# The Equity of Virtual Ward Models of Care Across Sociodemographic Groups in the United Kingdom – A Systematic Review

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# The Equity of Virtual Ward Models of Care Across Sociodemographic Groups in the United Kingdom – A Systematic Review

## Abstract

**Purpose –** Virtual Wards (VWs), or “Hospital-at-Home (HAH)” services, deliver hospital-level care in patients’ homes by integrating remote monitoring and treatment, facilitating early discharge and reducing inpatient admissions. However, the equity of these care models in the UK remains unclear. This paper aims to synthesise existing evidence on VW’s effectiveness, suitability, and acceptability across diverse sociodemographic groups using the PROGRESS-Plus equity framework.

**Design/methodology/approach –** Systematic literature search of PubMed, CINAHL-PLUS (EbscoHost), and MedRxiv databases was conducted, alongside grey literature from government and NHS sources. Eligible studies were appraised using the Mixed Methods Appraisal Tool, and findings were synthesized narratively.

**Findings –** A total of 8,011 records were identified, with 7 studies and 3 government reports included in the final analysis. Using the PROGRESS-Plus framework, the review found that race/ethnicity/culture/language, socioeconomic status and occupation, social capital, age, and health status and comorbidities shaped the effectiveness, suitability, and acceptability of VWs. Barriers included cultural and communication mismatches, inadequate housing, lack of caregiving support, digital exclusion among older adults, and reduced benefit or engagement for those with complex health needs. Targeted interventions are needed for equitable VW implementation across the UK.

**Originality –** This is the first UK-based systematic review to examine the equity implications of VW implementation using the PROGRESS-Plus framework. While VWs offer system-wide benefits, there is a need for inclusive design and targeted interventions to ensure equitable access and outcomes across all population groups.

**Keywords** Virtual Wards, Hospital-at-Home, Health Inequity, UK

**Paper type** Literature review

## Background

Virtual wards (VWs) provide hospital-level care in patients' homes through integrated technology and multidisciplinary medical services (NHS England & NHS Improvement, 2022). As part of the broader "Hospital-at-Home (HAH)" spectrum, VWs offer acute care, monitoring, and treatment at home to prevent hospital admissions (the step-up model) or support early discharge (the step-down model) (Chappell *et al.,* 2024; NHS England & NHS Improvement, 2022).

VWs gained prominence during COVID-19 to ease hospital capacity (Vindrola-Padros *et al.,* 2021). Proponents suggest multiple potential benefits, including enhanced patient autonomy, personalised treatment, reduced hospital stress, and convenience for families (Chua *et al.,* 2021; NHS England, 2022). System-wide, VWs may alleviate hospital bed pressure, optimise resources, and reduce costs by potentially shortening hospital stays and leveraging home infrastructure (NHS England, 2022). Emerging evidence shows VWs may match or outperform traditional care, including possible reduced readmissions, shorter stays, and improved survival for chronic conditions like heart failure (Chauhan *et al*., 2022; Shi *et al*., 2024). They may also improve quality of life and reduce emergency department (ED) visits, particularly among frail patients (Low *et al*., 2017; Westby *et al*., 2024).

Therefore, the NHS has prioritised VW expansion, targeting clinical pathways such as frailty, acute respiratory infections, and heart failure, aiming for consistent utilisation rates above 80%, including children and young people (NHS England, 2024). Achieving this requires advanced remote monitoring, rapid access to diagnostics, and cross-service collaboration to enhance patient flow, as part of a broader strategy to modernise healthcare delivery and improve patient outcomes (NHS England, 2024).

However, there are challenges to further expanding use of VWs such as digital literacy gaps, housing suitability, and risks for isolated individuals (Chua *et al.,* 2021; Norman *et al.,* 2023). While research highlights clinical efficacy, evidence on effectiveness, suitability, and acceptability across populations remains limited (Chappell *et al.,* 2024). Digital inclusion is a key barrier, with language, technology access, and IT skills disproportionately impacting vulnerable groups. For example, a UK study found that 31.5% of patients referred to VWs could not use the required app (Fox *et al.,* 2022). Similar global concerns include cultural, ethnic, and socioeconomic factors further hindering virtual care access (Mistry *et al.,* 2022).

Given well-documented health inequalities in UK healthcare driven by factors like deprivation, gender, age, and ethnicity (Kulkarni *et al.,* 2022; Saunders *et al.,* 2021), it would be informative to understand whether VWs are equitable, and whether they address or exacerbate existing disparities. For example, while VWs might enhance healthcare access for underserved areas, they risk excluding groups with limited digital access or poor living conditions, potentially further disadvantaging vulnerable populations.

This review synthesises existing evidence on the impact of VWs across diverse sociodemographic groups, focusing on effectiveness, suitability, and acceptability to understand their role in addressing or exacerbating health inequalities, and to offer insights for healthcare providers and policymakers.

**Box 1.** Definitions

- **Effectiveness:** Examines whether VWs improve intended health outcomes and reduce harm across different sociodemographic groups.
- **Suitability:** Evaluates how well VWs align with the needs, contexts, and resources of diverse populations of the UK.
- **Acceptability:** Examines how VWs are perceived by patients, families, and healthcare providers, including satisfaction, comfort, and willingness to engage.

## Methods

This systematic review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines and was carried out between July and November 2024.

### *Eligibility Criteria*

This review followed the PICOS (Population, Intervention, Comparison, Outcome, Study design) framework (Amir-Behghadami and Janati, 2020). Publications were included if they focused on UK adults (19+); described VW or HAH hospital-level care at home; and involve a comparison to conventional inpatient care via step-up (prevent admission) or step-down (early discharge) models. Eligible outcomes included indicators of effectiveness (e.g., access to care, recovery, readmission, mortality), suitability (e.g., alignment with patient needs/resources), and acceptability (e.g., patient/family satisfaction, engagement). Acceptable study designs included empirical literature, descriptive or evaluative government reports, or theses employing randomized controlled trials (RCTs), cohort, case-control, cross-sectional, observational, evaluation, and mix methods. Only English-language publications from 2000 onward were considered.

Publications were excluded if they were abstracts, editorials, commentaries, letters to the editor, or opinion pieces; published before 2000; focused on populations outside the UK; or were non-human or non-English studies.

### *Information Sources*

The review searched PubMed, CINAHL-PLUS (EbscoHost), and MedRxiv, and also included resources from NHS England's VW evidence catalogue (accessible through the FutureNHS learning platform), which contains both academic papers and grey literature like government and policy reports. Reference lists from included studies were manually reviewed for additional relevant literature.

### *Search Strategy*

The search strategy focused on two main concepts: VW services and the UK, with specific search terms detailed in Table I.

*[Insert Table I here]*

### *Selection Process*

Results were imported into EndNote (https://endnote.com/) for deduplication. Relevant papers were first identified through title and abstract screening by the first author (GP), then full texts of the retrieved articles were further assessed for eligibility by two authors independently (GP and DS). The first author thoroughly screened the NHS catalogue of VW resources, including articles, government reports, and NHS publications. Potentially relevant documents were then reviewed by the second author, with any uncertainties resolved jointly. The selection process is summarised using the PRISMA 2020 diagram.

### *Data Extraction*

Key study details, including aims, outcomes, samples, and findings, were extracted into a summary table. Health inequality data were extracted using the PROGRESS-Plus framework to identify relevant factors, such as place of residence, race/ethnicity/culture/language, occupation, gender/sex, religion, education, socioeconomic status, and social capital (O'Neill *et al.,* 2013).

### *Quality Assessment of Studies*

Study quality was evaluated using the Mixed Methods Appraisal Tool (MMAT) across five criteria: research relevance, design appropriateness, data reliability, analysis robustness, and findings validity, rated as "yes," "no," or "can't tell" (Hong *et al.,* 2018). Following MMAT guidelines, overall quality scores were not calculated; instead, detailed ratings were provided to capture methodological strengths and weaknesses. Sensitivity analysis was omitted due to study design variability, and no studies were excluded to ensure comprehensive evidence.

### *Data Synthesis*

Findings were synthesized using a narrative approach, as meta-analysis was unsuitable due to variability in study designs, outcome measures, and reporting formats, along with the inclusion of qualitative data that could not be quantitatively aggregated. Potential equity implications were inferred from reported differences across PROGRESS-Plus categories. These interpretations were indirect and hypothesis-generating rather than conclusive, given the absence of formal subgroup analyses and limited contextual information (e.g., population demographics) in most included studies.

## Results

The literature search (July-November 2024) yielded 8,011 records, with 22 additional records identified through NHS England's evidence catalogue. After deduplication, 8,024 records were screened by title and abstract, with 73 selected for full-text review. Four were unavailable, and 59 were excluded based on study design (n = 4), intervention (n = 11), outcomes (n = 36), or geographical location (n = 8). Ultimately, 10 records (7 studies and 3 government reports) met the inclusion criteria. See Figure 1 for the PRISMA 2020 flow diagram.

*[Insert Figure 1 here]*

### *Study Characteristics*

Table II summarises the characteristics of the included studies and government reports, which span from 2000 to 2024: mixed methods (n = 5), RCTs (n = 2), quantitative observational (n =2), and qualitative (n = 1). Only Crellin *et al.* (2024) directly examined health disparities in virtual care, while Tsiachristas *et al.* (2019) addressed them indirectly through demographic comparisons. Other studies did not explicitly investigate outcome variations, but relevant findings were inferred indirectly.

*[Insert Table II here]*

### ***How sociodemographic factors influence the effectiveness, suitability, and acceptability of VWs in the UK?***

Thematic analysis using the PROGRESS-Plus framework identified how equity-related factors may moderate VW effectiveness, suitability, and acceptability.

Race, ethnicity, culture, and language

Ethnic and cultural background shaped VW acceptability, with individuals from minority ethnic groups facing language barriers, cultural mismatches, and limited service understanding, reducing trust and participation (Crellin et al., 2024). Underrepresentation of these groups in VW cohorts suggests systemic issues in access and inclusivity (The Wessex Academic Health Science Network, 2022).

Evidence on clinical effectiveness by ethnicity was limited; Nunan et al. (2020) identified potential differences in readmission rates, although statistical significance was unclear. Cultural considerations also influenced suitability, as services were inconsistently adapted to diverse needs, limiting their relevance and accessibility.

Socioeconomic status and occupation

Socioeconomic factors influenced participation through structural barriers and lifestyle constraints. Housing quality and stability were key to suitability, as low-income patients often lived in environments unsuitable for remote care (The Health Foundation, 2023). Overcrowded or insecure housing limited privacy, space, and technology needed for remote monitoring.

Effectiveness was impacted by environmental and financial barriers like overcrowded housing and unstable employment, limiting consistent patient engagement. Crellin et al. (2024) found financial hardship reduced sustained participation. Acceptability was similarly shaped by socioeconomic conditions, with some viewing VWs as impractical without additional support.

### Social capital

Living arrangements and caregiving influenced patient engagement and suitability. In terms of effectiveness, Lewis et al. (2017) found no significant differences in unplanned hospital admissions or ED visits between those living alone and with others. Cotton et al. (2000) reported similar findings on readmission rates.

Caregiver presence was key to suitability. Crellin et al. (2024) and Health Foundation (2023) found patients with caregivers were better able to use monitoring technology and remain engaged in their care. In contrast, those without support, particularly individuals living alone, faced more difficulties with technologies. Acceptability was lower among some elderly living alone due to fear or lack of confidence managing alone (Health Innovation Network, 2021).

### Age

Age appeared to shape digital engagement and perceptions of VWs. Contrary to assumptions, acceptability increased with age, with older individuals more willing to be treated remotely than younger patients, particularly when adequate support was available (Health Foundation, 2023).

However, suitability challenges related to digital literacy were common among older adults, who often struggled with devices and information. Crellin et al. (2024) and Health Innovation Network (2021) noted this sometimes led to refusal or disengagement.

### Health status and comorbidities

Patients with complex needs, chronic conditions, or disabilities faced barriers to VW engagement. Tsiachristas et al. (2019) found higher mortality risks for those with multiple comorbidities in home care; Crellin et al. (2024) noted severe conditions required more support and lowered engagement.

Suitability and acceptability concerns included struggles to access equivalent remote care (Health Foundation, 2023) and emotional barriers. Cotton et al. (2000) found anxiety or depression caused discomfort with remote care, with a preference for in-person visits. Isolation, fear of being alone, and reduced confidence commonly led to declining participation (Health Innovation Network, 2021; Dismore et al., 2019).

# Discussion

### *Summary of Findings*

This systematic review evaluated how VWs impact health inequalities in the UK by examining variations in effectiveness, suitability, and acceptability across sociodemographic groups. The findings aim to inform more equitable implementation of virtual care models.

Across the 10 included studies, only two directly examined health disparities in VW services, while the rest provided indirect or subgroup-level insights. This underscores a significant gap in the UK literature. While evidence on clinical efficacy is growing (Jeppesen *et al.,* 2012; Lee *et al.*, 2022), few studies examine the intersection of VWs with key equity dimensions. This limits our ability to draw robust conclusions about whether VWs mitigate or exacerbate health inequalities. More focused research is needed to understand how VWs influence diverse populations and ensure they promote equity in healthcare delivery.

Findings on effectiveness suggest patients with multiple comorbidities, limited social support, or unstable housing may benefit less from VW services. Suitability challenges included inadequate living environments, lack of caregiver support, and cultural or language mismatches that hindered patient engagement. Acceptability was shaped by trust, confidence using digital tools, and perceived relevance, particularly among individuals from ethnic minority groups, older adults, and those facing digital exclusion.

### *Comparisons with Previous Literature*

This review echoes findings from an Australian systematic review, which identified cultural and ethnic inequities in virtual care (Mistry *et al.,* 2022). Similar to our findings, this review found older adults, people from lower socioeconomic backgrounds and minority ethnic groups were underrepresented in virtual services due to digital, structural, and cultural barriers. Both reviews note that older adults and low-income individuals face more barriers from limited digital access and confidence, while younger individuals were generally more engaged with virtual services.

Budhwani *et al.* (2022) highlight barriers like limited internet access, high costs, systemic racism, and mistrust in digital tools, disproportionately impacting socioeconomically disadvantaged and racialized groups. Our review supports this, showing these challenges often reduce VW suitability, which frequently lacks culturally sensitive design and tailored engagement for individuals from minority communities. Limited outreach and engagement strategies likely lowered engagement, though this was not systematically studied. These findings underscore the need for culturally responsive design and infrastructure investment to ensure equitable virtual care implementation. Recent work by Yahya et al. (2025) similarly cautions that without intentional equity planning, VWs may inadvertently exacerbate existing health disparities.

### *Methodological Considerations*

A key strength of this review is its comprehensive inclusion of diverse studies and government reports, capturing broad perspectives on VW implementation, including real-world experiences from patients, the public, and NHS staff. Additionally, screening was conducted by two authors who reached consensus, and a study quality assessment was performed to ensure robust analysis. One limitation is that due to time constraints, this review was not prospectively registered on PROSPERO. Title and abstract screening was conducted by one author, which may introduce selection bias, though this was mitigated by dual screening at the full-text stage.

Other limitations include the small number of studies directly addressing health outcome variations across sociodemographic groups and reliance on indirect evidence.

To support an equity-focused analysis, the PROGRESS-Plus framework was applied to explore potential implications from observed differences across sociodemographic groups. As most studies lacked formal equity analyses, these interpretations remain indirect and exploratory, highlighting areas for future research rather than definitive conclusions on health inequalities.

## Conclusion

This review demonstrates that while VWs have the potential to improve care delivery in the UK, their effectiveness, suitability, and acceptability vary across sociodemographic groups. Barriers like poor housing, limited digital access, cultural mismatches, and lack of caregiver support disproportionately affect individuals from lower socioeconomic backgrounds, ethnic minorities, and those with complex needs. Although some older adults are receptive, engagement remains uneven.

Equitable VW implementation in the UK requires culturally appropriate communication, accessible technology, and targeted outreach. Monitoring and evaluation should incorporate equity-focused indicators from PROGRESS-Plus domains. Future UK-based research should prioritise disaggregated data and strategies to reduce structural barriers for underserved groups.

## References

Amir-Behghadami, M. and Janati, A. (2020), “Population, Intervention, Comparison, Outcomes and Study (PICOS) design as a framework to formulate eligibility criteria in systematic reviews”, *Emergency Medicine Journal*, Vol. 37 No. 6, p. 387, doi: 10.1136/emermed-2020-209567.

Budhwani, S., Fujioka, J., Thomas-Jacques, T., De Vera, K., Challa, P., De Silva, R., Fuller, K., Shahid, S., Hogeveen, S., Chandra, S., Bhatia, R. S., Seto, E. and Shaw, J. (2022), “Challenges and strategies for promoting health equity in virtual care: findings and policy directions from a scoping review of reviews”, *Journal of the American Medical Informatics Association*, Vol. 29 No. 5, pp. 990–999, doi: 10.1093/jamia/ocac022.

Chappell, P., Co, M., Hardie, T., Lloyd, T., Tallack, C., Gerhold, M. and Mayers, C. (2024), “What do virtual wards look like in England?”, *Health Foundation Working Papers*, No. 9, available at: https://www.health.org.uk/sites/default/files/upload/publications/2024/What%20do%20virtual%20wards%20look%20like%20in%20England.pdf.

Chauhan, U. and McAlister, F. A. (2022), “Comparison of mortality and hospital readmissions among patients receiving virtual ward transitional care vs usual postdischarge care”, *JAMA Network Open*, Vol. 5 No. 6, p. e2219113, doi: 10.1001/jamanetworkopen.2022.19113.

Chua, C. M. S., Ko, S. Q., Lai, Y. F., Lim, Y. W. and Shorey, S. (2021), “Perceptions of hospital-at-home among stakeholders: a meta-synthesis”, *Journal of General Internal Medicine*, Vol. 37 No. 3, pp. 637–650, doi: 10.1007/s11606-021-07065-0.

Cotton, M. M., Bucknall, C. E., Dagg, K. D., Johnson, M. K., MacGregor, G., Stewart, C. and Stevenson, R. D. (2000), “Early discharge for patients with exacerbations of chronic obstructive pulmonary disease: a randomised controlled trial”, *Thorax*, Vol. 55 No. 11, pp. 902–906, doi: 10.1136/thorax.55.11.902.

Dar, O., Riley, J., Chapman, C., Dubrey, S. W., Morris, S., Rosen, S. D., Roughton, M. and Cowie, M. R. (2009), “A randomized trial of home telemonitoring in a typical elderly heart failure population in North West London: results of the Home-HF study”, *European Journal of Heart Failure*, Vol. 11 No. 3, pp. 319–325, doi: 10.1093/eurjhf/hfn050.

Dismore, L. L., Echevarria, C., Van Wersch, A., Gibson, J. and Bourke, S. (2019), “What are the positive drivers and potential barriers to implementation of hospital at home selected by low-risk DECAF score in the UK: a qualitative study embedded within a randomised controlled trial", *BMJ Open*, Vol. 9 No. 4, p. e026609, doi: 10.1136/bmjopen-2018-026609.

Fox, R., Saeed, Z., Khan, S., Robertson, H., Crisford, S., Wiggam, A., Foley, A., Raza, F. and Wright, M. (2022), "Lessons learnt for digital inclusion in underserved communities from implementing a covid virtual ward", *PLOS Digital Health*, Vol. 1 No. 11, p. e0000146, doi: 10.1371/journal.pdig.0000146.

Health Innovation Network (2021), "Rapid evaluation of Croydon virtual ward", available at: https://healthinnovationnetwork.com/wp-content/uploads/2022/01/Croydon-VW-Evaluation-Report-to-NHSX-v10.pdf.

Hong, Q. N., Fàbregues, S., Bartlett, G., Boardman, F., Cargo, M., Dagenais, P., Gagnon, M., Griffiths, F., Nicolau, B., O'Cathain, A., Rousseau, M., Vedel, I. and Pluye, P. (2018), "The Mixed Methods Appraisal Tool (MMAT) version 2018 for information professionals and researchers", *Education for Information*, Vol. 34 No. 4, pp. 285–291, doi: 10.3233/EFI-180221.

Jeppesen, E., Brurberg, K. G., Vist, G. E., Wedzicha, J. A., Wright, J. J., Greenstone, M., and Walters, J. A. (2012), "Hospital at home for acute exacerbations of chronic obstructive pulmonary disease", *Cochrane Library*, doi: 10.1002/14651858.CD003573.pub2.

Kulkarni, K., Shah, R., Mangwani, J. and Dias, J. (2022), "The impact of deprivation on patients awaiting planned care", *Bone & Joint Open*, Vol. 3 No. 10, pp. 777–785, doi: 10.1302/2633-1462.310.BJO-2022-0037.R1.

Lee, J. Y., Yang, Y. S. and Cho, E. (2022), "Transitional care from hospital to home for frail older adults: a systematic review and meta-analysis", *Geriatric Nursing*, Vol. 43, pp.64–76, doi: 10.1016/j.gerinurse.2021.11.003.

Lewis, C., Moore, Z. E. H., Doyle, F., Martin, A., Patton, D. and Nugent, L. E. (2017), "A community virtual ward model to support older persons with complex health care and social care needs", *Clinical Interventions in Aging*, Vol. 12, pp. 985–993, doi: 10.2147/CIA.S130876.

Low, L. L., Tan, S. Y., Ng, M. J. M., Tay, W. Y., Ng, L. B., Balasubramaniam, K., Towle, R. M. and Lee, K. H. (2017), "Applying the integrated practice unit concept to a modified virtual ward model of care for patients at highest risk of readmission: a randomized controlled trial", *PLoS ONE*, Vol. 12 No. 1, p. e0168757, doi: 10.1371/journal.pone.0168757.

Mistry, S. K., Shaw, M., Raffan, F., Johnson, G., Perren, K., Shoko, S., Harris-Roxas, B. and Haigh, F. (2022), "Inequity in access and delivery of virtual care interventions: a scoping review", *International Journal of Environmental Research and Public Health*, Vol. 19 No. 15, p. 9411, doi: 10.3390/ijerph19159411.

NHS England (2022), "Supporting information: virtual ward including hospital at home", available at: https://www.england.nhs.uk/wp-content/uploads/2021/12/B1207-i-supporting-guidance-virtual-ward-including-hospital-at-home.pdf.

NHS England (2024), "Priorities and operational planning guidance 2024/25", available at: https://www.england.nhs.uk/publication/priorities-and-operational-planning-guidance-2024-25/.

NHS England and NHS Improvement (2022), "Enablers for success: virtual wards including hospital at home", available at: https://innovationandimprovement.wordpress.com/2022/04/27/enablers-for-success-virtual-wards-including-hospital-at-home/.

Norman, G., Bennett, P. and Vardy, E. R. L. C. (2023), "Virtual wards: a rapid evidence synthesis and implications for the care of older people", *Age And Ageing*, Vol. 52 No. 1, doi: 10.1093/ageing/afac319.

Nunan, J., Clarke, D., Malakouti, A., Tannetta, D., Calthrop, A., Xu, X. H., Chan, N. B., Khalil, R., Li, W. and Walden, A. P. (2020), "Triage into the community for COVID-19 (TICC-19) patients pathway – service evaluation of the virtual monitoring of patients with COVID pneumonia", *Acute Medicine Journal*, Vol. 19 No. 4, pp. 183–191, doi: 10.52964/AMJA.0826.

O'Neill, J., Tabish, H., Welch, V., Petticrew, M., Pottie, K., Clarke, M., Evans, T., Pardo, J. P., Waters, E., White, H., & Tugwell, P. (2013). Applying an equity lens to interventions: using PROGRESS ensures consideration of socially stratifying factors to illuminate inequities in health. *Journal of Clinical Epidemiology*, Vol. 67 No. 1, pp. 56–64, doi: https://doi.org/10.1016/j.jclinepi.2013.08.005

Saunders, C. L., Flynn, S., Massou, E., Lyratzopoulos, G., Abel, G. and Burt, J. (2021), “Sociodemographic inequalities in patients’ experiences of primary care: an analysis of the General Practice Patient Survey in England between 2011 and 2017”, *Journal of Health Services Research & Policy*, Vol. 26 No. 3, pp. 198–207, doi: 10.1177/1355819620986814.

Shi, C., Dumville, J., Rubinstein, F., Norman, G., Ullah, A., Bashir, S., Bower, P. and Vardy, E. R. L. C. (2024), “Inpatient-level care at home delivered by virtual wards and hospital at home: a systematic review and meta-analysis of complex interventions and their components”, *BMC Medicine*, Vol. 22 No.1, doi: 10.1186/s12916-024-03312-3.

The Health Foundation (2023), “How do the public and NHS staff feel about virtual wards?”, available at: https://www.health.org.uk/news-and-comment/charts-and-infographics/how-do-the-public-and-nhs-staff-feel-about-virtual-wards.

Tsiachristas, A., Ellis, G., Buchanan, S., Langhorne, P., Stott, D.J. and Shepperd, S. (2019), “Should I stay or should I go? A retrospective propensity score-matched analysis using administrative data of hospital-at-home for older people in Scotland”, *BMJ Open*, Vol. 9 No.5, p. e023350, doi: 10.1136/bmjopen-2018-023350.

Vindrola-Padros, C., Sidhu, M. S., Georghiou, T., Sherlaw-Johnson, C., Singh, K. E., Tomini, S. M., Ellins, J., Morris, S. and Fulop, N. J. (2021), “The implementation of remote home monitoring models during the COVID-19 pandemic in England”, *EClinicalMedicine*, Vol. 34, p. 100799, doi: 10.1016/j.eclinm.2021.100799.

Wessex Academic Health Science Network (2022), “Rapid Evaluation of Hampshire Hospitals NHS Foundation Trust Virtual Ward programme”, available at: https://healthinnovationwessex.org.uk/img/insight_reports/HHFT%20Rapid%20Evaluation%20Final%20Report%20020922%20-%20For%20distribution.pdf.

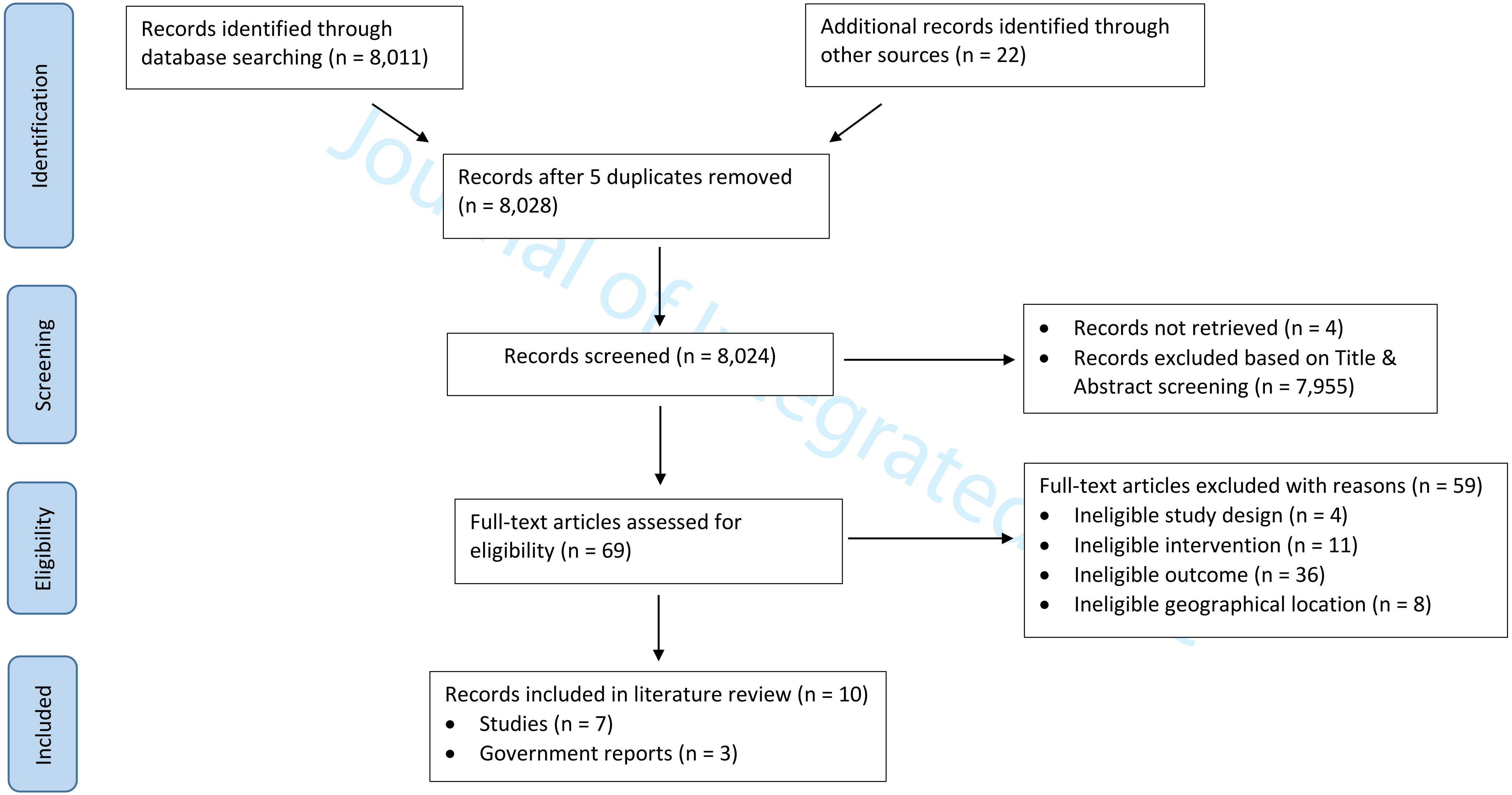
Westby, M., Ijaz, S., Savović, J., McLeod, H., Dawson, S., Welsh, T., Roux, H. L., Walsh, N. and Bradley, N. (2024), “Virtual wards for people with frailty: what works, for whom, how and why—a rapid realist review”, *Age And Ageing*, Vol. 53 No. 3, doi: 10.1093/ageing/afae039.

Yahya, F., Cooper, M., and Nazar, H. (2025). Hospital at home (virtual wards): developing a logic model and dark logic model. BMC Health Services Research, Vol. 25 No.1, doi: https://doi.org/10.1186/s12913-025-12872-w

**Table I.** Search Terms

| Term between search terms | Concept 1: Virtual ward services | AND | Concept 2: United Kingdom |
|---|---|---|---|
| | Virtual ward | | United Kingdom |
| OR | Virtual care model | | UK |
| OR | Virtual hospital | | England |
| OR | Virtual inpatient | | Scotland |
| OR | Home hospitalization | | Wales |
| OR | Hospital@home | | Northern Ireland |
| OR | Home care | | Great Britain |
| OR | Home care services | | NHS |
| OR | Step down care | | |
| OR | Step up care | | |
| OR | Remote monitoring | | |
| OR | Telehealth | | |
| OR | Telemedicine | | |
| OR | Telemonitoring | | |
| OR | Telemanagement | | |
| OR | Remote patient management | | |

**Figure 1.** PRISMA 2020 Flow Diagram



**Source(s):** Author's own creation/work

**Table II.** Summary of methods and key results of included studies

| Author & Year | Setting | Aim | Study Design | VW Model of Care | Sample Size | Outcomes Reported in the Study | Main Findings Relevant to Inequalities | PROGRESS-Plus Categories | MMAT Quality Assessment |
|---|---|---|---|---|---|---|---|---|---|
| Cotton *et al.*, 2000 | Glasgow, Scotland | To evaluate early discharge with home respiratory nurse support versus standard hospital care for COPD exacerbations. | RCT | Step-down | 81 | • Additional hospital days within 60 days of initial admission.<br>• Mortality during the 60-day period.<br>• Readmission rate. | Living alone was not a risk factor for readmission, but social isolation, increased anxiety, and depression may be. | • **Health status and comorbidities** (anxiety, depression)<br>• **Social capital** (living alone, social isolation, caregiver access) | Good |
| Dar *et al.*, 2009 | London, England | To assess home telemonitoring on heart failure patients discharged from three hospitals. | RCT | Step-down | 182 | • Clinic visits.<br>• Days alive and out of hospital.<br>• Hospitalizations due to heart failure.<br>• Quality of life. | Telemonitoring was acceptable and usable in this elderly, multi-ethnic sample, with good satisfaction reported, though outcome differences by sociodemographic subgroup were not examined. | • **Age** (elderly participants)<br>• **Race, ethnicity, culture, and language** (multi-ethnic cohort)<br>• **Social capital** (living alone, caregiver support) | Good |
| Lewis *et al.*, 2017 | Dublin, Ireland | To assess whether a community VW reduces unplanned hospital visits and examine predictors of long-term care needs. | Quantitative Observational | Step-up | 54 | • ED presentations.<br>• Number of bed days and hospital admissions.<br>• Hospital admission risk/activity, comparing individuals living alone versus those with a caregiver. | Before community VW admission, those living alone had fewer hospital and ED visits. Post-VW, no differences were found in unplanned admissions or ED presentations between those living alone and others. | • **Social capital** (family support, living alone) | Good |

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|---|---|---|---|---|---|---|---|---|---|
| Dismore *et al.*, 2019 | North East England | To identify facilitators and barriers to implementing HAH. | Qualitative | Step-down | 89 | • Barriers and facilitators to implementing HAH. | Fear of being alone, especially among patients living alone or without informal support, was a common barrier to participation. | • **Social capital** (fear of being alone, resistance linked to lack of informal support) | Good |
| Tsiachristas *et al.,* 2019 | Across Scotland | To compare populations admitted to HAH services versus hospitals and evaluate their impact on costs and mortality. | Retrospective observational cohort | Step-up | 22,610 | • Healthcare costs<br>• Mortality rates | Patients in HAH were older, more socioeconomically disadvantaged, and had frequent hospitalizations. The HAH cohort also included more women and individuals with multiple chronic conditions than those admitted to hospital. HAH admission was linked to higher mortality risk during follow-up. | • **Age**<br>• **Health status and comorbidities** (multiple chronic conditions)<br>• **Socioeconomic status and occupation** (lower SES) | Good |
| Nunan *et al.,* 2020 | Reading, England | To evaluate the feasibility of a triage and follow-up pathway for mild COVID-19 pneumonia. | Mixed Methods | Step-down | 273 | • Patient satisfaction<br>• Perceived safety and reassurance from daily contact and home monitoring<br>• National Early Warning Score (NEWS-2).<br>• Oxygen saturation at presentation. | No significant differences in re-attendance rates, but possible associations with ethnicity, baseline oxygen saturation levels, post-walk saturation changes, and total NEWS scores. | • **Race, ethnicity, culture, and language** (ethnicity-related differences noted) | Good |
| Health Innovation Network, 2021 | London, England | To examine the impact of a VW in Croydon, including demographics, effectiveness, acceptability, experiences, healthcare utilization, cost savings, and outcomes. | Mixed Methods Evaluation | Step-up, step-down | 250 | • General improvement in clinical outcomes<br>• Economic impact and cost analysis<br>• Health service utilization<br>• Health status<br>• Patient and staff feedback | VW patients, primarily older adults, found remote monitoring kits user-friendly, though 4% declined—often due to low confidence, especially if living alone. Satisfaction and quality of life were high, but a minimum digital literacy was needed. | • **Age**<br>• **Health status and comorbidities** (some support needs noted in older adults)<br>• **Race, ethnicity, culture, and language** (implied through user preference and design suitability) | Good |

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| | | | | | | • Representativeness of VW users | | • **Social capital** (living alone, caregiver access, confidence managing care alone) | |
| Wessex Academic Health Science Network, 2022 | Hampshire, England | To evaluate the HHFT VW program's demographics, referrals, outcomes, bed usage, workforce redesign, technology, and patient experiences, focusing on step-up and step-down processes. | Mixed Methods Evaluation | Step-up, step-down | 1,223 | • Representativeness of VW users<br>• Patient outcomes (e.g., health conditions, discharge outcomes)<br>• Patient experience<br>• Healthcare utilization<br>• Cost savings<br>• Service expansion | Most patients in the HHFT VW program were White British (92%), reporting high satisfaction and valuing regular consultations, staff expertise, and telephone communication. | • **Race, ethnicity, culture, and language** (underrepresentation of ethnic minorities) | Good |
| The Health Foundation, 2023 | Across UK | To explore public and NHS staff perceptions of VWs and identify key factors for effective implementation. | Mixed Methods | Step-up, step-down | 8,351 | • Demographic variations in support<br>• Digital exclusion and access<br>• Key factors for successful VW implementation<br>• Perceived barriers to VWs<br>• Public and staff support for VWs | Disabled individuals and those with caregivers showed higher support, while people from lower socioeconomic backgrounds were less enthusiastic, citing unsuitable homes. Confidence in VW technologies grew with familiarity. | • **Health status and comorbidities** (disability)<br>• **Race, ethnicity, culture, and language** (cultural relevance, communication preferences)<br>• **Social capital** (caregiver presence, confidence in care)<br>• **Socioeconomic status and occupation** (housing insecurity, financial hardship) | Good |
| Crellin *et al.*, 2024 | Across England | To identify disparities in access, engagement, and | Mixed-Methods Evaluation | Step-down | 1,361 | • Barriers to engagement<br>• Health disparities | Patient engagement varied by age, health status, ethnicity, gender, and employment. Older | • **Age** | Good |

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| | | experiences with COVID-19 remote monitoring, focusing on inclusivity adaptations and patient factors. | | | | - Patient engagement and experiences<br>- Services effectiveness<br>- Staff and carer perspectives | patients found the service less helpful, minority ethnic groups faced greater comprehension challenges, and illness severity impacted support needs. Living situation and social connections influenced feelings of reassurance. | - **Health status and comorbidities** (illness severity)<br>- **Race, ethnicity, culture, and language** (minority groups experienced communication barriers)<br>- **Social capital** (caregiver presence, social connectedness)<br>- **Socioeconomic status and occupation** (employment status affected engagement) | |

# Appendices

## Appendix A – The PRISMA 2020 Checklist

| Section and Topic | Item # | Checklist item | Location where item is reported |
|---|---|---|---|
| **TITLE** | | | |
| Title | 1 | Identify the report as a systematic review. | Page 1 |
| **ABSTRACT** | | | |
| Abstract | 2 | See the PRISMA 2020 for Abstracts checklist. | Pages 2 |
| **INTRODUCTION** | | | |
| Rationale | 3 | Describe the rationale for the review in the context of existing knowledge. | Pages 3-4 |
| Objectives | 4 | Provide an explicit statement of the objective(s) or question(s) the review addresses. | Page 4 |
| **METHODS** | | | |
| Eligibility criteria | 5 | Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses. | Pages 5-7 |
| Information sources | 6 | Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted. | Pages 5 |
| Search strategy | 7 | Present the full search strategies for all databases, registers and websites, including any filters and limits used. | Page 6, Appendix B |
| Selection process | 8 | Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process. | Page 6 |
| Data collection process | 9 | Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process. | Page 6 |
| Data items | 10a | List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect. | Pages 6-7 |
| | 10b | List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information. | Pages 6-7 |
| Study risk of bias assessment | 11 | Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process. | N/A |
| Effect measures | 12 | Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results. | N/A |
| Synthesis methods | 13a | Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)). | Page 6, Table II |
| | 13b | Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions. | N/A |
| | 13c | Describe any methods used to tabulate or visually display results of individual studies and syntheses. | Page 6 |

| Section and Topic | Item # | Checklist item | Location where item is reported |
|---|---|---|---|
| | 13d | Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used. | Page 6 |
| | 13e | Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression). | N/A |
| | 13f | Describe any sensitivity analyses conducted to assess robustness of the synthesized results. | N/A |
| Reporting bias assessment | 14 | Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases). | N/A |
| Certainty assessment | 15 | Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome. | Pages 6 |
| **RESULTS** | | | |
| Study selection | 16a | Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram. | Pages 7, Figure 1 |
| | 16b | Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded. | Pages 7, Figure 1 |
| Study characteristics | 17 | Cite each included study and present its characteristics. | Page 7, Table II |
| Risk of bias in studies | 18 | Present assessments of risk of bias for each included study. | N/A |
| Results of individual studies | 19 | For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots. | Table II |
| Results of syntheses | 20a | For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies. | Pages 8-10, Table II |
| | 20b | Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect. | N/A |
| | 20c | Present results of all investigations of possible causes of heterogeneity among study results. | N/A |
| | 20d | Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results. | N/A |
| Reporting biases | 21 | Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed. | N/A |
| Certainty of evidence | 22 | Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed. | Table II, Appendix C |
| **DISCUSSION** | | | |
| Discussion | 23a | Provide a general interpretation of the results in the context of other evidence. | Page 10 |
| | 23b | Discuss any limitations of the evidence included in the review. | Pages 11-12 |
| | 23c | Discuss any limitations of the review processes used. | Pages 11-12 |

| Section and Topic | Item # | Checklist item | Location where item is reported |
|---|---|---|---|
| | 23d | Discuss implications of the results for practice, policy, and future research. | Pages 10-12 |
| **OTHER INFORMATION** | | | |
| Registration and protocol | 24a | Provide registration information for the review, including register name and registration number, or state that the review was not registered. | N/A |
| | 24b | Indicate where the review protocol can be accessed, or state that a protocol was not prepared. | N/A |
| | 24c | Describe and explain any amendments to information provided at registration or in the protocol. | N/A |
| Support | 25 | Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review. | N/A |
| Competing interests | 26 | Declare any competing interests of review authors. | N/A |
| Availability of data, code and other materials | 27 | Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review. | N/A |

## Appendix B – Full Search Strategy

**PubMed**

(“virtual ward” OR “virtual care model” OR “virtual hospital” OR “virtual inpatient” OR “home hospitalization” OR “hospital@home” OR “home care” OR “home care services” OR “step down care” OR “step up care” OR “remote monitoring” OR “telehealth” OR “telemedicine” OR “telemonitoring” OR “telemanagement” OR “remote patient management”)
AND
(“United Kingdom” OR UK OR England OR Scotland OR Wales OR “Northern Ireland” OR “Great Britain” OR NHS)

Filters - Free full text, Full text, Clinical Trial, Comparative Study, Controlled Clinical Trial, Evaluation Study, Government Publication, Observational Study, Randomized Controlled Trial, English, Humans, Adult: 19+ years, 2000 to present

**CINAHL-PLUS (EbscoHost)**

| Search ID | Search Terms |
|---|---|
| S1 | TI “virtual ward” OR AB “virtual ward” |
| S2 | TI “virtual care model” OR AB “virtual care model” |
| S3 | TI “virtual hospital” OR AB “virtual hospital” |
| S4 | TI “virtual inpatient” OR AB “virtual inpatient” |
| S5 | TI “home hospitalization” OR AB “home hospitalization” |
| S6 | TI “hospital at home” OR AB “hospital at home” |
| S7 | TI “home care” OR AB “home care” |
| S8 | TI “home care services” OR AB “home care services” |
| S9 | TI “step down care” OR AB “step down care” |
| S10 | TI “step up care” OR AB “step up care” |
| S11 | TI “remote monitoring” OR AB “remote monitoring” |
| S12 | TI “telehealth” OR AB “telehealth” |
| S13 | TI “telemedicine” OR AB “telemedicine” |
| S14 | TI “telemonitoring” OR AB “telemonitoring” |
| S15 | TI “telemanagement” OR AB “telemanagement” |
| S16 | TI “remote patient management” OR AB “remote patient management” |
| S17 | S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 |
| S18 | TI “united kingdom” OR AB “united kingdom” |
| S19 | TI “uk” OR AB “uk” |
| S20 | TI “england” OR AB “england” |
| S21 | TI “scotland” OR AB “scotland” |
| S22 | TI “wales” OR AB “wales” |
| S23 | TI “northern ireland” OR AB “northern ireland” |
| S24 | TI “great britain” OR AB “great britain” |
| S25 | TI “nhs” OR AB “nhs” |
| S26 | S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 |
| S27 | S17 AND S26 |

Limiters - Full Text; References Available; Abstract Available; Publication Year: 2000-2024; Publication Date: 20000101-20241130; Peer Reviewed; English Language; Research Article; Human; Geographic Subset: UK & Ireland; Age Groups: Adult, 19-44 years, Middle Age, 45-64 years, Aged, 65+ years, Aged, 80 and over; Language: English

Expanders - Apply related words; Apply equivalent subjects

Search modes - Find any of my search terms

**MedRxiv**

(“virtual ward” OR “virtual care model” OR “virtual hospital” OR “virtual inpatient” OR “home hospitalization” OR “hospital@home” OR “home care” OR “home care services” OR “step down care” OR “step up care” OR “remote monitoring” OR “telehealth” OR “telemedicine” OR “telemonitoring” OR “telemanagement” OR “remote patient management”)
AND
(“United Kingdom” OR UK OR England OR Scotland OR Wales OR “Northern Ireland” OR “Great Britain” OR NHS)

Source: Author’s own work

## Appendix C – Quality Assessment of Included Studies Using the MMAT Checklist

| Author & Date | Screening Questions | | Qualitative Studies | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Are there clear research questions? | Do the collected data allow to address the research questions? | Is the qualitative approach appropriate to answer the research question? | Are the qualitative data collection methods adequate to address the research question? | Are the findings adequately derived from the data? | Is the interpretation of results sufficiently substantiated by data? | Is there coherence between qualitative data sources, collection, analysis and interpretation? | Comments |
| **Dismore et al., 2019** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | N/A |
| | | | Quantitative RCTs | | | | | |
| | | | Is randomization appropriately performed? | Are the groups comparable at baseline? | Are there complete outcome data? | Are outcome assessors blinded to the intervention provided? | Did the participants adhere to the assigned intervention? | Comments |
| **Cotton et al., 2000** | Yes | Yes | Yes | Yes | Yes | No | Yes | Outcome assessors were not blinded; the nature of the interventions (home-based care vs. traditional hospital care) made blinding impractical, and the studies did not report blinding procedures. |
| **Dar et al., 2009** | Yes | Yes | Yes | Yes | Yes | No | Yes | |

| | | | Quantitative Non-Randomized Studies | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | **Are the participants representative of the target population?** | **Are measurements appropriate regarding both the outcome and intervention (or exposure)?** | **Are there complete outcome data?** | **Are the confounders accounted for in the design and analysis?** | **During the study period, is the intervention administered (or exposure occurred) as intended?** | **Comments** |
| **Lewis et al., 2017** | Yes | Yes | Yes | Yes | Yes | Unclear | Yes | The study did not clearly report whether potential confounders were controlled for in the design or analysis. |

| | | | Mixed Methods Studies | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | **Is there an adequate rationale for using a mixed methods design to address the research question?** | **Are the different components of the study effectively integrated to answer the research question?** | **Are the outputs of the integration of qualitative and quantitative components adequately interpreted?** | **Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?** | **Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?** | **Comments** |
| **Nunan et al., 2020** | Yes | Yes | Yes | Yes | Yes | Unclear | Yes | Limited information was provided in the included records regarding how the authors addressed divergences and inconsistencies |
| **The Health Foundation, 2023** | Yes | Yes | Yes | Yes | Yes | Unclear | Yes | |
| **Wessex Academic** | Yes | Yes | Yes | Yes | Yes | Unclear | Yes | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Health Science Network, 2022** | | | | | | | | between the quantitative and qualitative data. |
| **Health Innovation Network South London, 2021** | Yes | Yes | Yes | Yes | Yes | Unclear | Yes | |

Source: Author's own work