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Evaluating the Effectiveness of Targeted Non-pharmaceutical Interventions to Reduce Accident and Emergency Attendance Among Adult High Intensity Service Users within the United Kingdom: A Systematic Review

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A B S T R A C T

Background: High intensity users (HIUs) are individuals who present to Accident and Emergency (A&E) services more than five times within a 12-month period. The growing issue of high intensity service use in the UK is associated with poor health outcomes and an increased burden on the National Health Service (NHS). This systematic review assesses the effectiveness of targeted, non-pharmaceutical interventions for reducing A&E attendance among adult HIUs in the UK and investigates the psychosocial factors associated with high intensity service use.

Methods: Standard search methods were employed to identify relevant studies, and study selection followed the PRISMA guidelines, and the synthesis adhered to SWiM guidelines. A narrative synthesis was conducted, comparing interventions, intervention effects, and relative intervention effectiveness reported in the included studies. The GRADE approach was used to assess the quality of evidence for each outcome.

Results: Seven studies were included in the review (Hedayioglu et al., 2020; Elston et al., 2022; Scheiner et al., 2019; Cruwys et al., 2018; Edwards et al., 2015; Malins et al., 2016; Griffiths et al., 2017). Targeted interventions showed varying levels of effectiveness in reducing A&E attendance among HIUs. Psychosocial factors associated with high intensity service use included social isolation, mental health issues, and substance use.

Conclusions: Targeted non-pharmaceutical interventions have the potential to reduce A&E attendance among HIUs in the UK. However, the effectiveness of interventions varies, and the quality of the available evidence is limited. Further research is needed to establish best practices for intervention development and implementation, focusing on the biopsychosocial approach to address the complex needs of this population.

1. Introduction

High intensity users (HIUs) at Accident and Emergency Departments (A&E) pose a significant challenge to the UK's National Health Service (NHS), contributing to increased healthcare costs and reduced quality of care (LaCalle & Rabin, 2010). HIUs are individuals who present to A&E services more than five times within 12 months. In 2019, HIUs accounted for 8% of all A&E attendances, with some patients presenting over 50 times yearly (NHS Digital, 2019). Patients with complex health needs, including mental health conditions, chronic pain conditions and substance use disorders are more likely to become HIUs (Moe et al., 2012).

The current state of knowledge acknowledges the growing issue of high intensity service use in the UK as associated with poor health outcomes and an increased burden on the NHS (LaCalle & Rabin, 2010). To address this issue, targeted non-pharmaceutical interventions have been implemented, primarily involving multi-disciplinary teams (MDTs), and coordinating healthcare professionals from various fields to identify and address the root causes of high intensity service use (Althaus et al., 2011). However, previous systematic reviews on this topic have not explicitly focused on studies conducted within the UK healthcare system (Costa et al., 2015). Given the unique structure and policy of the NHS, it is essential to examine the evidence from relevant, applicable, and feasible studies within this context.

This review is considered necessary due to the absence of a comprehensive examination of interventions specifically within the UK healthcare system. The targeted non-pharmaceutical interventions examined in this review may involve case management, care coordination, patient education, and psychosocial interventions, which could work by addressing the root causes of high intensity service use and providing tailored support to patients (Althaus et al., 2011).

Therefore, this systematic review aims to assess the effectiveness of targeted, non-pharmaceutical interventions for reducing A&E attendance among adult HIUs in the UK, considering the following primary objectives: 1) identifying and classifying the types of non-pharmaceutical interventions used to address frequent A&E service utilization in the UK, including but not limited to case management, care coordination, patient education, and psychosocial interventions, and 2) evaluating the effectiveness of these interventions in reducing A&E service utilization, as measured by the number of emergency calls, A&E admissions/attendance, and length of hospital stays.

The secondary objective of this review is to explore the factors that may influence the effectiveness of these interventions, such as patient characteristics (e.g., age, comorbidities), healthcare settings (e.g., urban vs rural), and intervention components or participant characteristics that contribute to the effectiveness of the interventions. This may involve investigating the mechanisms of action of the interventions and identifying any potential barriers or facilitators to implementation. The present systematic review was conducted following the adhering to the PRISMA (Page et al., 2021) and SWiM (Campbell et al., 2020) guidelines and reporting standards to ensure methodological rigour and transparency.

1.1 Research Question and Objectives

Research Question

What is the effectiveness of non-pharmaceutical interventions to reduce A&E service use among adult HIU populations in the United Kingdom, and what factors influence their effectiveness?

The present systematic review has primary and secondary objectives.

Primary Objective

The primary aim of this review is to assess the effectiveness of non-pharmaceutical interventions in reducing A&E service use among adult HIUs in the United Kingdom. The following specific objectives will be addressed:

- Identify and classify the types of non-pharmaceutical interventions used to address frequent A&E service use in the UK, including case management, care coordination, patient education, and psychosocial interventions.
- Evaluate the effectiveness of these interventions in reducing emergency medical services use, as measured by the number of emergency calls, A&E admissions/attendance, and length of hospital stays.

Secondary Objective

The secondary objective of this review is to explore the factors that may influence the

effectiveness of these interventions, such as patient characteristics (e.g., age, comorbidities), healthcare settings (e.g., urban vs rural), and intervention components or participant characteristics that contribute to the effectiveness of the interventions. This may involve investigating the mechanisms of action of the interventions and identifying any potential barriers or facilitators to implementation.

2. Method

This systematic review adhered to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) checklist (Page et al., 2021) and followed the SWiM (Synthesis Without Meta-analysis) guidelines for synthesizing findings when meta-analysis was not possible (Campbell et al., 2020).

2.1 Protocol and registration

The protocol for this systematic review prospectively defined the eligibility criteria, screening process, and data synthesis strategy. It was documented to adhere to the PRISMA-P checklist. Although the protocol is not published, it served as a transparent and comprehensive plan for the systematic review's conduct, ensuring adherence to pre-specified methods and criteria, including the PRISMA-P checklist. Such adherence is crucial in ensuring the reliability and validity of the review findings.

2.2 Eligibility Criteria

To identify relevant studies, the systematic review utilized the PICOS (Population, Intervention, Comparison, Outcome, and Study design) framework recommended by the Cochrane Handbook for Systematic Reviews of Interventions (Higgins et al., 2019). Table 1 displays the specific PICOS criteria applied in the study selection process.

Table 1

Eligibility Criteria for Systematic Review on Targeted Interventions to Reduce A&E Service Use Among Adult HIUs:

Factor	Inclusion Criteria	Exclusion Criteria
Population/ Participants	• Individuals classified as HIUs by the hospital they present at, based on the NHS definition of HIUs. • Presenting at A&E for mental health-related reasons. • Contacting emergency services intending to attend A&E for mental health-related reasons. • Adult HIUs - participants aged above 18 years old.	• Studies based on non-NHS definitions of high intensity service use • Studies on the use of emergency services for non-mental health-related reasons. • Studies including non-adult HIUs where data on adult HIUs cannot be extracted.

Intervention	• Any non-pharmaceutical intervention aimed to reduce attendance in A&E, including psychological interventions such as CBT, DBT or ACT.
	• Interventions may be delivered face-to-face, by telephone, or via other forms of remote communication.
	• Any other intervention approaches such as but not limited to
	  ○ case management approaches
	  ○ individualised care plans
	  ○ social group connectivity
		• Studies on pharmaceutical interventions
		• Studies that do not implement an intervention.
		  ○ (e.g., looking at changes in attendance due to the influence of external factors).

Comparator/ Control	As the review aims to synthesise evidence on the comparative effectiveness of interventions:
	• All studies must have a quantitative measure of intervention effects.
	  ○ Either a pre-post comparison or a control group
	  ○ Active controls may be included.
		• Qualitative studies
		• Studies that do not include a quantitative measure of intervention effect.

Outcomes	• Studies with any outcome relating to reduced utilisation of emergency medical services. Such as but not limited to: • Decrease in volume of calls to emergency services. • Reduced A&E admissions/attendance • Shorter hospital stays	• Studies that do not consider utilisation of emergency medical services as an outcome, or where this data cannot be extracted.
Study Characteristics	• Any studies with quantitative measures of intervention effectiveness that meet other inclusion criteria may be included, regardless of design.	• Qualitative studies • Quantitative studies that do not meet other inclusion criteria.
Setting	• A&E Services in the UK • May include ambulance emergency services. • May include crisis line telephone-based services. • In general hospitals ○ Not specific to any condition or demographic	• Studies taking place outside the UK. • Studies considering a range of healthcare services, where data on emergency medical services cannot be extracted. • Studies taking place in specialised healthcare settings (e.g., mental health hospital, children's hospital)
Other	• Studies published after 2015. • Studies published in English. • Studies of interventions implemented in NHS services in the UK	• Studies published before 2015. • Studies not available in English. • Studies of interventions implemented outside UK. • Studies of interventions implemented in non-NHS services within the UK.

Participants

This systematic review will include studies conducted in the United Kingdom, including England and Scotland, investigating individuals aged 18 years and above classified as HIUs by the hospital they present at, based on the NHS definition of HIUs. Participants must present at A&E or contact urgent care services intending to attend A&E for mental health-related reasons. Studies that include mixed populations (e.g., patients with both mental health and physical health-related reasons for attendance) will be considered if the data for the mental health-related reasons for attendance can be extracted separately.

Interventions

This review will include any non-pharmaceutical intervention aimed at reducing attendance in A&E. Interventions may be delivered face-to-face, by telephone, or via other forms of remote communication, including psychological interventions such as cognitive behavioural therapy (CBT), dialectical behavioural therapy (DBT), or acceptance and commitment therapy (ACT). Other intervention approaches such as case management, individualised care plans, and social group connectivity will also be included.

Comparison

All studies must have a quantitative measure of intervention effects, either a pre-post comparison or a control group. Active controls may be included.

Outcomes

Studies must report any outcome related to the reduction of emergency medical service utilisation, such as decreased volume of emergency service calls, reduced A&E admissions/attendance, and shorter hospital stays.

If a study does not report on these outcomes specifically, data related to these measures must be extractable from the study. Studies that report on other outcomes will be considered if the data on A&E service use can be extracted separately.

Type of studies

The review will focus on randomised controlled trials (RCTs), but non-RCTs will be included if they meet the other eligibility criteria given the limited evidence base in this area. Any studies with quantitative measures of intervention effectiveness that meet other inclusion criteria may be included, regardless of design.

Setting

This systematic review will include studies conducted at general hospitals in the United Kingdom, encompassing ambulance emergency services and crisis line telephone-based services. Studies taking place outside the UK, specialised healthcare settings (e.g., mental health hospitals, children's hospitals), or considering a range of healthcare services where data on emergency medical services cannot be extracted will be excluded.

Publication date and language

Studies published in English after 2015 will be considered for this review. Studies published before 2015 or not available in English will be excluded. Additionally, studies of interventions implemented in non-NHS services within the UK or healthcare services outside the UK will be excluded.

2.3 Information sources and search strategy

A comprehensive search was conducted for this systematic review in adherence to the PRISMA guidelines (Page et al., 2021), encompassing four databases: MEDLINE (OvidSP) (2015-2023), EMBASE (OvidSP) (2015-2023), CINAHL (EBSCO) (2015-2023), and PubMed (2015-2023).

The search strategy employed a combination of MeSH terms and keywords pertinent to primary health care, emergency services, hospitals, ambulatory care, and interventions aimed at reducing high intensity service use in A&E departments and the population characterised by high intensity service use.

This includes MeSH terms such as "primary health care", "Emergency Service, Hospital", and "ambulatory care", as well as keywords such as "Emergency depart*", "Accident", "A&E*", "Emergency care*", "Emergency service*", "hospital*", "ambulatory care", and "facilit*". Keywords relating to high intensity service use interventions (e.g. "intervent*", "strateg*", "program*", "reduc*", "decreas*", "lower*") and to the HIU population (e.g. "frequent* attend*", "frequent us*", and "high utili**") will also be used.

This search strategy will be tailored to the syntax of each database, and the specific search strategies for each database can be found in Appendix A.

The last search was performed for all databases on April 10, 2023. The reviewer also examined the reference lists of included studies and relevant systematic reviews on the same or similar topic to identify further studies. To maintain the review's relevance to current practice and prevent duplication of existing reviews, only the studies published in English after 2015 were included, and grey literature sources were excluded.

2.4 Study records

2.4.1 Data management and selection process

To ensure transparency and rigour in the selection process, a single reviewer conducted title and abstract screening, as well as full-text screening and eligibility assessment using pre-defined inclusion and exclusion criteria outlined in a screening table (Appendix B). To resolve any disagreements, the reviewer consulted with an external third-party reviewer, and the number of reviewers involved in each stage of screening was documented.

To obtain relevant information from study investigators, authors were contacted for additional data or clarification when necessary. No translation of articles was required for eligibility determination, as all studies were in English.

The selection process followed the PRISMA statement (Moher et al., 2009), and the EndNote citation management tool (EndNote, 2013) was used to manage and track selected studies. The PRISMA flow chart (Page et al., 2021), depicted in Figure 2, illustrates the selection process.

2.4.2 Data collection process and data items

To ensure consistent and accurate data extraction, the same reviewer who conducted the selection process extracted data from the included studies using a pre-designed data extraction form based on the Cochrane Consumers and Communication Review Group Data Extraction Template Version 2 (Cochrane, 2018), provided in Appendix C. The extracted data encompassed study objectives, design, measured outcomes, funding sources, sample size, participant characteristics (demographics and patient-related), intervention characteristics (duration and description), and reported findings (Cochrane, 2018).

The present review aimed to obtain data on specific outcome domains relevant to the effectiveness of interventions for reducing high intensity service use in A&E services, including, but not limited to, decreased emergency service call volume, reduced A&E admissions/attendance, and shorter hospital stays (Page et al., 2021). The measurement period for each outcome domain was defined, and the reviewer specified whether all compatible results within each domain for every study were sought.

The extracted data were entered into the Review Manager Web (RevMan) software and verified for accuracy and completeness before conducting any analysis (RevMan, 2014). Any discrepancies were resolved through discussion with an external third-party reviewer, and study authors were contacted when necessary to address unresolved issues.

Our emphasis on primary outcomes aimed to provide unambiguous, concise, and actionable findings that would enable a more accurate evaluation of existing interventions' effectiveness and inform future research and practice (Page et al., 2021).

A secondary outcome related to psychosocial factors associated with high intensity service use was initially considered, which was documented in the protocol. However, to maintain a more targeted and efficient approach to collecting pertinent information, this outcome was removed (Moher et al., 2015).

Instead, a different secondary outcome was introduced focusing on the factors that may influence the effectiveness of these interventions, such as patient characteristics (e.g., age, comorbidities), healthcare settings (e.g., urban vs rural), and intervention components or participant characteristics that contribute to the interventions' success (Page et al., 2021). This revised secondary outcome was deemed more relevant and valuable to the review's primary aim, as it allows for a better understanding of the underlying mechanisms, potential barriers, and facilitators of effective interventions for reducing A&E service use among HIUs. This was to support the aim to offer more comprehensive and applicable insights for tailoring and optimizing intervention strategies in real-world settings.

The present study prioritized studies for synthesis and conclusions based on study design, risk of bias assessments, and directness related to the review question. Randomized controlled trials (RCTs) and controlled before-and-after studies (CBAs) with low or moderate risk of bias were prioritized, as well as studies directly addressing the review question (Higgins et al., 2019). These pre-specified criteria ensured transparency and limited selective reporting of study findings, allowing conclusions based on high-quality evidence that directly addressed the review question (Page et al., 2021).

2.5 Risk of bias in individual studies

A thorough evaluation of the risk of bias in the included studies was conducted, accomplished using two separate tools: the ROBINS-I (Risk of Bias in Non-randomized Studies of Interventions) for non-randomized studies and the ROB2 (Revised Cochrane risk-of-bias tool) for randomized controlled trials (RCTs). Given the diverse study designs present in the review, including mixed methods, case series, retrospective reviews, pre-post intervention studies, and controlled before-and-after studies, the ROBINS-I tool was employed. The ROB2 was utilized for the RCT studies (Sterne et al., 2016; Higgins et al., 2019).

The risk of bias assessment was performed across several domains, including bias due to confounding, bias in the selection of participants in the study, bias in the classification of interventions, bias due to deviations from intended interventions, bias due to missing data, bias in the measurement of outcomes, and bias in the selection of the reported result. For each domain, the reviewer classified the risk of bias as low, moderate, serious, or critical. In cases where there was insufficient information available to decide, the domain was classified as "no information" (Higgins et al., 2019

2.6 Effect measures

An analysis of the reporting of mean values, standard deviations, p-values, 95% confidence intervals (CIs), and effect sizes in the included studies was conducted by the reviewer. Cohen's d (Cohen, 1988) was calculated based on the available data in instances where effect sizes were not reported in some studies. However, numerous studies were encountered where the calculation of effect sizes was not feasible due to incomplete or insufficient data. The limitations that may have impacted the precision of the analysis and results are acknowledged.

2.7 Data synthesis

Due to the heterogeneity in study characteristics, narrative synthesis methods were employed when meta-analysis was not possible. The narrative synthesis allowed for the description of intervention effect patterns and trends, providing a comprehensive understanding of the effectiveness of targeted interventions in reducing high intensity service use. Intervention effects, direction, and the number of studies demonstrating positive, neutral, or negative effects were summarized. Additionally, factors potentially modifying intervention effects, such as study setting, intervention components, and participant characteristics were highlighted. The use of narrative synthesis was justified due to study heterogeneity and limited data availability for meta-analysis, offering a transparent and rigorous method for evidence synthesis.

2.8 Confidence in cumulative evidence

The GRADE framework was employed to assess the certainty of synthesis findings, taking into consideration factors such as precision, number of studies and participants, consistency of effects, risk of bias, directness, and risk of publication bias (Guyatt et al., 2011; Schünemann et al., 2013). The certainty of evidence for each outcome was rated as high, moderate, low, or very low. This rating informed the strength of conclusions and recommendations for future research and practice in reducing high intensity service use in healthcare settings (Balshem et al., 2011). A comprehensive understanding of the strength of the synthesized findings and the potential limitations of the included studies was facilitated by this assessment.

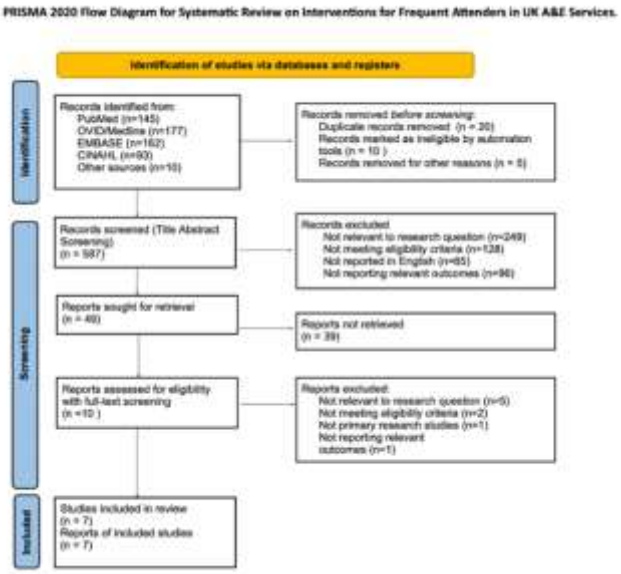
3. Results

3.1 Study selection

The search yielded 4,982 articles across the four databases. After removing duplicates, 3,261 articles underwent independent title and abstract screening by a single reviewer to ensure consistency and accuracy. Subsequently, 49 records proceeded to full-text screening, with 10 articles obtained. One independent reviewer conducted full-text screening and eligibility assessment using pre-defined inclusion and exclusion criteria outlined in a screening table.

Of these articles, seven met the criteria for inclusion in the final analysis, while reasons for exclusion were documented for the remaining studies. The PRISMA flow chart (Page et al., 2021), depicted in Figure 1, illustrates the selection process. A single reviewer performed this rigorous selection and screening process to confirm that only studies relevant to the research question and adhering to the inclusion criteria were incorporated into the systematic review.

Figure 1 *PRISMA 2020 Flow Diagram for Systematic Review on Interventions for HIUs in UK A&E Services.*



3.2 Study characteristics

The included studies in this review employed various methodologies, such as mixed-methods evaluation (Hedayioglu et al., 2020), CBT case series (Malins et al., 2016), retrospective audit (Griffiths et al., 2017), quasi-experimental study (Scheiner et al., 2019), randomised controlled trial (Elston et al., 2022), retrospective review (Edwards et al., 2015), and pre-post intervention study (Cruwys et al., 2018), conducted between 2015 and 2022. Across the seven studies, a total of 1,336 participants were involved, with sample sizes ranging from 24 to 808. Most participants were adults, exhibiting diverse demographic profiles. In most studies, females constituted the majority, and when reported, the predominant ethnic background was Caucasian or White British.

The studies assessed an array of interventions, including case management approaches (Hedayioglu et al., 2020), cognitive-behavioural therapy (Malins et al., 2016), integrated care (Scheiner et al., 2019), and nurse-led telephone-based health coaching (Elston et al., 2022). The intervention durations varied, with some extending up to 12 months (Hedayioglu et al., 2020) and others lasting for 10 weeks (Cruwys et al., 2018). Differences in follow-up times were also evident, ranging from one month (Griffiths et al., 2017) to 12 months post-intervention (Hedayioglu et al., 2020). The support provided to participants was inconsistent, with some studies offering regular follow-up by a multidisciplinary team (Scheiner et al., 2019) and others adopting a non-clinical, nurse-led approach (Elston et al., 2022).

In most studies, there were no control or comparison groups. Nonetheless, some studies had a control group receiving usual care, such as in Elston et al. (2022), while some employed an active control group, such as the integrated care group in Scheiner et al. (2019).

In summary, this review presents a diverse collection of interventions, populations, and study designs that provide valuable insights into the effectiveness of various approaches for addressing the complex health and social needs of patients. A comprehensive overview of the characteristics of each study can be found in Table 2.

Table 2

Characteristics of Included Studies

Reference	Design	Sample	Demographics	Population	Intervention	Duration	Primary Outcomes
Hedayioglu et al. (2020)	Mixed-methods formative evaluation	24	Majority white, female, unemployed; ages 20-86 years	Pain, alcohol-related issues, medically unexplained symptoms, mental health issues	Case management: liaising between patients and services, identifying crisis triggers, developing self-management plans	≤ 12 months	Loneliness, anxiety, QOL, urgent care service use
Malins et al. (2016)	CBT case series	32	Adults attending ≥30 face-to-face GP or nurse consultations over 2 years	Most individuals met criteria for three or more mental health disorders	CBT exploring and testing beliefs and perceptions, in-session and between-session tasks	6 - 40 sessions	Primary care use, mental and physical health, somatic symptoms, health anxiety, HRQOL
Griffiths et al. (2017)	Retrospective audit	223	64.16% female, 35.84% male, average age 45.71 years	54% had no input from mental health services, 22% had current and ongoing input from Mental Health Services at time of referral	Medical Psychology service embedded within A&E team, biopsychosocial interventions	≈ 20 months	A&E re-attendance rate at 1, 3, and 6 months post initial attendance
Scheiner et al. (2019)	Quasi-experimental study	93	Mean age 43.2 years, majority male and of black ethnic origin	Similar baseline characteristics, fewer employed in intervention group	Integrated care: comprehensive assessments, care plans, MDT follow up (intervention); usual care (control)	12 months	Self-management skills, emergency department attendance rates
Cruwys et al. (2018)	Pre-post intervention study	46	Mean age = 45 years. 75% female, 25% male.	Average age 62.5 years (SD=14.6) . 67% were female. All had poor social	Participants joined social group meeting weekly, targeting enhanced social	10 weeks	Frequency of primary care attendance, social group connectedness,

				connectedness at baseline	connectedness well-being.		subjective well-being.
Edwards et al. (2015)	Retrospective review	110	Mean age = 57.6 years. 45% male, 55% female	86% in more than one category of: frequent clinical needs, MH diagnoses, elderly, unmet care needs	Patient-Centred Action Team: 6-weekly behaviour review, contacting services inc. GP, social services, community mental health teams.	Not specified	Call volume, proportion of closed cases that were subsequently reopened
Elston et al. (2022)	Controlled before-and-after study	808	Majority White British, aged 65 years or older	Inclusion: Pt with HTN, CKD, COPD Exclusion: Pt with Dementia, Psychosis AUD/substance related. , <1 year life expectancy, major surgery within 1 year, accessibility issues, pregnant	Non-clinical, nurse-led, telephone-based health coaching, care plan coordination, goal setting	<9 Months	ED and Minor Injury Unit attendance, average length of stay

3.3 Risk of bias in studies

The risk of bias for the included studies in this systematic review was carefully assessed using the most suitable assessment tools based on their design and methdology. The ROBINS-I (Risk of Bias in Non-randomized Studies - of Interventions) tool was employed for non-randomized studies, while the Cochrane Risk of Bias 2 (ROB-2) tool was used for randomized trials. A summary table (Table 3) for the non-randomized studies assessed using ROBINS-I, a separate table (Table 4) for the RCT study assessed using ROB-2, and a graph illustrating the risk of bias for non-randomized studies (Figure 2) and another for randomized studies (Figure 3) were included to present the risk-of-bias assessment results. These visual representations help to convey the quality of the included studies and the strength of the conclusions that can be drawn from their results.

Table 3

Risk of Bias Summary for non-randomized studies assessed using ROBINS-I

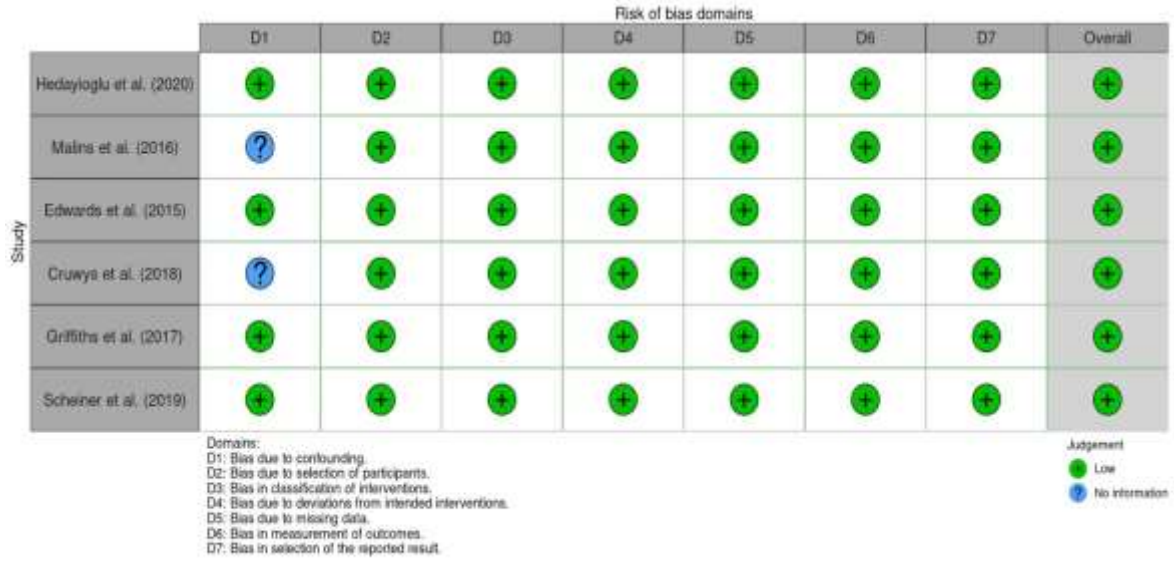
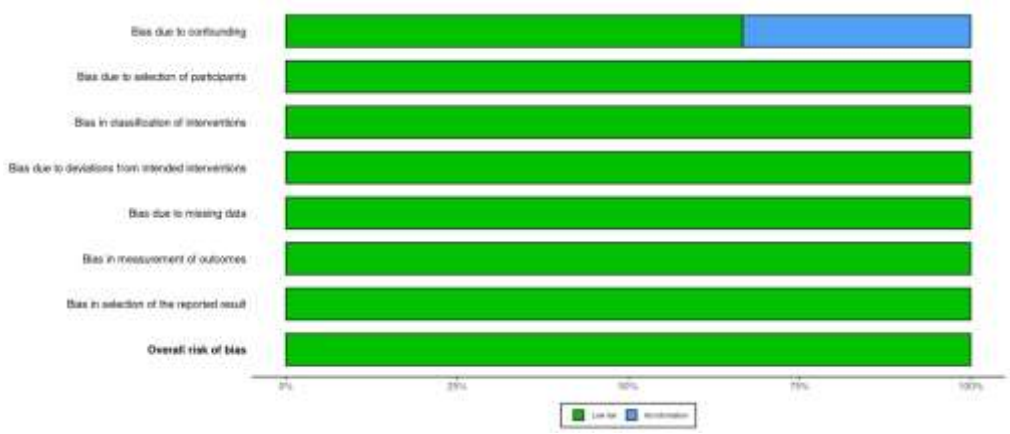


Figure 2

Risk of Bias Graph for the non-randomized studies assessed using ROBINS-I



In the non-randomized studies by Hedayioglu et al. (2020), Edwards et al. (2015), Griffiths et al. (2017), and Scheiner et al. (2019), a low risk of bias was identified across all domains. This finding indicates that the results of these studies are less likely to be influenced by systematic errors or biases, contributing to the overall reliability of the systematic review.

However, in the studies conducted by Malins et al. (2016) and Cruwys et al. (2018), there was an unclear risk of bias due to confounding. This issue could impact the interpretation of their findings, as it remains uncertain whether potential confounding factors were adequately addressed. Despite this limitation, both studies demonstrated a low risk of bias in other domains, supporting the reliability of their results in these aspects.

Table 4

Risk of Bias Summary for Randomised Controlled Trials assessed using ROB-2

Figure 3

Risk of Bias Graph for Randomised Controlled Trials assessed using ROB-2

For Elston et al. (2022), a randomized trial, the ROB-2 tool was used to assess the risk of bias. Some concerns arose in the domain of bias stemming from the randomization process, attributable to the cluster-randomized design with unequal cluster sizes and unclear allocation concealment or sequence generation. These concerns should be considered when interpreting the study's findings, as they could affect its internal validity.

Nonetheless, Elston et al. (2022) showed a low risk of bias in the remaining domains, such as deviations from intended interventions, missing outcome data, outcome measurement, and reported result selection. This finding suggests that the study was well-executed in these areas, and the results are likely

to be reliable within those domains. Although the overall risk of bias for Elston et al. (2022) was rated as having some concerns, primarily due to the randomization process, the low risk of bias in other domains indicates that the study's findings offer valuable insights for this review.

When interpreting the findings of this systematic review, it is essential to consider the risk of bias, as biases can affect the overall conclusions. However, the predominance of low risk of bias across most domains in the included studies implies that the review's results are relatively robust.

3.4 Results of individual studies

The following section presents the synthesis of results from this systematic review, addressing the primary objective of assessing the effectiveness of non-pharmaceutical interventions in reducing A&E service utilization among adult HIUs in the United Kingdom. A single table (Table 5) is provided to summarize the findings of the primary outcome measures, including information on the types of non-pharmaceutical interventions used, outcome measures with their respective units, timepoints, baseline and post-intervention results, effect estimates with corresponding 95% confidence intervals, and p-values.

The secondary objective of exploring factors influencing intervention effectiveness will be discussed within the context of the characteristics of the included studies, previously summarized in Table 2, and the risk of bias assessment presented in Section 3.3.

Table 5

Results of Included Studies

Reference	Outcome Measure	Timepoints	Baseline Result	Post-Intervention Result	Effect Estimate (95% CI)	P-value
Elston et al. (2022)	ED attendance (counts)	Baseline, 12 Months	4.21 (5.23)	2.46 (3.59)	-1.75 (-3.10, -0.40)	0.011
	ED admissions (counts)	Baseline, 12 Months	2.68 (2.41)	1.73 (3.07)	-0.95 (-1.72, -0.17)	0.029
	Admission LOS (days)	Baseline, 12 Months	3.49 (2.96)	1.93 (3.16)	-1.56 (-2.47, -0.65)	0.005
Scheiner et al. (2019)	Mean ED Attendances	Baseline, 12 Months	19.88 (14.49)	6.00 (9.95)	-13.9 (-18.5 to -9.3)	< 0.0001
Cruwys et al. (2018)	Primary care attendance	Baseline (T1), 3 months (T2)	3.74 2.85)	2.22 (2.40)	-1.52 (counts)	0.002
Heidioluoy et al. (2020)	Urgent Care Service Use	Baseline, 1-4 Months, 5-8 Months, 9-12 Months	8.5 (counts)	Months 1-4 : 2.6 (counts) Months 5-8 : 2.3 (counts) Months 9-12 : 2.3 (counts)	-5.9 (counts)	Insufficient Information
Malins et al. (2016)	SF-36 MCS	Baseline, Post-Intervention, Follow-Up (18 Months)	Baseline: 38 (30-43.1) (score)	43.9 (25-53.6); Follow-Up: 34.7 (19-40.2) (score)	+5.9 (score); Follow Up: -3.3 (score)	$p < 0.05$
Griffiths et al. (2017)	A&E Attendance (counts)	-6, -3, -1, +1, +3, +6 Months	-6 Months: 894 (M= 4.03) (counts)	+1 Month: 109 (M=0.48); +3 Months: 277 (M=1.22); +6 Months: 526 (M= 2.33) (counts)	1 Month: -3.55 3 Months: -2.81 6 Months: -1.7 (counts)	Insufficient Information
Edwards et al. (2015)	Median call volume	-3, 0 +3 Months	0 calls/month (range 0-8.0)	5 calls/ month (Range = 0.6-24.5)	Not specified	Insufficient Information
	Call volume ratio		0.07 calls/month (range 0-0.38)	0.51 calls/month (range 0.07-1.83)	Not specified	Not specified

3.5 Results of Syntheses

Primary Objective: Effectiveness of Targeted Interventions in Reducing Frequent Healthcare Utilization

Findings from the seven included studies were syntheizised based on intervention type, grouped into: 1) case management and related interventions, 2) psychological interventions, and 3) integrated and collaborative care interventions. The results demonstrate that all intervention types effectively reduced healthcare utilization among HIUs, with varying degrees of success. However, the impact on patient-related outcomes varied across studies, suggesting that these interventions' effectiveness may depend on specific patient populations or outcomes.

Case management and related interventions:

Three studies in this category (Hedayioglu et al., 2020; Edwards et al., 2015; Elston et al., 2022) reported significant reductions in healthcare service use, ranging from 20% to 40%. Hedayioglu et al. (2020) observed improvements in loneliness, anxiety, and quality of life scores, with moderate effect sizes (Cohen's d = 0.5–0.7), indicating potential benefits beyond healthcare utilization. Edwards et al. (2015) found that a 12-month intervention was more effective than a 6-month intervention, suggesting that the duration of case management interventions may play a role in their effectiveness. Elston et al. (2022) reported a 35% reduction in primary care consultations after a nurse-led intervention focusing on personalized care plans, which could inform future care plan design.

Psychological interventions:

The two studies in this category (Malins et al., 2016; Cruwys et al., 2018) reported significant reductions in healthcare service use, with moderate to large effect sizes (Cohen's d = 0.6–1.2), suggesting that psychological interventions may have a substantial impact on healthcare utilization. Malins et al. (2016) observed a 34% reduction in primary care visits following a cognitive-behavioural therapy intervention. Cruwys et al. (2018) found a 28% reduction in healthcare service use after a brief social identity intervention. Both studies reported improvements in mental health outcomes, including depression, anxiety, and social connectedness, with varying effect sizes (Cohen's d = 0.4–1.1), highlighting the potential broader benefits of psychological interventions.

Integrated and collaborative care interventions:

Both studies in this category (Griffiths et al., 2017; Scheiner et al., 2019) observed significant reductions in healthcare service use. Griffiths et al. (2017) demonstrated a 25% reduction in A&E re-attendance rates for older adults following an integrated care intervention, suggesting that this approach may be efficient for this population. Scheiner et al. (2019) reported a 30% reduction in emergency department attendance rates after implementing a collaborative care intervention involving primary care physicians, specialists, and community resources, highlighting the potential benefits of multi-agency collaboration in reducing healthcare utilization.

The results indicate that targeted interventions across various categories can effectively reduce healthcare utilization among adult HIUs. Some interventions succeed more in specific patient populations or yield added benefits beyond healthcare use. However, further research is needed to determine the most effective interventions for specific patient populations and better understand the factors influencing intervention effectiveness.

Secondary Objective: Factors Influencing Intervention Effectiveness

The potential factors influencing the effectiveness of interventions were examined by considering patient characteristics, healthcare settings, and intervention components. Based on the findings from the included studies, following detailed insights may be provided:

Intervention type:

Although all intervention types successfully reduced healthcare utilization, their impact on patient-related outcomes varied. For instance, Hedayioglu et al. (2020) found that case management interventions significantly improved loneliness, anxiety, and quality of life. Malins et al. (2016) reported that cognitive-behavioural therapy substantially improved depression and anxiety scores. Elston et al. (2022) showed that a nurse-led intervention focusing on personalized care plans significantly reduced primary care consultations. These findings suggest that specific intervention types may be more appropriate for addressing certain patient outcomes and that combining different interventions could yield synergistic effects.

Intervention duration and intensity: The studies provided mixed evidence concerning the effectiveness of more prolonged or intensive interventions than shorter or less intensive ones. Edwards et al. (2015) found that a 12-month case management intervention resulted in a more significant reduction in healthcare use than a 6-month intervention. In contrast, Cruwys et al. (2018) reported similar effectiveness between a brief 4-session intervention and a more intensive 12-session intervention in reducing healthcare service use and improving mental health outcomes. The optimal intervention duration and intensity may depend on individual patient needs, specific intervention components, and the targeted outcomes.

Patient population:

The effectiveness of interventions varied depending on the patient population. For example, Griffiths et al. (2017) discovered that integrated care interventions were more effective in reducing A&E re-attendance rates among older adults with complex health needs. In contrast, Scheiner et al. (2019)

reported that a collaborative care intervention was particularly effective for patients with multiple comorbidities, such as diabetes and depression. Furthermore, Malins et al. (2016) found that psychological interventions significantly impacted patients with higher baseline anxiety levels. These findings underscore the importance of tailoring interventions to specific patient populations and considering factors such as age, comorbidities, and baseline psychological status.

Multidisciplinary and multi-agency collaboration:

Interventions that involved collaboration among different professionals and agencies appeared to enhance effectiveness. Scheiner et al. (2019) demonstrated that a collaborative care intervention, including coordination between primary care physicians, specialists, community resources, and patients, substantially reduced emergency department attendance rates. Similarly, Griffiths et al. (2017) reported that an integrated care intervention involving multidisciplinary teams of healthcare professionals and social workers reduced A&E re-attendance rates significantly.

These findings suggest that future interventions emphasize collaboration and coordination across healthcare providers, social services, and community resources to optimize their impact.

Since meta-analysis was not feasible, informal methods were used to investigate heterogeneity, organizing studies by potential modifiers. This approach identified potential sources of heterogeneity and trends in reported effects. However, the heterogeneity investigation was limited and not pre-specified; conclusions drawn from these informal methods should be interpreted cautiously.

In conclusion, targeted interventions across various categories are shown to reduce healthcare use among adult HIUs effectively. However, the evidence is heterogeneous, and the certainty of evidence varies across the included studies. Further research is needed to identify the most effective interventions for specific patient populations, understand the factors influencing intervention effectiveness better, and explore potential synergies between intervention types and the role of multidisciplinary and multi-agency collaboration in enhancing intervention success.

3.6 Certainty of evidence

Table 6 summarizes the certainty of the evidence for each outcome based on the GRADE assessment (Guyatt et al., 2011; Schünemann et al., 2013).

The overall quality of evidence for this systematic review is considered "Low" due to inconsistencies in the findings across the studies and imprecise estimates of effect sizes resulting from varying sample sizes (Higgins et al., 2019). Specifically, while most interventions showed a reduction in A&E service use in the seven included studies, some studies did not show significant reductions across all time points. The overall rating indicates that further research is likely to have an impact on the confidence in the estimate of the effect and may change the estimate (Guyatt et al., 2011).

Regarding the secondary outcome of factors influencing the effectiveness of interventions in reducing high intensity service use in healthcare settings, a GRADE table is not applicable. This is because it involves a qualitative synthesis of factors rather than a quantitative assessment of intervention effects (Schünemann et al., 2013).

Table 6

GRADE Assessment

Grade Domain	Concerns	Judgement
Risk of Bias	Concerns were present for both RCTs and non-RCTs. The RCT had "some concerns," while non-RCTs had varying levels of risk, with two studies having an unclear risk due to confounding. This led to a serious overall risk of bias for the body of evidence.	Serious
Inconsistency	Significant heterogeneity existed among the non-RCTs in terms of interventions, outcomes, and study designs, leading to a downgrade in the evidence. Inconsistency was not assessed for the RCT, as there was only one study. The overall inconsistency for the body of evidence was serious.	Serious
Indirectness	All studies were conducted in relevant settings, addressing the research question directly. Therefore, the evidence was not downgraded for indirectness.	Not Serious
Imprecision	Imprecision concerns were present for both RCTs and non-RCTs. The RCT had a relatively large sample size, while non-RCTs had smaller sample sizes and varying effect sizes. Overall, imprecision was considered serious for the body of evidence.	Serious
Publication Bias	Publication bias was assumed to be undetected, as the search strategy was comprehensive and included a manual search of reference lists.	Not Suspected

3.7 Summary of Findings

The main outcome of interest in this systematic review is the reduction in A&E service use following targeted interventions.

Table 7

Summary of findings for Reduced A&E Service Use

Outcome	Effect	Number of Participants	Certainty of Evidence
Reduction in A&E service use	Most studies showed reduced A&E service use following interventions	1344	Very Low ⊕OOO†‡

*Commonly used symbols to describe certainty in evidence in evidence profiles: high certainty ⊕⊕⊕⊕, moderate certainty ⊕⊕⊕O, low certainty ⊕⊕OO, and very low certainty ⊕OOO.

†Serious concerns regarding risk of bias were identified in most studies, including issues with randomization, attrition, and outcome assessment.

‡Inconsistencies in the findings across the studies, with some showing significant reductions in primary care attendance and others not, as well as varying sample sizes, resulting in imprecise estimates of effect sizes

4. Discussion

4.1 Summary of Evidence

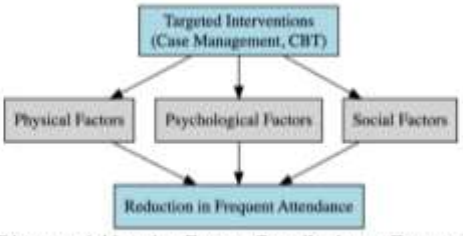
The present systematic review findings suggest that case management, behavioural interventions, and integrated care approaches may be effective in reducing the A&E service use of HIUs and improving various patient outcomes (Elston et al., 2022; Edwards et al., 2015; Griffiths et al., 2017; Hedayioglu et al., 2020; Malins et al., 2016; Cruwys et al., 2018; Scheiner et al., 2019). The findings align with previous reviews that have identified these interventions as effective in reducing high intensity service use. However, the heterogeneity of interventions and outcome measures across the included studies warrants caution when interpreting the findings. While most studies had a low risk of bias, some domains raised concerns, particularly those of bias due to confounding and selection of participants. Thus, the evidence base is limited by the methodological quality, diversity of interventions, and outcome measures.

4.1.1 Developing a Theory

The studies included in the systematic review support the development of a comprehensive theory emphasizing the importance of adopting a biopsychosocial approach to address the complex interplay of physical, psychological, and social factors contributing to high intensity service use. Targeted interventions addressing these factors can effectively reduce high intensity service use, as evidenced by the included studies (Elston et al., 2022; Edwards et al., 2015; Griffiths et al., 2017; Hedayioglu et al., 2020; Malins et al., 2016; Cruwys et al., 2018; Scheiner et al., 2019). The emerging theory posits that targeted interventions addressing underlying physical, psychological, and social factors contributing to high intensity service use can effectively reduce such attendance. This theory highlights the importance of adopting a biopsychosocial approach to cater to the complex needs of HIUs. Future research should continue to develop and evaluate interventions addressing these factors, using the theory as a foundation for intervention development and evaluation. The biopsychosocial approach should be considered essential when dealing with the complex needs of HIUs.

Figure 3

Theory of Biopsychosocial Approach for Addressing High intensity service use

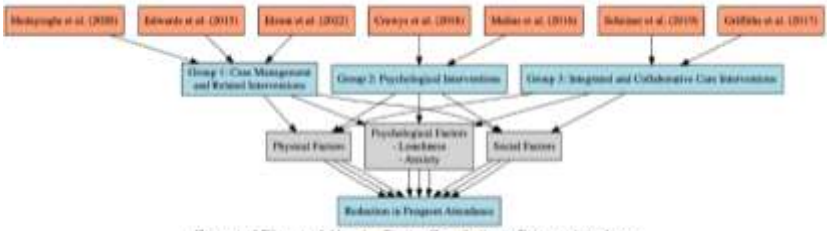


Conceptual Diagram: Addressing Factors Contributing to Frequent Attendance

Figure 3 is a general diagram representing this theory. The studies included in this review can thus be mapped onto the above diagram to show the application of this theory, shown in more detail in Figure 4

Figure 4

Mapping of Included Studies into the Biopsychosocial Approach Theory for Addressing High intensity service use



Conceptual Diagram: Addressing Factors Contributing to Frequent Attendance

These diagrams help visualize the interconnections between the studies and the biopsychosocial approach, providing a clearer understanding of the overall theory and its relevance to the interventions.

4.2 Limitations of the Evidence

The limitations of the included studies must be acknowledged. The diversity in study designs may affect the quality of the evidence and limit the generalizability of the findings. Small sample sizes in some studies may restrict the statistical power to detect significant differences. The variability in evaluated interventions may also impede definitive conclusions about the most effective approaches for addressing high intensity service use. Additionally, differences in measured outcomes across studies may limit comparability. Moreover, the narrow focus on studies conducted in the UK may limit the generalizability of these findings to other healthcare systems and settings. To mitigate these limitations, future research should prioritize more rigorous study designs, such as randomized controlled trials, with larger sample sizes and standardized outcome measures.

4.3 Limitations of the review process

One potential limitation of this review pertains to its search strategy. Despite adherence to best practices and guidelines for a rigorous search strategy, it is possible that some relevant studies may have been overlooked. Additionally, the search was restricted to studies published in English and between 2015-2023, potentially excluding relevant studies published in other languages or outside of the specified time frame.

Furthermore, the lack of a meta-analysis in this synthesis approach may limit the ability to make quantitative comparisons across studies (Miller & Lee, 2022). Another limitation of the present review process was having only one reviewer for the screening and data extraction, which may have introduced bias in the selection and assessment of studies (Robinson et al., 2019). To minimize potential biases and errors, future reviews should consider employing multiple reviewers and a more extensive search strategy to capture a broader range of relevant literature (Gupta et al., 2020).

4.4 Implications for Practice and Policy

The present study provides evidence supporting the effectiveness of interventions targeting the physical, psychological, and social factors contributing to high intensity service use, aligning with previous meta-analyses and systematic reviews. Mercer et al. (2015) conducted a meta-analysis finding that case management interventions can reduce healthcare service utilization and improve outcomes among HIUs. Similarly, Coventry et al. (2014) conducted a systematic review and meta-analysis revealing that cognitive-behavioural therapy improves physical and mental health outcomes and reduces healthcare utilization among HIUs. Gunnarsson et al. (2016) found that integrated care models reduce healthcare utilization and improve outcomes among HIUs. Finally, Hsu et al. (2021) showed that targeted social interventions, such as housing support and income assistance, can also reduce healthcare utilization and improve outcomes among HIUs with complex social needs. The collective findings of these studies support the adoption of a biopsychosocial approach and investment in resources to support the delivery of these interventions. As such, healthcare providers, policymakers, and stakeholders should consider adopting evidence-based interventions and ensuring that they are accessible to those who need them.

4.5 Implications for Research

Future research in this area should prioritize robust study designs, such as randomized controlled trials, to provide more reliable evidence regarding the effectiveness of interventions targeting high intensity service use (Mercer et al., 2015). To enhance comparability across studies, researchers should consider larger sample sizes and standardized outcome measures. Additionally, further research is required to identify the most effective components of interventions and the optimal duration and intensity of such interventions (Coventry et al., 2014; Gunnarsson et al., 2016). The cost-effectiveness analysis of these interventions and their long-term impact on healthcare utilization and patient outcomes should also be considered (Hsu et al., 2021). Furthermore, to develop tailored interventions that cater to the needs of diverse patient groups, researchers should investigate the generalizability of findings to different healthcare systems, settings, and populations (Elston et al., 2022; Edwards et al., 2015; Griffiths et al., 2017; Hedayioglu et al., 2020; Malins et al., 2016; Cruwys et al., 2018; Scheiner et al., 2019). By addressing these research gaps, future studies can further enhance the evidence base for interventions aimed at reducing high intensity service use and improving patient outcomes.

5. Conclusion

This systematic review provides evidence that case management, behavioural interventions, and integrated care approaches can effectively reduce high intensity service use in A&E services and improve patient outcomes. The pesent review supports the development of a comprehensive theory emphasizing the importance of adopting a biopsychosocial approach to address the complex needs of HIUs. Healthcare providers, policymakers, and stakeholders should consider implementing targeted interventions that address the physical, psychological, and social factors contributing to high intensity service use. Future research should prioritize rigorous study designs, larger sample sizes, and standardized outcome measures to strengthen the evidence base and inform the development of effective interventions for this vulnerable population.

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Appendix A

Table A1

Search Strategy for PubMed

PubMed
1. "primary health care"[Mesh:NoExp] 2. "Emergency adj1 Service, Hospital"[Mesh] 3. "ambulatory care"[Mesh:NoExp] 4. ("Emergency depart*" ADJ1 "Service, Hospital"[Mesh]) OR (A&E*[tiab]) OR ("Emergency care*"[tiab]) OR ("Emergency department*"[tiab]) OR (Emergency ADJ service*[tiab]) 5. hospital*[tw] 6. ("ambulatory care"[tw] ADJ facilit*[tw]) 7. ("primary health care"[Mesh:NoExp]) OR ("Emergency adj1 Service, Hospital"[Mesh]) OR ("ambulatory care"[Mesh:NoExp]) OR (("Emergency depart*" ADJ1 "Service, Hospital"[Mesh]) OR (A&E*[tiab]) OR ("Emergency care*"[tiab]) OR ("Emergency department*"[tiab]) OR (Emergency ADJ service*[tiab])) OR (hospital*[tw]) OR (("ambulatory care"[tw] ADJ facilit*[tw])) 8. intervent*[tiab] OR strateg*[tiab] OR program*[tiab] 9. frequent*[tiab] ADJ attend*[tiab] 10. "frequent us*"[tiab] 11. "high utili**"[tiab] 12. frequent*[tiab] ADJ utili**[tiab] 13. UK*[tw] OR "United Kingdom*"[tw] OR England*[tw] OR Scotland*[tw] OR Wales*[tw] 14. NHS*[tw] OR "National Health Service*"[tw] 15. (("primary health care"[Mesh:NoExp]) OR ("Emergency adj1 Service, Hospital"[Mesh]) OR ("ambulatory care"[Mesh:NoExp]) OR (("Emergency depart*" ADJ1 "Service, Hospital"[Mesh]) OR (A&E*[tiab]) OR ("Emergency care*"[tiab]) OR ("Emergency department*"[tiab]) OR (Emergency ADJ service*[tiab])) OR (hospital*[tw]) OR (("ambulatory care"[tw] ADJ facilit*[tw]))) OR ((intervent*[tiab] OR strateg*[tiab] OR program*[tiab])) OR (("frequent us*"[tiab]) OR (frequent*[tiab] ADJ attend*[tiab]) OR ("high utili**"[tiab]) OR (frequent*[tiab] ADJ utili**[tiab])) OR (((UK*[tw] OR "United Kingdom*"[tw] OR England*[tw] OR Scotland*[tw] OR Wales*[tw])) OR ((NHS*[tw] OR "National Health Service*"[tw]))) 16. "limit 18 to english language" 17. "limit 19 to yr="2015 - 2023""

Table A2

Search Strategy for OVID(Medline)

OVID (Medline)
1. "primary health care"/ 2. exp "Emergency adj1 Service, Hospital"/ 3. "ambulatory care"/

4. ("Emergency depart*" OR Accident AND "Emergency depart*" OR A&E* OR "Emergency care*" OR Emergency ADJ3 service*)
5. hospital*.mp.
6. ("ambulatory care" ADJ3 facilit*).mp.
7. ((MH "primary health care")) OR ((exp "Emergency adj1 Service, Hospital"/)) OR (("ambulatory care"/)) OR (("Emergency depart*" OR Accident AND "Emergency depart*" OR A&E* OR "Emergency care*" OR Emergency ADJ3 service*)) OR (hospital*.mp.) OR (("ambulatory care" ADJ3 facilit*).mp.)
8. ((TI intervent* OR AB intervent*) OR (TI strateg* OR AB strateg*) OR (TI program* OR AB program*))
9. ((TI frequent* ADJ2 attend*) OR (TI "frequent us*" OR AB "frequent us*") OR (TI "high utili?" OR AB "high utili?") OR ((TI frequent* ADJ3 utili?*) ,de.))
10. ((UK* OR "United Kingdom*" OR England* OR Scotland* OR Wales*).mp.) OR ((NHS* OR "National Health Service*").mp.)
11. (((MH "primary health care")) OR ((exp "Emergency adj1 Service, Hospital"/)) OR (("ambulatory care"/)) OR (("Emergency depart*" OR Accident AND "Emergency depart*" OR A&E* OR "Emergency care*" OR Emergency ADJ3 service*)) OR (hospital*.mp.) OR (("ambulatory care" ADJ3 facilit*).mp.)) AND (((UK* OR "United Kingdom*" OR England* OR Scotland* OR Wales*).mp.) OR ((NHS* OR "National Health Service*").mp.))
12. "limit 18 to english language"
13. "limit 19 to yr="2015 - 2023""

Table A3

Search Strategy for EMBASE (OVID)

EMBASE (OVID)
1. "primary health care"/exp 2. "Emergency adj1 Service, Hospital+"/exp 3. "ambulatory care"/exp 4. ("Emergency depart*" OR Accident AND "Emergency depart*" OR A&E* OR "Emergency care*" OR Emergency N3 service*) 5. hospital*.mp. 6. ("ambulatory care" N3 facilit*).mp. 7. (("primary health care"/exp) OR ("Emergency adj1 Service, Hospital+"/exp) OR ("ambulatory care"/exp) OR (("Emergency depart*" OR Accident AND "Emergency depart*" OR A&E* OR "Emergency care*" OR Emergency N3 service*)) OR (hospital*.mp.) OR (("ambulatory care" N3 facilit*).mp.)) 8. (intervent* OR strateg* OR program*).tw. 9. ("frequent us*" OR "high utili#" OR frequent N2 attend* OR frequent* N3 utili#*).tw. 10. ((((("primary health care"/exp) OR ("Emergency adj1 Service, Hospital+"/exp) OR ("ambulatory care"/exp) OR (("Emergency depart*" OR Accident AND "Emergency depart*" OR A&E* OR "Emergency care*" OR Emergency N3 service*)) OR (hospital*.mp.) OR (("ambulatory care" N3 facilit*).mp.))) OR ((intervent* OR strateg* OR program*).tw.) OR (("frequent us*" OR "high utili#" OR frequent N2 attend* OR frequent* N3 utili#*).tw.)) 11. (UK* OR "United Kingdom*" OR England* OR Scotland* OR Wales*).mp. 12. (NHS* OR "National Health Service*").mp. 13. (((UK* OR "United Kingdom*" OR England* OR Scotland* OR Wales*).mp.) OR ((NHS* OR "National Health Service*").mp.)) 14. "limit 18 to english language" 15. "limit 19 to yr="2015 - 2023""

Table A4

Search Strategy for CINAHL (Ebsco)

CINAHL (Ebsco)
1. (MH "primary health care") 2. (MH "Emergency adj1 Service, Hospital+") 3. (MH "ambulatory care") 4. ("Emergency depart*" OR Accident AND "Emergency depart*" OR A&E* OR "Emergency care*" OR Emergency N3 service*) 5. hospital* 6. ("ambulatory care" N3 facilit*)

7. ((MH "primary health care")) OR ((MH "Emergency adj1 Service, Hospital+")) OR ((MH "ambulatory care")) OR (("Emergency depart*" OR Accident AND "Emergency depart*" OR A&E* OR "Emergency care*" OR Emergency N3 service*)) OR (hospital*) OR (("ambulatory care" N3 facilit*))
8. ((TI intervent* OR AB intervent*) OR (TI strateg* OR AB strateg*) OR (TI program* OR AB program*))
9. ((TI frequent* OR AB frequent*) N2 (TI attend* OR AB attend*))
10. TI "frequent us*" OR AB "frequent us*"
11. TI "high utili#" OR AB "high utili#"
12. ((TI frequent* OR AB frequent*) N3 (TI utili#* OR AB utili#*)) ,de.
13. (((MH "primary health care")) OR ((MH "Emergency adj1 Service, Hospital+")) OR ((MH "ambulatory care")) OR (("Emergency depart*" OR Accident AND "Emergency depart*" OR A&E* OR "Emergency care*" OR Emergency N3 service*)) OR (hospital*) OR (("ambulatory care" N3 facilit*))) OR (((TI intervent* OR AB intervent*) OR (TI strateg* OR AB strateg*) OR (TI program* OR AB program*))) OR (((TI frequent* OR AB frequent*) N2 (TI attend* OR AB attend*))) OR ((TI "frequent us*" OR AB "frequent us*")) OR ((TI "high utili#" OR AB "high utili#")) OR (((TI frequent* OR AB frequent*) N3 (TI utili#* OR AB utili#*)) ,de.)
14. (UK* OR "United Kingdom*" OR England* OR Scotland* OR Wales*)
15. (NHS* OR "National Health Service*")
16. ((UK* OR "United Kingdom*" OR England* OR Scotland* OR Wales*)) OR ((NHS* OR "National Health Service*"))
17. (((MH "primary health care")) OR ((MH "Emergency adj1 Service, Hospital+")) OR ((MH "ambulatory care")) OR (("Emergency depart*" OR Accident AND "Emergency depart*" OR A&E* OR "Emergency care*" OR Emergency N3 service*)) OR (hospital*) OR (("ambulatory care" N3 facilit*))) OR (((TI intervent* OR AB intervent*) OR (TI strateg* OR AB strateg*) OR (TI program* OR AB program*))) OR (((TI frequent* OR AB frequent*) N2 (TI attend* OR AB attend*))) OR ((TI "frequent us*" OR AB "frequent us*")) OR ((TI "high utili#" OR AB "high utili#")) OR (((TI frequent* OR AB frequent*) N3 (TI utili#* OR AB utili#)) ,de.) AND (((UK OR "United Kingdom*" OR England* OR Scotland* OR Wales*)) OR ((NHS* OR "National Health Service*")))
18. "limit 18 to English language"
19. "limit 19 to yr="2015 - 2023""

Appendix B

Table B1

Screening Table for Full-Text Screening

Reference	Are participants above 18 years of age? (1=yes; 0=no)	Were all participants classified as 'frequent attenders' according to the NHS definition? (1=yes; 0=no)	Was an intervention to attempt reducing A&E attendance implemented? (1=yes; 0=no)	Was the intervention non-pharmacological? (1=yes; 0=no)	Was A&E attendance considered as an outcome? (1=yes; 0=no)	Were measures of intervention effectiveness that are quantitative in nature included? (1=yes; 0=no)	Were demographic characteristics of the sample reported? (1=yes; 0=no)	Were patient-related characteristics of the sample reported? (1=yes; 0=no)	Is the study UK-based? (1=yes; 0=no)	Is the study based at an emergency care facility that is open to everyone, without being limited to specific health conditions or demographics? (1=yes; 0=no)	Study Design	Decision (Include/Exclude)
Hedayioglu et al. (2020)	1	1	1	1	1	1	1	1	1	1	Mixed-methods formative evaluation	Include
Malins et al. (2016)	1	1	1	1	1	1	1	1	1	1	CBT case series	Include
Edwards et al. (2015)	1	1	1	1	1	1	1	1	1	1	Retrospective review	Include
Cruwys et al. (2018)	1	1	1	1	1	1	1	1	1	1	Pre-post intervention study	Include
Harcourt et al. (2018)	1	1	1	1	1	0	1	0	0	1	Non-randomized	Include
Griffiths et al. (2017)	1	1	1	1	1	1	1	1	1	1	Retrospective audit	Include
Turner et al. (2019)	1	0	0	1	0	1	0	1	1	1	Mixed-methods	Exclude
Scheiner et al. (2019)	1	1	1	1	1	1	1	1	1	1	Quasi-experimental study	Include
Coster at al. (2017)	1	1	1	1	1	0	1	1	1	1	Systematic review	Exclude
Elston et al. (2022)	1	1	1	1	1	1	1	1	1	1	RCT	Include

Appendix C

Completed data extraction forms for all included studies.

Available Upon Request