The impact of Barcode Medication Administration on Patient Safety in UK hospital settings: a mixed-methods realist evaluation

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Background: Medication errors most commonly occur during medication administration, with an estimated 37 million medication administration errors (MAEs) each year in English hospitals, of which 2.8 million (7.5%) cause moderate/ severe patient harm(1). Barcode medication administration (BCMA) systems are increasingly implemented in hospital settings, with the aim of decreasing MAEs. However, little is known about the underlying mechanisms that support their use.

Objectives: We aim to explore the impact of BCMA on patient safety, including MAEs and nursing time spent providing direct patient care, in terms of what works, for whom, under what circumstances, and how. Objectives are to: (1)Develop an initial programme theory for how BCMA is expected to work in practice; (2) Refine the programme theory to establish what works, for whom, under what circumstances, and how, in relation to BCMA and its impact on patient safety; (3)To make recommendations for practice and policy in relation to how to implement and use BCMA.

Methods: A mixed-methods realist evaluation(2) at three acute hospital trusts, two in London and one in the Southwest. Phase1 involved a narrative review to develop an initial programme theory; Phase2 utilised interviews with key informants to refine the initial programme theory. The programme theory is now being tested in Phase3 using observation of medication administration, analysis of BCMA alert data, and interviews with nurses and patients. These data will be triangulated to refine and finalise the programme theory in Phase4, together with recommendations for practice. We are working with two PPI partners who are shaping the study and reviewing study documents and interview guides.

Results: The narrative review included 31 studies, of which only four were from the UK. For Phase2 we interviewed 6 key informants (3 pharmacists, 2 nurses and a human factors specialist). Phases1 and 2 findings informed the development of an initial programme theory comprising 13 context, mechanism and outcome configurations for how BCMA is being expected to work, which are now being tested in Phase3. The initial programme theory shows how contexts (e.g. nurses' perception of the impact of BCMA on patient safety, use of BCMA for specific drug rounds and specific medications) can trigger crtain mchanisms and outcomes related to use of BCMA and increase or decrease in medication adminstration errors.

Conclusion: To our knowledge, this study will be the first realist evaluation of BCMA. We intend the results of this study to inform practice and policy regarding use BCMA to support patient safety.

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Implications for research and practice

- To our knowledge, this study will be the first realist evaluation of BarCode Medication Administration (BCMA).
- We intend the results of this study to inform practice and policy regarding use of BCMA to support patient safety.

1. Challenge

- It is estimated that 37 million medication administration errors (MAEs) occur every year in English hospitals, of which 2.8 million (7.5%) cause moderate/ severe patient harm.
- BCMA systems are increasingly implemented in hospital settings, with the aim of decreasing MAEs.
- Little is known about the underlying mechanisms that support their use.

2. Objectives

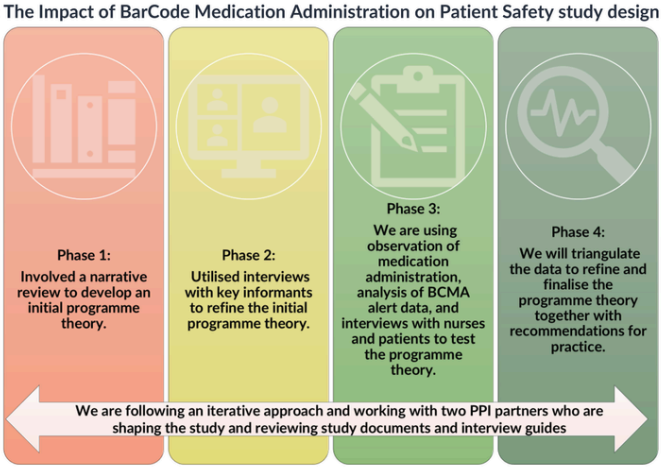
We aim to explore the impact of BCMA on patient safety, including MAEs and nursing time spent providing direct patient care, in terms of what works, for whom, under what circumstances, and how. Objectives are to:

- Develop an initial programme theory for how BCMA is expected to work in practice;
- Refine the programme theory to establish what works, for whom, under what circumstances, and how, in relation to BCMA and its impact on patient safety;
- To make recommendations for practice and policy in relation to how to implement and use BCMA.

3. Design

A mixed-methods realist evaluation (Figure 1) at three acute hospital trusts, two in London and one in the South West.

Figure 1: The Impact of BarCode Medication Administration on Patient Safety study design (phases 1-4)



4. Results

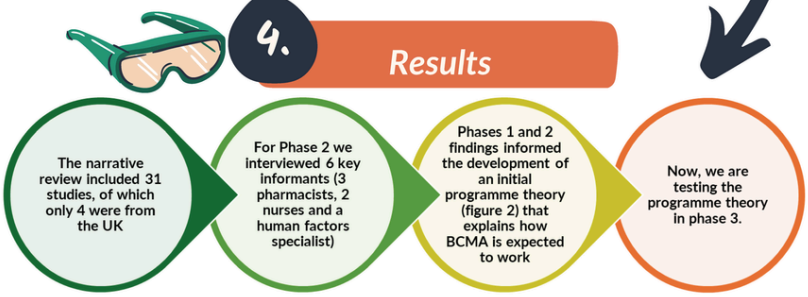


Figure 2: Initial Programme Theory of the Impact of BarCode Medication Administration on Patient Safety

Context (C)	Mechanisms (M)	Proximal Outcomes (PO)	Distal Outcomes (O)
C1: Where specific medications or formulations do not fit the standard BCMA workflow	M1: Nurses want to stay within the minimum requirements of policy	PO1: Nursing staff use the system with workarounds	O1: Increases possible medication administration errors
C2: When nurses administer medication during established administration time	M2: Nurses are keen to be efficient in their work	PO2: Lower use of BCMA by nurses	O2: Enhanced medication administration timeliness
C3: Where BCMA Technology does not work as expected/ BCMA features are not fit for purpose	M3: Nurses may over-rely on BCMA	PO3: Compliance with medication scanning	O3: Decreases potential medication administration error related to any errors in medication barcodes
C4: When nurses have a positive perception of using workarounds	M4: Nurses will struggle to comply with BCMA processes	PO4: Increases use of BCMA by nurses	O4: Enhances accuracy of medication administration
C5: Where the organisation responds to C4 with the provision of training for nurses	M5: Nurses desire to avoid the stigma of overdue medication	PO5: To increase accuracy in documentation and quick access to information	O5: Decreases medication administration timeliness
C6: Where using BCMA is perceived as allowing nurses to spend more time on patient care		PO6: Non-compliance with BCMA processes among nurses	O6: Leads to dose omissions
C7: Where there is adequate organisational IT infrastructure and resources		PO7: Omit essential step(s) of BCMA process	
C8: Where there are inadequate organisational infrastructure and resources		PO8: Increase compliance with BCMA process	
C9: When a patient identification barcode is not usable or accessible		PO9: Inaccurate documentation by nurses	
C10: When medication does not have a readable barcode			
C11: When organisations will expect clinicians to use the BCMA regardless of whether they fit the standard BCMA workflow			
C12: Where BCMA processes are incompatible with nurses' workflow			
C13: When nurses have a negative perception of BCMA medication reports			

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