref: NIHR160821)

Signature Page

The undersigned confirm that the following protocol has been agreed and accepted and that the Chief Investigator agrees to conduct the study in compliance with the approved protocol and will adhere to the principles outlined in the Declaration of Helsinki, the Sponsor's SOPs, and other regulatory requirement.

I agree to ensure that the confidential information contained in this document will not be used for any other purpose other than the evaluation or conduct of the investigation without the prior written consent of the Sponsor.

I also confirm that I will make the findings of the study publicly available through publication or other dissemination tools without any unnecessary delay and that an honest accurate and transparent account of the study will be given; and that any discrepancies from the study as planned in this protocol will be explained.

For and on behalf of the Study Sponsor:
Signature: Date: ...../...../.....
.....
Name (please print):
.....
Position: .....

Chief Investigator:
Signature: ..... Date: ...../...../.....
Name: (please print):
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Version Control

Version Number	Author	Proposed change	Date
V1.0	Richard Jacques	NA	01-Oct-2024
V1.1	Ciarán McInerney	1. Updating staff details to reflect departures, replacements, and recruitments. 2. Changing the number of hospital sites to be observed from “9-10” to “8”. 3. Typos and clarifications. 4. Inclusion of ambulance staff in the list of desired participants for interviews.	03-Oct-2025

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General Information

Sponsor

University of Sheffield

Western Bank

Sheffield

S10 2TN

Chief Investigators

Dr Richard Jacques
School of Medicine and Population Health
University of Sheffield
Regent Court
30 Regent Street
Sheffield
S1 4DA

Phone: 0114 222 0813
Email: r.jacques@sheffield.ac.uk

Professor Suzanne Mason
School of Medicine and Population Health
University of Sheffield
Regent Court
30 Regent Street
Sheffield
S1 4DA

Phone: 0114 222 0694
Email: s.mason@sheffield.ac.uk

Co-Investigators

Dr Rebecca Simpson (School of Medicine and Population Health, University of Sheffield)

Dr Jen Lewis (School of Medicine and Population Health, University of Sheffield)

Dr Fiona Sampson (School of Medicine and Population Health, University of Sheffield)

Anna Cantrell (School of Medicine and Population Health, University of Sheffield)

Dr Liz Croot (School of Medicine and Population Health, University of Sheffield)

Dr Jo Coster (School of Medicine and Population Health, University of Sheffield)

Ciarán McInerney, PhD (School of Medicine and Population Health, University of Sheffield)

Dr Jaqui Long (School of Medicine and Population Health, University of Sheffield)

Professor Colin Angus (School of Medicine and Population Health, University of Sheffield)

Dr Susan Croft (Sheffield Teaching Hospitals NHS Foundation Trust)

Professor Daniel Lasserson (Warwick Medical School, University of Warwick)

Howard Whiting (PPI Representative)

1 Summary of Research (Abstract)

1.1 Research Question

What impact are same day emergency care (SDEC) services having on patterns of acute hospital admission and discharge?

1.2 Background

Emergency Departments (EDs) in England are under exceptionally high demand, and this has continued to rise consistently since 2003. Emergency admissions are also increasing, documented at 6.5 million in 2023, with a corresponding rise in occupancy levels for acute hospital beds. On average, 95% of inpatient beds are full. High bed occupancy is a key driver of worsening ED performance, which in turn has a direct impact on ambulance response and handover times. Up to 80% of hospital beds are filled by unplanned admissions, but many of these admissions are discharged within 24 hours of arrival. This suggests that alternative management may avoid admission for a subset of these patients.

Reducing overall acute admissions is a priority for the NHS, because it is acknowledged to be, at times, inefficient, expensive and not always in the best interests of patients. SDEC services were established to provide care for patients being considered for emergency admission, and offer investigation, care and treatment of patients for whom admission to hospital would have otherwise been the default option. SDEC is separate from ED and aims to streamline clinical processes for same day delivery, thereby reducing emergency admissions. Under the NHS Long Term Plan, SDEC models were intended to be available 12 hours a day, 7 days a week in every hospital from 2019/20 [NHS 2019]. However, SDEC services have been inconsistently implemented across England, and no research has yet been carried out into its effectiveness in reducing emergency admissions.

1.3 Aims and Objectives

This study aims to:

1. Review the evidence relating to different definitions and perspectives on attendances suitable for SDEC Services
2. Describe a taxonomy of the current provision of SDEC Services nationally
3. Understand current acute admission patterns and their variation across England
4. Measure the impact of introducing SDEC services in reducing avoidable emergency admissions, cost to the NHS, on staff and patients
5. Identify features of SDECs that are most successful in reducing avoidable admission rates, and improving ED performance, patient and staff experience

Objectives:

1. Describe existing definitions of patients and conditions suitable for attendance at SDEC Services by undertaking an international rapid literature review.
2. Understand how SDEC services are being delivered within England by undertaking a national survey of Acute Hospital Trusts and describing a taxonomy of services.

3. Apply definitions of conditions suitable for SDEC to explore trends in activity and outcomes over time, variation between hospitals, and patient groups using CUREd+, a national linked data set of routine ED and hospital admissions.
4. Explore how SDEC services impact ED performance, hospital admissions, staff and patient experience by undertaking detailed case studies of 6-8 hospitals with different SDEC configurations.
5. Explore the impact of SDECs by modelling the costs of introducing SDEC services in terms of avoided admissions, reattendance, readmission, hospital length of stay and outpatient appointments.

1.4 Methods

To address our objectives, we will undertake a mixed-methods study with three inter-related work packages, each with multiple components. Work package 1 will establish the evidence base regarding different definitions and perspectives on which attendances are suitable for SDEC and will survey current service provision for SDEC across England in order to identify different models of service delivery. This work package will take the form of a rapid literature review and a survey. Work package 2 will consist of a quantitative analysis of a linked dataset of routine emergency care data across England (the CUREd+ dataset) to explore trends in activity and outcomes before, during and after SDEC implementation, and will explore variation between hospitals and different patient groups. The same dataset will be used to perform a cost-consequence analysis which will establish the policy-level effect of SDECs on key outcomes and NHS costs. Work package 3 will examine 6-8 case study hospitals in detail, each with different service configurations, to understand how SDEC services impact hospital admission and ED performance, and the mechanisms by which SDECs may reduce emergency admissions. This work package will include quantitative and qualitative components to provide a contextualised understanding of the most effective SDEC considerations, how they work and are managed, and their economic consequences. Following the third work package we will use a triangulation protocol to integrate findings from each work package prior to final reporting and dissemination.

1.5 Timelines for delivery

The project will take 30 months. This will include project setup and ethics approval for WP1 and WP3. WP 1 and 2 will take place largely simultaneously, with WP1 (Mapping existing SDEC patients, conditions and configurations) scheduled for months 1-15 and WP2 (Analysis of National hospital admission rates and ED performance measures for SDEC conditions and their associated costs) for months 1-17. WP3 (Understanding the impact of SDECs on ED performance, hospital admissions, costs and staff & patients) will build on the results of WP1 and 2, and will take place during months 13-27. Synthesis of results from each work package will take place in the final three months of the project. Project steering group meetings will take place in months 2,15 and 27 to ensure timely delivery. PPI meetings will take place in months 2, 8, 15, 21 and 27 to ensure opportunity for feedback and guidance from PPI colleagues at key stages of the research.

1.6 Anticipated impact and dissemination

This study has significant policy and patient relevance given that reducing avoidable hospital admissions is a key challenge and priority for the government and NHSE. We anticipate that we will provide clear definitions of eligibility and use, quantify costs, and demonstrate patient outcomes of SDEC policy for the first time. We will identify key criteria for success of SDEC and provide guidance regarding successful service configurations, which will inform future strategies for reducing hospital admissions and ensuring SDEC service delivery is supported by strong evidence.

Findings will be of interest to a wide audience across health and social care, including academics, policy makers, commissioners, service providers, Voluntary, Community and Social Enterprises, patients and the public, and relevant royal colleges/societies. We will tailor outputs to this wide audience and use multiple media to achieve this. Standard academic publications and conference presentations will be produced for each work package and overall regarding project integration and summary findings. We will seek press releases regarding our findings and produce short reports and podcasts to highlight areas that will be of significant interest to different stakeholders. The study website and social media will be used to reach a wider public audience and will showcase animations and illustrated summaries to convey key findings. We will liaise with our contacts at NHSE and the DHSC to identify the most effective and impactful way to reach a wide audience for disseminating our findings. This will include the NHSE SDEC Programme of organisations and NHS Benchmarking. We will also work with the Royal College of Emergency Medicine (RCEM), the Society for Acute Medicine (SAM) and the Social Care Institute for Excellence (SCIE) to ensure a clear strategy of dissemination to best influence practice recommendations.

2 Lay Summary

Background:

Our hospitals are getting busier and busier leading to long waits in A&E departments for assessment and for a hospital bed. This leads to difficulties for hospitals and staff in delivering good patient care which can have a serious impact on safety of care and long-term health.

Some patients who are admitted to hospital can have safe care and better outcomes if they are treated without staying overnight. This can often lead to better experiences, reduced complications and reduced costs for the NHS. Same Day Emergency Care Services (SDEC) were developed by the NHS to provide safe care for patients without an overnight stay. Same Day Emergency Care services provide rapid assessment, diagnosis and treatment for a wide range of urgent conditions. However, there are a lot of differences in how these services are run across the country. At present we do not know what effect these services are having on patients, hospital admissions or A&E performance. Our study is designed to understand what effect Same Day Emergency Care Services are having on patient care and hospitals nationally.

Aims, Design and Methods:

There are 3 related work packages:

WP1
1) We will review existing research to understand how Same Day Emergency Care conditions and patients have been picked up before (WP1a)
2) We will survey all major hospitals in England to understand how they deliver Same Day Emergency Care services (WP1b)

WP2
We will analyse NHS data that we hold on A&E attendances, hospital admissions, outpatient attendances and deaths from the whole of England to report which patients are being admitted to hospital, and of these, which are suitable for Same Day Emergency Care. We will describe differences in patterns of admission across time, between different geographical areas, different populations and across seasons.

WP3
1) Using findings from WP1&2 we will invite 8 hospitals for in-depth study of their Same Day Emergency Care Services. This will include speaking to staff and patients to understand the benefits and challenges of having Same Day Emergency Care Services (WP3c)
2) We will use the NHS data we hold for further in-depth analysis to describe how each Same Day Emergency Care service is helping to reduce hospital admissions and improve A&E performance (WP3a)
3) Describe the costs of introducing Same Day Emergency Care Services to the NHS (WP2b, 3b)

Bringing together each WP
We will bring together findings from the 3 work packages to describe the current national picture

for hospital admissions. We will present a summary of how Same Day Emergency Care services are delivered and how successful they are. Finally, the study will report on the most important success factors for the ongoing delivery of Same Day Emergency Care services.

Patient and Public Involvement (PPI)
We have talked to patients and public in planning this research. We will keep engaging patients and public through our PPI panel in each stage of the study. This will involve getting the group to review and comment on the findings and then working with the research team to find ways of getting our study out to a wide audience.

Dissemination
Our results will be produced in different formats, including scientific papers, short reports, social media posts, cartoons, visual presentations. We will consult our PPI panel, policy makers and relevant medical colleges/societies to make sure we target findings to have the most impact.

3 Background and Rationale

Same Day Emergency Care (SDEC) is the provision of same day care for patients who would otherwise be considered for emergency hospital admission. Patients referred to SDEC undergo investigation, care and treatment with the expectation they will be discharged on the same day.

SDEC aims to benefit both patients and healthcare service providers, reducing demand on inpatient services and avoiding associated risks of admission to patients. Referrals into SDEC units can be from multiple sources including Emergency Department (ED), direct transfer from ambulance service, direct from primary care or NHS 111 telephone services. Specialities delivering SDEC services commonly include acute medicine, general surgery, paediatrics, and gynaecology [NHSE 2018]. The NHS Long Term Plan recommends that 30% of patients attending acute services should be treated via SDEC thereby avoiding the need for hospital admission [NHS 2019]. Recent NHSE communications to all Acute Trusts and Integrated Care Boards (ICB) listed amongst 10 priority interventions to improve the integration of urgent and emergency care as: 'reducing variation in SDEC provision by providing guidance and operating a variety of SDEC services for at least 12 hours per day, 7 days per week' [NHSE 2023].

SDEC is not to be viewed as an extension of the ED and its value is in streamlining clinical processes for delivery on the same day thereby reducing emergency admissions and reliance on hospital beds.

However, uptake of SDEC has been mixed, with the NHS Benchmarking report of 2021 demonstrating that 64% of UK hospitals had an SDEC open for at least 12 hours, 7 days a week, meaning they will be closed during peak attendance times of 5pm to midnight [Dean 2022]. This has led to the Royal College of Emergency Medicine (RCEM) warning that "the value of SDEC is not being realised as provision is patchy and highly variable across England" [RCEM 2021]. With widespread investment, but variability in SDEC utilisation across the country, it is unknown to what extent SDEC services are reducing hospital admissions and streamlining care.
Research is needed now to understand and inform NHS policy on different models of SDEC and how they can successfully reduce hospital admissions.

3.1 Brief literature review of published evidence

A brief search of the literature conducted on Medline, Embase and Web of Science could not identify any studies comparing different SDEC service models, or SDEC to usual care (hospital admission), the number of patients that may benefit from SDEC services remains unknown, and there are no economic evaluations of SDEC. For acute healthcare providers, there remains uncertainty as to the most effective model to deploy, how to identify suitable patients, and what add-on services might be needed. A recent review commented that, given the current priority for SDECs in the NHS, more evidence is needed in order to inform likely clinical benefit and effective implementation [Atkin 2022a]. A small number of single site evaluations found some impact on patient care. For instance, introduction of an acute neurology service within ED using the SDEC model described positive impact on working diagnoses, hospital admissions, urgent outpatient referrals, and emergency investigations [Alim-Marvasti 2022]. The use of an SDEC model of care delivery reduced hospital admission and mortality [Reschen 2020]. However, during times of

winter pressure, acute medical units found their SDEC spaces being converted into inpatient beds, reducing their ability to deliver same-day care [Atkin 2022b]. Using acuity scoring systems like the Amb score and GAPS was found to have poor discriminatory ability to identify acute medical admissions suitable for discharge within 12 hours, limiting their utility in selecting patients for assessment within SDEC services within this diverse patient population. [Atkin 2022c].

3.2 Proposed contribution to knowledge, policy and practice

The research proposed will evaluate the different models of SDEC care and their impact on patients, services and the workforce. The evaluation will seek to describe whether SDEC reduces hospital admissions, changes performance of frontline services such as the emergency department, has downstream consequences on other services such as outpatient service use, and its influence on overall NHS costs. It will also document the impact on patients attending the ED who subsequently are referred for SDEC, the workforce who utilise SDEC or work in SDEC and any associated impact on adult social care services. The availability of our large routinely linked patient level health database (CUREd+) will enable us to describe pathways from attendance to discharge for patients who are eligible for SDEC care and explore how attendance and admission patterns have changed over time with each hospital acting as its own control.

3.3 Why is this research needed now?

Emergency Department demand has risen consistently since 2003. In 2019 there were 25.6 million ED attendances, 20% more than in 2011. Emergency admissions also grew by 28% over the same period to 6.5 million [DHSC 2023]. Occupancy levels for acute hospital beds have risen in recent years with 95% of inpatient beds filled on average. High bed occupancy is a key driver of worsening ED performance, which in turn has a direct impact on ambulance ‘handover’ and response times. Public satisfaction with healthcare is at an all-time low [Kings Fund 2023], including a drop in satisfaction with inpatient and ED care. It is well documented that acute hospital admission can be harmful for patients. Long waits in the ED and time in a hospital bed lead to physical deterioration especially amongst older people and those with long term conditions [HSIB 2023]. Inpatients are also at risk of nosocomial infections which can increase their length of hospital stay impacting recovery. Finally, discharging patients back to their own home can be challenging if they become deconditioned meaning more support is needed before going home [Panagioti 2019].

Reducing overall acute admissions is a priority for the NHS, because it is acknowledged to be, at times, inefficient, expensive and not always in the best interests of patients. Releasing some of the resources taken up by acute admission would facilitate more funding being channelled into other interventions such as monitoring patients in their own home. Up to 80% of hospital beds are taken up by unplanned admissions, and during times of high pressure, such as winter, increased unplanned admissions directly impact the delivery of elective services [ONS 2023]. However, up to 30% of emergency admissions are discharged within 24 hours of arrival to hospital [NHSE 2015], suggesting that alternative management could safely avoid admission for a subset of these patients. Understanding current SDEC service provision nationally and the contribution to reducing hospital performance and patient outcomes is vitally important. Identifying key criteria for success as well as defining use, cost-effectiveness, and patient outcomes will inform future

strategies for reducing hospital admissions and ensuring SDEC service delivery is supported by strong evidence.

4 Aims and Objectives

RESEARCH QUESTION:

What impact are Same Day Emergency Care (SDEC) services having on patterns of acute hospital admission and discharge?

AIMS:

1. To review the evidence relating to different definitions and perspectives on attendances suitable for SDEC Services (WP1)
2. To describe a taxonomy of the current provision of SDEC Services nationally (WP1)
3. To understand current acute admission patterns and their variation across England (WP2)
4. To measure the impact of introducing SDEC services in reducing avoidable emergency admissions and cost to the NHS (WP2, 3a&3b)
5. To identify features of SDECs that are most successful in reducing avoidable admission rates, and improving ED performance, patient and staff experience (WP3c)

OBJECTIVES:

1. Describe existing definitions of patients and conditions suitable for attendance at SDEC Services by undertaking an international rapid literature review. (WP1a)
2. Understand how SDEC services are being delivered within England by undertaking a national survey of Acute Hospital Trusts and describing a taxonomy of services. (WP1b)
3. Apply definitions of conditions suitable for SDEC which were identified in WP1 to explore trends in activity and outcomes over time, variation between hospitals, and patient groups using CUREd+, a national linked data set of routine ED and hospital admissions. (WP2)
4. Explore how SDEC services impact ED performance, hospital admissions, staff and patient experience by undertaking detailed case studies of 6-8 hospitals with different SDEC configurations. (WP3a&c)
5. Explore the impact of SDECs by modelling the costs of introducing SDEC services in terms of avoided admissions, reattendance, readmission, hospital length of stay, outpatient appointments. (WP2b&3b)

5 Research Plan / Methods

5.1 Design and conceptual framework

This is an observational mixed methods study that will describe how SDEC services are currently being used and enable an understanding of what aspects of SDEC work well in achieving the goal of reducing hospital admissions. We will take a pragmatic health services research approach to address the aims of the proposed research. Survey data, combined with findings from a rapid literature review, will be applied to provide an overview of where SDEC is being delivered and categorise the different modes of delivery in acute hospitals into a taxonomy of SDEC. Taxonomies of SDEC will be overlaid onto a large routine linked dataset of hospital ED attendances and acute admissions to describe overall patterns of attendance and hospital admission, changes due to the opening of SDEC services and variation between acute hospitals in rates of attendance and admission. The routine data will also be used to measure changes in costs to the NHS that SDECs may have delivered. In-depth case studies in hospitals with different taxonomies of SDEC and varying admission rates will provide a greater understanding of what works and why, informing the recommendations of the study for policy makers, health and social care service providers, clinical staff and patients. The study will be delivered in 3 work packages outlined below. Following the third work package we will use a triangulation protocol to integrate findings from each work package.

5.2 WP1: Mapping existing SDEC patients, conditions and configurations

This WP will describe the existing literature defining patients and conditions suitable for same day hospital care through a rapid evidence review. It will also survey current service provision for SDEC across England in order to identify different models of service delivery.

5.2.1 WP1a: Rapid Evidence Review

We will conduct a rapid evidence review of UK and international literature relating to different definitions and perspectives on attendances suitable for SDEC Services. The inclusion of international literature is important to enable learning from experiences of similar services in other countries. The rapid review of published and ‘grey’ literature will provide an overview, description and summary of the evidence on attendances suitable for SDEC.

Methods for the rapid review:
Conduct systematic searches across the major medical and health related bibliographic databases, additional ‘grey’ literature searches of relevant websites and citation searches of key references and studies included in the review.

Databases to search:

- MEDLINE
- Cumulative Index to Nursing and Allied Health Literature (CINAHL)
- Health Management Information Consortium (HMIC)
- EMBASE
- Web of Science
- The Cochrane Library

The search will be developed on Medline with input from the project team which includes HW, our PPI co-applicant. The broad search will include MeSH and free-text terms and synonyms for the different facets of the search and use truncation and wildcards as appropriate. The first facet is the concept of SDEC Services and also any previous or existing similar service models e.g. clinical decision units. Search terms for SDEC to include: “same day emergency care”, SDEC, “ambulatory emergency care”, AEC, ambulatory emergency care units, AECU, “acute care unit”, ACU, “ambulatory care”, clinical decisions units. The second search facet is for the concept of suitable conditions for SDECs. Search terms for appropriate/suitable conditions for attendance to SDEC to include: suitable attendance, appropriate attendance, patient admission, referral, avoidable admission(s), ambulatory care sensitive condition(s), ACSC, avoidable hospitalisation/hospitalization. The two facets will be combined using the boolean operator AND to find research about suitable conditions/attendance for SDEC. The date range for the search will be 2000-Current. Once the search is finalised on Medline it will be translated to the other databases reflecting the nuances of each database.

The websites of relevant organisations will be searched:

- NHS Ambulatory Emergency Care Network https://www.ambulatoryemergencycare.org.uk/
- NHS England https://www.england.nhs.uk/
- Royal College of Emergency Medicine https://rcem.ac.uk/
- Royal College of Physicians https://www.rcplondon.ac.uk/
- The King’s Fund https://www.kingsfund.org.uk/
- The Health Foundation https://www.health.org.uk/
- The Nuffield Trust https://www.nuffieldtrust.org.uk/
- The Society for Acute Medicine https://www.acutemedicine.org.uk/

Citation searches will be conducted on Web of Science.

The results from the searches will be imported into Endnote for removal of duplicates and to screen for inclusion. The full inclusion criteria will be developed in discussion with the project team. Article selection will be undertaken by the lead reviewer (AC) with a 10% check by the Project Manager and any decision that can’t be resolved will be discussed with the wider project team. An initial screen will consider title and abstract followed by a screen of the full-text of potentially relevant items. Items will not be excluded on study design to allow inclusion of a broad range of relevant evidence. From initial brief searches we envisage that included items will comprise guidance around how to select patients for SDECs, data studies of different methods for selecting admissions for SDECs observational studies of SDECs, studies on how to identify attendees suitable for SDECs, case studies of SDECs.

Data from relevant items will be extracted, summarised and presented in tables. The evidence will be synthesised narratively in discussion with the project team, the grouping of studies for the synthesis will be decided by the evidence and could be by method used to determine suitable attendance, SDEC service model or by study design. The rapid review will not include any research participants but we will ensure that we are inclusive in the studies we select and report where demographic and socio-economic factors are considered by the studies included in the review. The findings of the review will be summarised in a final rapid review report and paper. Analysis of the range of definitions will be applied where possible to the routine data analysis in WP2.

5.2.2 WP1b: National survey of SDEC delivery

We will undertake a survey of all 152 acute NHS Trusts with Type 1 EDs in England (type I ED is a consultant-led 24 hour service with full resuscitation facilities and designated accommodation for the reception of accident and emergency patients) to collect data on existing SDEC services that will enable us to describe a taxonomy of SDEC services that are currently being offered. The survey will document how SDEC has been operationalised including specialties involved, opening hours, staffing, referral processes and patterns, patient numbers and clinical conditions managed (including ICD10 and SNOMED codes).

A pilot of the survey has commenced (February 2024) across 30 NHS acute trusts where we will test the process of contacting relevant leads within each Trust, evaluate the length of the survey and its content in order to maximise response rates and review clarity of responses. Following this amendments will be made to the survey to maximise the quality and scale of data collection.

Questions will be targeted at relevant clinical leads, operations directors and departmental managers. We will ask the relevant SDEC lead in each organisation to cascade questions they cannot answer. We will follow up by email or telephone for non-responses. The applicant team has a strong track record of high response rates from emergency care settings. We have previously achieved response rates of 56%, 65% and 73% in postal surveys of English EDs [Sampson 2005, Munro 2006, Mason 2006]. We will maximise response rates in the following ways:

1. Where possible we will use routinely available data to populate fields (e.g. population served, size of department) and ask respondents to confirm or amend responses in order to minimise the impact on staff.
2. The Society for Acute Medicine (SAM) is supporting this proposed study (see letter of support). They undertake a Benchmarking Audit (SAMBA) of acute care provision. The SAMBA network has acute medicine leads in hospitals in England that deliver SDEC services. We have agreed to work in a complementary manner ensuring there is no duplication of data collection. SAM have also agreed to encourage participation in the survey through their membership.
3. NHSE have agreed to support the proposed study (see letter of support). They have a network of SDEC contacts through their SDEC collaboration platform. We will utilise this platform to raise awareness of the study.
4. The Royal College of Emergency Medicine are supporting the proposed study (see letter of support). Their SDEC group will be a route to raise awareness and importance of the study and assist in disseminating the survey.
5. A researcher will contact non-responding hospitals individually to follow up on the request and offer the opportunity to provide the survey responses by phone.

5.3 WP2: Analysis of national hospital admission rates and ED performance measures for SDEC conditions and their associated NHS costs

This WP will be undertaken to gain a clear description of how rates of admission to hospital change over time and between acute hospitals. It will focus especially on attendances that are suitable for SDEC services identified following WP1a and b. We will conduct an analysis of national (England) routinely collected linked hospital data applying the definition of ED attendances suitable for SDEC identified in WP1a and b to explore trends in activity and outcomes over time

and variation between hospitals and different patient groups (WP2a). We will then perform a cost-consequence analysis (WP2b) which will establish the policy-level effect of SDECs on key outcomes and NHS costs, controlling for important covariates established through WP1 & WP2a.

Data

The CUREd+ Research Database has been developed as part of the NIHR Applied Research Collaboration Yorkshire and Humber Urgent Care theme. SM is the data controller for the database. It builds upon previous work developing the CUREd Research Database [Mason 2022] which has expanded our expertise in handling and analysing routine data for research. CUREd+ contains data for the whole of England between April 2011-March 2023 on all patients receiving care at a Walk-in Centre, Minor Injuries Unit, Urgent Care Centre, ED, inpatient or outpatient hospital care. ED data is linked to admitted patient and civil registrations of deaths data so that patients can be followed through the system from the ED to discharge from hospital or death. NHS England have performed the linkage and assigned each patient a unique pseudo identifier that is common across all datasets within CUREd+, enabling reliable linkage and tracing of admissions/recontacts/deaths. This data is currently being processed by our data specialist team for analysis - this includes checking for completeness and validating the fields sent from NHSE. Data and linkage quality will be ensured by careful validation of received data against relevant rules and code sets, and data cleaning processes developed in conjunction with these. The database is held in our secure data environment at the University of Sheffield. It will be ready for analysis by Summer 2024. The SDEC analysis will focus on the time period from the introduction of the Emergency Care Data Set in financial year 2017/18 to the end of financial year 2022/23. This period accounts for the time immediately before the introduction of SDEC services in 2019 and covers the period when SDEC services were being established and then becoming business as usual.

Outcomes

To comprehensively assess SDEC, our study outcomes will be aligned with the metrics from the NHS Improvement and Ambulatory Emergency Care Network guide on Same Day Emergency Care [NHSE 2018], focusing on measuring and reporting care processes and activity, direct impact of SDEC, indirect measures to ensure balance and safety issues are identified and reported:

1. **Process/activity measure:** number of unplanned attendances at a Type 1 ED that are suitable for SDEC. The starting point for identifying attendances that are suitable for SDEC will be SNOMED diagnosis codes identified by the Flag_SDEC indicator in the Diagnosis codeset from the Emergency Care Data Set Technical Output Specification [NHSD 2023]. This definition will be refined through consultation with the project advisory and PPI groups, and findings from WP1 surveys and review.

2. **Impact measures:**
    a. Number of unplanned attendances at a Type 1 ED that are suitable for SDEC that result in admission to hospital (identified using the discharge destination field or an acute admission record on the same or following day)
    b. Number of unplanned attendances at a Type 1 ED that are suitable for SDEC that result in discharge
    c. Average length of stay in hospital for patients admitted following an unplanned

attendance at a Type 1 ED that was suitable for SDEC
   d. Average time in ED (from arrival to discharge or admission) for unplanned attendances at a Type 1 ED that are suitable for SDEC.

3. **Balance measures:**
   a. Number of re-attendances to ED within 7 days of an unplanned attendance at a Type 1 ED that was suitable for SDEC.
   b. Number of outpatient follow-up appointments within 90 days of an unplanned attendance at a Type 1 ED that was suitable for SDEC.
4. **Safety measures:**
   a. Number of acute hospital admissions within 7 days after discharge from an unplanned attendance at a Type 1 ED that was suitable for SDEC.
   b. Number of deaths within 7 days after discharge from an unplanned attendance at a type 1 ED that was suitable for SDEC.

5.3.1 WP2a: Describing trends in outcomes over time and between hospitals

We will use time series plots of monthly counts and/or proportions at a national level to describe trends in the outcomes over time. This analysis will focus on the time period from the introduction of the Emergency Care Data Set (ECDS) in financial year 2017/18 to the end of financial year 2022/23.

For the remaining statistical analysis in WP2 we will utilise the most recent data in the CUREd+ research database (financial year 2022/23) due to its suitability for case study hospital selection in WP3. This time period, following the 2019 introduction of SDEC services, represents current ED casemix and avoids issues due to temporal changes in healthcare policies and the COVID-19 pandemic.

We will use summary statistics to describe the casemix of all attendances at ED and those attendances that are suitable for SDEC services. Patient characteristics (e.g. age, sex, deprivation, ethnicity), attendance characteristics (e.g. arrival mode, time of day) and other patient groups identified by the PPI panel and stakeholder group (e.g. frail and marginalised groups) will be analysed. Categorical variables will be summarised using frequencies and percentages, with numerical variables summarised using mean and standard deviation or median and interquartile range, dependent upon the distribution of the data. Further descriptive analysis will focus on the subgroup of these patients who are admitted. For these patients we will summarise the primary diagnosis using ICD10 codes, procedures and length of stay in hospital using the admitted patient care data. Differences in the summary statistics between all attendances and those with a condition suitable for SDEC will identify if any patient groups are more or less likely to use SDEC services.

We will investigate associations between patient/attendance characteristics and different impact (admitted vs not admitted), balance (re-attend vs don't re-attend) and safety (admitted vs not admitted and died vs survived) outcomes. In each case the dependent outcome variable is binary so we will use logistic regression models to test for an association reporting odds ratios and confidence intervals.

The results of WP1 will identify a taxonomy of SDEC services. We will repeat the descriptive analysis for each type of service that is being offered. If there are a large number of different services being

used then we will repeat the analysis on the most frequent.

We will investigate variation in outcomes between hospitals using funnel plots [Spiegelhalter 2005]. Standardised rates will be calculated adjusting for differences in ED casemix using either direct standardisation with the pooled population of ED attendances in England as the standard or direct risk standardisation [Nicholl 2013] if more complicated casemix adjustment is required. The factors to include in the standardisation will include age, sex and deprivation but this will be reviewed following the descriptive analysis above. We will construct the funnel plots around the mean standardised rates using 95% control limits to identify high and low rates of outcomes. The PPI panel and stakeholder group will be consulted in the development of the analysis plan for WP2 to provide patient and stakeholder perspectives on case mix and attendance characteristics they deem important to investigate.

5.3.2 WP2b: Policy level analysis

This work package builds on the descriptive analysis in WP2a by using explanatory statistical methods to determine whether SDEC policy is associated with changes in outcomes and NHS costs. This produces a cost-consequences analysis; a cost-effectiveness analysis, which relies on a single outcome measure, is not considered to be relevant given the diverse nature of the outcomes envisaged.

This analysis aims to determine the overall impact of SDEC policy across all hospitals for which we receive SDEC start dates from the WP1 survey. As in WP2a, it will account for the time immediately before the introduction of SDEC services in 2019 and cover the period during which SDEC services were being established and then becoming standard practice.

We will follow the framework successfully applied in our previous HDRUK study [Garner 2023], which modelled costs using a discrete time series approach and allowed for the incremental implementation of policy across multiple hospitals at different time points. This took into account seasonal effects as well as the impact of COVID-19, and facilitated an increasingly precise estimate of policy effect as it was rolled out across hospitals. This is thus suitable for a policy-level analysis of the impact of SDEC.

Outcomes will align with those in WP2:

- Acute admissions following an unplanned ED attendance at a Type 1 ED that was suitable for SDEC
- Unplanned ED attendances at a Type 1 ED that were suitable for SDEC resulting in discharge
- Re-attendances to ED within 7 days of an unplanned attendance at a Type 1 ED that was suitable for SDEC
- Acute hospital admissions within 7 days after discharge from an unplanned attendance at a Type 1 ED that was suitable for SDEC
- Outpatient follow-up appointments within 90 days of an unplanned attendance at a Type 1 ED that was suitable for SDEC

Costs for each patient attending an ED with a condition suitable for SDEC will be estimated by applying unit costs to each of these outcomes. Unit costs will be based on Reference Costs using the recorded Healthcare Resource Group (HRG) for each hospital event.

Outcomes and their costs will be modelled separately. Outcomes will be modelled using mixed effects Poisson or Negative Binomial regressions, and costs associated with each outcome will be presented descriptively and modelled using mixed effects multivariable Gamma regression, which is typically the most suitable model for cost data. The primary predictor will be the presence or absence of SDEC services at the corresponding hospital at the time of the event. Covariates will include a categorical variable to represent periods associated with COVID-19 lockdowns, and a continuous variable to act as a time-varying proxy for the severity of the pandemic (e.g., regional number of bed days associated with COVID-19). Temporal variables (month and seasonality) will be included as covariates to estimate both an immediate 'step' effect of introducing SDEC services and any changing effects over time.

Additional covariates will be included where they are identified as relevant through work undertaken in WP1 and WP2b, and through the construction of causal directed acyclic graphs (DAGs) to identify important confounders and mediators.

Model assumptions will be checked and models will be adapted if necessary.

5.4 WP3: Understanding the impact of SDECs on ED performance, hospital admissions, costs, and staff & patients

This work package will be used to gain a deeper understanding of how SDECs work in practice and how they might impact on unplanned admissions. We will undertake detailed case studies of 6-8 SDECs with different service configurations to understand how SDEC services impact hospital admission and ED performance, and the mechanisms by which SDECs may lead to reduced admissions. The case study work package will be conducted in three parts: 1) analysis of routine data to explore impact SDEC services have on ED performance and hospital measures (WP3a) 2) analysis of cost implications of SDEC services (WP3b) and 3) qualitative analysis including observation alongside patient and staff interviews to understand how SDECs have been implemented and staff and patient perspectives of the impact of SDEC on care (WP3c).

We will use data from WP2 to identify SDEC case study hospitals with a range of admission rates, ensuring we sample from a variety of the taxonomies identified within WP1. We will identify up to 20 case study hospitals to invite to participate and recruit 6-8 for in-depth study. We believe this number of case study sites will provide sufficient variation in models of SDEC care to be evaluated. Whilst the selection will be based primarily on the service configuration, we will aim to include as much diversity as possible in terms of population demographics (e.g. age, rurality, ethnicity and deprivation). We will stratify by type of SDEC service (including interventions offered), ED size and hospital admission rates (including outliers in terms of high/low admission rates) to ensure our sample represents variation in practice nationally. The PPI panel will advise on characteristics of case study hospitals that they feel are important to explore in depth.

5.4.1 WP3a: Case study time-series analysis of ED performance and hospital admissions

The aim of WP3a is to investigate the impact of SDEC services on ED performance and hospital admissions focusing on case study hospitals selected following WP1 and 2. We will use an interrupted time series (ITS) design to model the impact of introducing SDECs on the outcomes described in WP2 [Bernal 2017].

As it is likely SDECs will have been introduced to individual hospitals at different time points, the ITS model will be fitted separately for each case study hospital. The outcomes of interest take the form of count data (e.g. number of admissions), therefore we will use a model which is suitable for this data which is likely to be a Poisson or Negative Binomial generalised linear model (GLM). We will include some systematic components: an underlying time trend, and fixed seasonal effect. To investigate the impact of introducing and delivering SDEC services we will test for a level (immediate) and slope (gradual) change in outcomes. We will also explore whether the model should be an AutoRegressive (AR) model by looking at the AutoCorrelation Function (ACF) and the Partial AutoCorrelation Function (PACF). We will check the model assumptions and if necessary adapt the models.

For each model, we will use at least two years of data prior to the SDEC being introduced and at least one year post. The survey in WP1 will provide information on when the SDEC service was introduced to each hospital. In the ideal scenario, SDECs would have been introduced in 2019/2020; in these cases we will have the following time intervals:

i) at least 2 years of data prior to the introduction of SDEC;
ii) 1 year following the introduction of SDEC but before the COVID-19 pandemic;
iii) a period during COVID-19 when there were national lockdowns;
iv) a period 'post' COVID-19 when SDECs will have been fully introduced but after variation associated with lockdowns or other systematic COVID-19 related disruption.

In this scenario, we will model these 4 segments separately for each case study hospital:

i) The first segment will be modelled solely with predictors relating to time (including a seasonal effect and any potential AR terms).
ii) The second segment will include an additional step change variable representing the introduction of SDEC.
iii) The third segment will include terms to account for national lockdowns and COVID-19 cases (e.g. regional bed days related to COVID-19 inpatients);
iv) The final segment will include all previous terms minus the national lockdown variable.

This procedure will allow us to separate the effect of SDEC from COVID-19 related disruption, and will allow the contrast of any differing effects of SDEC in the pre- and post-pandemic periods. It is not anticipated that there will be any major patient demographic changes in the WP3a,b study period, however this will be assessed in WP2a and analysis methods will be adjusted accordingly if appropriate.

Following the results from WP2, any patient characteristics (e.g. particular age or clinical groups) for which SDECs appear to provide benefit (e.g., reduces acute admissions) or disadvantages (e.g. increases unplanned reattendances), will be explored further in the case study hospitals by replicating the above analyses as subgroup analyses. The PPI panel and project stakeholder group will be consulted on the patient characteristics proposed.

5.4.2 WP3b: Case study time-series analysis of economic outcomes

This analysis aims to provide additional detail to supplement WP3a by determining the specific effects on costs of the unique SDEC implementations at case study hospitals. This analysis will

adopt the same ITS framework used in WP3a, with outcome costs estimated using the approach described in WP2b. Models will utilise gamma linkage as is appropriate for cost distributions as in WP2b.

Testing of model assumptions and aggregation of results will take place as for WP3a.

5.4.3 WP3c: Case study observations and interviews with patients and staff

We will undertake 2-5 days of non-participant observation of SDEC services at 8 sites to understand how well they reflect the descriptions provided within the hospital survey (WP1) and to understand factors that affect how SDEC services are operationalised. Data collection in the study sites will begin with an orientation visit in which we will map the key stakeholders involved both within the operation of SDEC and those who may be affected by the SDEC (e.g. areas where patients are referred to and from and social care services providing post discharge support).

When undertaking observation, we will observe how SDECs process patients, how they operate and what happens to patients at different times of the day, including what happens to patients at the end of SDEC operation hours. Hours spent at each site will vary depending on how the model works, the complexity of referral patterns and the amount of information we are able to obtain prior to the visits. We will seek to follow patient journeys for patients attending the ED with SDEC-sensitive conditions (e.g. COPD, chest pain) to understand how the SDEC service impacts their care. We will ask open-ended questions of patients about their referral pathway into the SDEC, of SDEC staff to understand how they manage referrals, and of ambulance staff to understand how they convey patients to the SDEC and any comparisons with other SDECs they interact with. We will use an 'assumed consent' model for the non-participant observation, placing posters around the department to let people know that we are undertaking the observation and providing an opportunity to opt out. We have successfully used this approach in previous research projects. We will use this observation to provide a detailed description of different service models, elaborating on the basic data provided in WP1. We will seek to understand factors that lead to successful (or unsuccessful) implementation reflected in the routine data analysis. We will supplement qualitative work with any documentation about pathways associated with the SDEC, or quantitative data about workforce, referrals etc to supplement data from WP1b.

We will collect detailed notes during observation and write these up in detail following each visit. Notes will be read by the qualitative research team in between visits to ensure that the data collection is robust and to understand any areas that require further exploration during future fieldwork visits. Co-Apps Susan Croft, Suzanne Mason and Daniel Lasserson working at different hospitals will help to develop and pilot data collection forms prior to data collection.

We will conduct semi-structured interviews with 32-36 stakeholders across the case study hospitals, including ED clinical leads, business managers, operations directors, SDEC clinical leads, nurse coordinators and ambulance clinicians. We will identify potential participants during our observation periods, and in collaboration with the research lead at each site and with ambulance staff. We will use these interviews to understand how contextual factors have impacted how SDECs operate and any effect this has had on hospital emergency admission patterns to explain WP3 findings. Interviews will be undertaken either face-to-face during fieldwork visits or via Google Meets or telephone at a later stage. We will evaluate outliers to understand barriers and enablers to use of SDECs and how SDECs can impact wider hospital admission rates and differing

performance.

Patients will usually be referred into an SDEC via ED, GPs, ambulance services and NHS 111 and will not have chosen to access the SDEC specifically. This raises important questions about patient understanding of the service and whether this may impact on future use of the service. We will interview a sample of 16-20 patients (together with carers or family where appropriate) across four of the case study hospitals, selecting hospitals with different types of SDEC and diverse populations. Due to the difficulty of recruiting patients in emergency and urgent care settings, we will undertake patient recruitment in a subset of the sites and have costed in research nurse time to help with recruitment. A research nurse will help to identify appropriate patients at each of the four hospitals. We will seek to sample purposively for age, sex, ethnicity, method of referral and condition. When selecting hospitals in which to undertake interviews we will ensure we have EDs covering different populations and we will include at least one with a high proportion of population from ethnic minority backgrounds. The interviews will explore patient understanding of SDEC services, perspectives around use of SDEC (including avoiding hospital admission and any associated changes in demand for social care services) and understanding of different models of SDEC referral (i.e. via ED, GP etc) as well as any other topics identified by PPI.

Detailed observation notes will be taken by the researcher and entered into NVivo. All interviews will be audio-recorded and transcribed verbatim by the transcribing team at University of Sheffield. Transcripts will be loaded into NVivo to help with data management. Interviews will be analysed using framework analysis. The PPI panel will be asked to comment on topic guides (with particular focus on developing topic guides for patient/carer interviews) and help develop findings by reviewing subsets of anonymised observation notes and interview transcripts.

5.5 Work package integration

Integration of work packages is an important process of mixed method studies to maximise the value of the data and so that ‘the whole is more than the sum of the parts’ [Bryman 2006]. WP1 will form the initial basis of the study surveying all English hospitals about their SDEC services alongside conducting a literature review to better understand the definitions of same day emergency care for patients and their medical conditions. WP2 uses the information collected from the WP1 surveys and the definitions of SDEC conditions to apply to an analysis of national routine data that describes admission patterns and how they vary around the country. WP3 uses data from WP1 and WP2 to select case studies to investigate SDEC services and provide an in-depth picture of how SDECs are being delivered and the impact on admissions, NHS costs and other patient outcomes.

We have built in 3 months at the end of the project to ensure adequate time for integration of findings during the write-up period. We will use a triangulation protocol to integrate findings from each work package and understand whether there is agreement, silence or dissonance [Farmer 2006, O’Cathain 2010] between the findings (e.g. quantitative results, observational studies, patient and staff interview results). We will use findings from qualitative work packages to explore and explain findings within the quantitative work packages and use the different stakeholder perspectives (patient/healthcare professional) to understand future development and sustainability of SDEC services in reducing avoidable admissions and improving patient experience. The PPI panel will support the triangulation process of the findings at the second meeting held in year 3. Triangulating the results will help guide the overall interpretation of the

study results and assist with our dissemination strategy.

6 Dissemination, Outputs and Anticipated Impact

6.1 Dissemination and Outputs

Our study website will act as a source of information for all study documentation including outputs. Findings will be of interest to a wide audience including academics, policy makers, commissioners (through Integrated Care Boards), service providers (through acute hospital trusts), patients and the public, and relevant Royal Colleges/societies. We will tailor outputs to this wide audience and use multiple media to achieve this. The different media will include standard academic publication and conference presentation which we will also seek to press release where possible. We will produce 2 papers from WP1, one paper from WP2, two papers from WP3 and one final paper reporting overall findings. We will prepare short reports and podcasts for consumers such as policy makers, commissioners, acute hospital trusts and Royal Colleges/Societies highlighting areas that will be of significant interest to each organisation. We will ensure to feed back our findings in detail to those acute trusts participating in the survey and case study work.

In terms of reaching the public and patients, we will utilise the study website, produce an animation of up to 3 minutes (working with Nifty Fox), produce an A4 infographic (working with Research Retold), and use shorter written summaries that can be presented through social media to ensure wide engagement. We will also signpost to more in-depth reports on the study website through our social media dissemination. Both the animation and the infographic will be translated into two different languages to widen dissemination. We will have a half-day communications workshop with Research Retold in year 1 to set the foundations of the dissemination strategy with a further workshop in year 3 to finalise the dissemination plan.

We have had significant interest and support from NHSE and the DHSC in this proposed research. As such we will liaise with our contacts at each to identify the most effective and impactful way to disseminate our findings. This will include the NHSE SDEC Programme of organisations and NHS Benchmarking.

We have also received support from the Royal College of Emergency Medicine and Society for Acute Medicine who are both keen that the approach to dissemination should be through a joined-up strategy. We will work with both these organisations to ensure findings are relevant and reflect a desire to work together on solutions and best practice recommendations.

6.2 Expected impact

This study has significant policy, service and patient relevance given that reducing avoidable hospital admissions is a key challenge and priority for the government and NHSE. The development of effective SDEC services is one of 10 high impact interventions that NHSE are currently advocating in order to address winter pressures. Understanding current service provision nationally and the contribution to reducing hospital admissions is vitally important and is of key relevance to the NHSE SDEC programme. Identifying key criteria for success as well as

defining use, cost-effectiveness, and patient outcomes will inform future strategies for reducing hospital admissions and will ensure SDEC service delivery is supported by strong evidence.

The planned methods of analysis utilising real world routine NHS linked data in WP2 and 3 will develop existing skills and capacity in data processing and analysis which is an ambition of the NHS Data for R&D programme. We have a strong track record in this field and are ambitious to continue developing our expertise (www.sheffield.ac.uk/data-connect).

We have received enthusiastic support for our proposed research from NHSE and DHSC, and anticipate that we will have an ongoing dialogue with both in terms of reporting the findings in such a way that can influence policy, service delivery and best practice.

7 Project Timetable

We have based the project timetable on our previous experience of undertaking research across a range of mixed methods research projects. The project will take place over 30 months with the following timetable: study set up (months 0-3), WP1 (months 1-15), WP2 (months 1-17), WP3 (months 13-27), synthesis of results and dissemination (months 28-30). A project Gantt chart is included in appendix 1.

8 Project Management

Richard Jacques and Suzanne Mason will take overall responsibility for delivering the study ensuring that all applicants fulfil their commitment for the project to be delivered on time and on budget.

8.1 Project Management Group

A Project Management Group (PMG) will oversee day-to-day management of the project. Specific roles will include:

- Ensuring adherence with the study protocol
- Ensuring ethical and governance standards are met
- Monitoring data quality
- Developing and reviewing paperwork
- Responding to queries from the host institutions
- Developing the study protocol in response to operational challenges
- Review of results
- Dissemination of study findings

The PMG will comprise the CIs, co-investigators and lay representatives. The PMG will meet every 4-6 weeks, depending upon the stage of the research.

8.2 Project Advisory Group

A Project Advisory Group will be convened during study set up. This group will provide overall supervision of the SDEC project in general on behalf of the study sponsor (University of Sheffield) and funder (National Institute for Health and Care Research). The Project Advisory Group will ensure that the study is conducted according to the planned research, with specific tasks including:

- Approval of the study protocol
- Review of study progress
- Monitoring adherence to study protocol
- Consideration of new information relevant to the research question
- Scrutiny of protocol amendments and extension requests
- Recommend appropriate actions such as changes to the protocol, additional participant information, practical solutions to potential problems (e.g. data acquisition).

The Project Advisory Group will meet three times over the duration of the study and will include a PPI representative, leading researchers in the field, representation from NHS England, the Society for Acute Medicine and the SDEC group at the Royal College of Emergency Medicine, and NHS and Adult Social Care commissioners.

8.3 PPI Panel

Jo Coster and Howard Whiting will lead on PPI for the project. This includes convening the PPI panel and overseeing the links between the PPI panel and the project advisory group. The PPI panel will meet 5 times over the course of the project, two of these meetings are planned to be face-to-face with the remaining three via video conferencing.

8.4 Project Stakeholder Group

We will form a stakeholder group to get perspectives on the research from groups referring patients to SDEC (e.g. GPs, emergency department staff and ambulance services) and from community services such as social care (e.g. adult social care commissioners and service providers). This group will by chaired by Liz Croot and will meet three times during the project.

9 Ethical and Regulatory Considerations

9.1 Research Ethics Committee (REC) and other Regulatory review and reports

Before the start of the study, a favourable opinion will be sought from a REC for the study protocol, participant information sheets, consent forms, and other relevant documents e.g. advertisements.

We have HRA Research Ethics Committee (ref: 22/SW/0008) approval along with Confidential Advisory Group (CAG) section 251 approval (ref: 22/CAG/0019) for the use of the routine NHS data that is held in the CUREd+ Research Database. We also have University of Sheffield Research Ethics

Approval (ref: 064492) for the secondary analysis of anonymised data (WP2a, WP2b, WP3a, WP3b). We will obtain University of Sheffield Research Ethics approval for the survey of SDEC service delivery in WP1 and we will obtain NHS Ethics and HRA approval for observations and interviews in WP3c.

Substantial amendments that require review by NHS REC will not be implemented until that review is in place and other mechanisms are in place to implement at site.

All correspondence with the REC will be retained.

It is the Chief Investigator's responsibility to produce the annual reports as required.

An annual progress report will be submitted to the REC within 30 days of the anniversary date on which the favourable opinion was given, and annually until the study is declared ended.

If the study is ended prematurely, the Chief Investigator will notify the REC, including the reasons for the premature termination.

Within one year after the end of the study, the Chief Investigator will submit a final report with the results, including any publications/abstracts, to the REC.

Amendments

The chief investigator will be responsible for making the decision to amend the protocol and for deciding whether an amendment is substantial or non-substantial and will communicate said decisions to the REC, R&D and the study advisory committee. A record of any amendments will be detailed alongside protocol variations, and for each version number.

Consent

For the online survey of SDEC service delivery in WP1 we will seek informed consent from participants who access the online survey. The initial page before the survey starts will include a brief summary of the project along with a link to a downloadable participant information sheet. Participants will be asked to tick boxes to confirm they have understood the information sheet and all points that require consent. The final page of the survey will also include a link to the information sheet again, encouraging participants to download for their records.

For WP3, we will undertake non-participant observation within 6-8 SDECs to understand factors that affect how SDEC services are operationalised. We will seek to follow patient journeys for patients attending the ED with SDEC-sensitive conditions (e.g. COPD, chest pain) to understand how the SDEC service impacts their care. We will ask open-ended questions to patients about their referral pathway into the SDEC, of SDEC staff to understand how they manage referrals, and ambulance clinicians conveying patients to the SDEC. We will use an 'assumed consent' model for the non-participant observation, placing posters around the department to let people know that we are undertaking the observation and providing an opportunity to opt out. At each case study site we will conduct semi-structured interviews with a number of staff working in SDECs, or

interacting with SDECs, and also with a small number of patients receiving care on an SDEC unit. Staff and patients who are eligible for interview will be identified and invited to participate. They will be provided with written participant information sheets and the opportunity to ask questions regarding participation. We will supply information to potential participants at the time, or take contact details for sending the information. Consent for interview at each site will be acquired before participant commences.

9.2 Peer Review

The study has been reviewed by the NIHR Health and Social Care Delivery Research Programme panel and has been subject to high quality independent peer review.

9.3 Patient & Public Involvement

Due to the potential impact of SDEC services on outcomes for a wide group of patients, it is important that we include PPI perspectives. We have consulted PPI representatives from two different PPI panels with diverse backgrounds in the development of this proposal: PPI members from the Sheffield Emergency Care Forum (SECF) (www.sheffieldclinicalresearch.org/for-patients-public/how-to-get-involved/sheffield-emergency-care-forum/) and members of the Data Connect PPI Network (www.sheffield.ac.uk/data-connect/public-involvement). Established in 2000, SECF has a long history of working with members of this research team to support and improve our research findings. SEFC have links into other health related groups, including HealthWatch, AgeUK and Primary Care Patient Participation Groups, which has been useful in helping with dissemination of previous study results. The Data Connect PPI Network is a new group to give a patient and public perspective on how we access and use routine NHS health data to benefit patient care, the public and the wider NHS.

We held an online workshop with our PPI members and sought other online feedback during August and September 2023. We gathered feedback on the proposed project plans and discussed areas for improvement or clarification. There was overall support provided for the project, it was acknowledged to be an important intervention aiming to reduce admission rates which in turn could help to tackle busy emergency departments. It was felt that an evaluation would be very helpful in understanding how SDEC services work.

As a result of this consultation the proposal was amended to include more detail on the selection of case study sites, to hearing the patient voice, to amending the lay summaries and adding clarity regarding the source of data we will be using for analysis.

Howard Whiting (PPI co-applicant) and Jo Coster have agreed to lead the coordination of our PPI activities. HW, our PPI co-app, has been collaborating with supporting the research team through attendance and contribution at management meetings in preparing this proposal. HW has provided valuable input about how to ensure we maximise the impact of the PPI panel when feeding into each WP of the study, including improving accessibility by providing supporting documentation, commenting on the planned delivery of each WP, and providing advice on how we integrate and disseminate findings.

PPI will be central to our study, adhering to guidance on UK standards as outlined in Involve (2019). We will actively involve a PPI panel of 6-8 individuals, providing them with regular opportunities to consult and shape the research process. SiC (co-applicant) is funded to lead and coordinate this panel. Panel members will include: HW (our PPI co-applicant), members of the Data Connect PPI panel, SECF members and new members recruited via the NIHR people in research website (www.peopleinresearch.org). To ensure our PPI panel reflects the diversity of ED users, we will aim to recruit individuals from diverse cultural and socioeconomic backgrounds, but also who have some lived experience of needing acute hospital care for themselves or for close family. We will provide access to all meetings via a virtual platform (e.g. Google Meet) to enable people from a wider geographical area to participate. We will provide clear information and terms of reference for the PPI panel detailing expectations of their role and remuneration. The following PPI activities have been co-designed with our PPI co-applicant:

1) HW, our PPI co-app, will collaborate with the research team through attendance and contribution at management meetings. HW will provide valuable input about how to maximise the impact of the PPI panel to each WP of the study, including commenting on the planned delivery of each WP, and providing advice on how study finding can be interpreted and disseminated.

2) HW will serve as a key member of the Project Advisory Group, offering a strategic view on how PPI can best contribute to the study's progression and reporting PPI panel activities to the Advisory Group.

3) A PPI panel will be convened by Jo Coster and meet five times throughout the study. We will hold two face-to-face meetings (the first a half-day introductory session, the second in year 3) and we will also provide hybrid facilities to support members unable to travel. The remaining meetings will be online via video conferencing lasting approximately 2 hours. During meetings, we will ask contributors to provide input into the development of research documents including the hospital survey, interview topic guides, information sheets, and lay summaries for ethics applications (WP1 and WP3). The PPI panel will also be consulted in the development of the analysis plan for WP2, providing a patient perspective on patient case-mix and attendance characteristics to investigate patterns of admission. PPI will support the interpretation and analysis of field work in WP3, through review of anonymised observation notes and interview transcripts and collective discussions about the emerging themes and findings. Between meetings PPI contributors will engage in approximately 5 hours of activities per year.

4) The PPI panel will play a key role in the dissemination of the project's findings to relevant stakeholder groups through the production of concise written summaries and animated presentations. Published outputs will adhere to the GRIPP2 reporting checklists where possible and relevant.

5) We will provide relevant training for our PPI panel as required (e.g. https://www.imperial.ac.uk/patient-experience-research-centre/ppi/ppi-training/) to support the activities they will undertake on the study.

9.4 Indemnity

The SDEC study is sponsored by the University of Sheffield. The University holds insurance covering liabilities arising from negligent harm caused by poor protocol design by the Chief Investigator and researchers employed by the University.

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11 Appendix 1: Project Gantt Chart