Exploring the implementation of interventions to reduce catheter-associated urinary tract infections (ENACT)

Appendices A to E

Contents

Appendix A: National CAUTI interventions

Note: CAUTI is the abbreviation for catheter-associated urinary tract infections.

Intervention name	Shortened to
The Health and Social Care Act 2008 Code of Practice on the prevention and control of infections and related guidance	HSC Act 2008
NICE QS90: Urinary Tract Infections in Adults	NICE QS90
NICE QSG1: Infection prevention and control	NICE QSG1
NICE catheter audit tools	NICE catheter audit tools
Department of Health and Public Health England (2013) Prevention and control of infections in care homes: an informative resource	DH PHE 2013
Safety Thermometer	Safety Thermometer
Epic 3	Epic 3
High Impact Intervention for best practice insertion and care	High Impact
Catheter Care: Royal College of Nursing Guidance for nurses	Catheter Care
HOUDINI Protocol	HOUDINI
Catheter Passport	Catheter Passport

Appendix B: Search terms in the rapid review

Medline search terms (1 January 2014 to 23 October 2018)

1   Catheter-Related Infections/
2   ((catheter related or catheter associated) adj2 infection?).ti,ab.
3   catheter*.ti.
4   catheters/
5   1 or 2 or 3 or 4
6   exp Urinary Tract Infections/
7   ((((urin* or bladder*) adj2 infection?) or cauti or cautis or uti or utis or bacteriuria or pyuria or cystitis).ti,ab.
8   6 or 7
9   5 and 8
10   catheters, indwelling/ or urinary catheters/
11   ((urin* or bladder? or indwelling) adj3 catheter*).ti,ab.
12   10 or 11
13   infection*.mp.
14   12 and 13
15   9 or 14
16   Catheter-Related Infections/pc or exp Urinary Tract Infections/pc
17   Infection Control/
18   ((infection? or cauti or cautis or uti or utis or bacteriuria or pyuria or cystitis) adj5 (reduc* or decreas* or prevent*)).ti,ab.
19   ((infection? or cauti or cautis or uti or utis or bacteriuria or pyuria or cystitis) adj2 rate?).ti,ab.
20   (infection? adj2 control*).ti,ab.
21   prevent*.ti.
22   16 or 17 or 18 or 19 or 20 or 21
23   (educat* or train* or learn* or teach* or class* or workshop* or lecture? or module? or self-study or studying).ti,ab.
24   (program* or project? or intervention or initiative?).ti,ab.
25   (competenc* or knowledge* or skill?).ti,ab.
26   (behav* adj3 (chang* or modif* or improv*)).ti,ab.
27   (practice adj3 (chang* or modif* or improv*)).ti,ab.
28   (quality adj3 (improv* or manag* or chang*)).ti,ab.
29   exp Health Personnel/ed [Education]
30   exp education, continuing/ or exp inservice training/
31   exp Professional Competence/
32   practice patterns, nurses'/ or practice patterns, physicians'/
33   23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32
34   15 and 22 and 33
35   limit 34 to "reviews (maximizes specificity)"

36   limit 35 to (english language and yr="2000 -Current")
37   34 not 36
38   limit 37 to (english language and yr="2000 -Current")

Embase search terms (1 January 2014 to 23 October 2018)

1   catheter infection/
2   ((catheter related or catheter associated) adj2 infection?).ti,ab.
3   catheter*.ti.
4   catheters/
5   1 or 2 or 3 or 4
6   exp Urinary Tract Infection/
7   (((urin* or bladder*) adj2 infection?) or cauti or cautis or uti or utis or bacteriuria or pyuria or cystitis).ti,ab.
8   6 or 7
9   5 and 8
10   exp urinary catheter/
11   ((urin* or bladder? or indwelling) adj3 catheter*).ti,ab.
12   10 or 11
13   infection*.mp.
14   12 and 13
15   9 or 14
16   catheter infection/pc or exp Urinary Tract Infection/pc
17   infection control/ or infection prevention/
18   ((infection? or cauti or cautis or uti or utis or bacteriuria or pyuria or cystitis) adj5 (reduc* or decreas* or prevent*)).ti,ab.
19   ((infection? or cauti or cautis or uti or utis or bacteriuria or pyuria or cystitis) adj2 rate?).ti,ab.
20   (infection? adj2 control*).ti,ab.
21   prevent*.ti.
22   16 or 17 or 18 or 19 or 20 or 21
23   (educat* or train* or learn* or teach* or class* or workshop* or lecture? or module? or self-study or studying).ti,ab.
24   (program* or project? or intervention or initiative?).ti,ab.
25   (competenc* or knowledge* or skill?).ti,ab.
26   (behav* adj3 (chang* or modif* or improv*)).ti,ab.
27   (practice adj3 (chang* or modif* or improv*)).ti,ab.
28   (quality adj3 (improv* or manag* or chang*)).ti,ab.
29   exp education/ and exp health care personnel/
30   exp continuing education/ or in service training/
31   Professional Competence/
32   clinical practice/
33   23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32

34   15 and 22 and 33
35   limit 34 to "reviews (maximizes specificity)"
36   limit 35 to (english language and yr="2000 -Current")
37   34 not 36
38   limit 37 to (english language and yr="2000 -Current")

Cochrane Search Terms (1 January 2014 to 23 October 2018)

1   MeSH descriptor: [Catheter-Related Infections] explode all trees
2   (((catheter related or catheter associated) NEAR/2 infection*)):ti,ab,kw
3   (catheter*):ti
4   MeSH descriptor: [Catheters] this term only
5   #1 or #2 or #3 or #4
6   MeSH descriptor: [Urinary Tract Infections] explode all trees
7   ((((urin* or bladder*) NEAR/2 infection*) or cauti or cautis or uti or utis or bacteriuria or pyuria or cystitis)):ti,ab,kw
8   #6 or #7
9   #5 and #8
10   MeSH descriptor: [Urinary Catheters] explode all trees
11   MeSH descriptor: [Catheters, Indwelling] explode all trees
12   (((urin* or bladder* or indwelling) NEAR/3 catheter*)):ti,ab,kw
13   #10 or #11 or #12
14   (infection*):ti,ab,kw
15   #13 and #14
16   #9 or #15
17   MeSH descriptor: [Catheter-Related Infections] explode all trees and with qualifier(s): [prevention & control - PC]
18   MeSH descriptor: [Urinary Tract Infections] explode all trees and with qualifier(s): [prevention & control - PC]
19   (((infection* or cauti or cautis or uti or utis or bacteriuria or pyuria or cystitis) NEAR/5 (reduc* or decreas* or prevent*))):ti,ab,kw
20   (((infection* or cauti or cautis or uti or utis or bacteriuria or pyuria or cystitis) NEAR/2 rate?)):ti,ab,kw
21   ((infection* NEAR2 control*)):ti,ab,kw
22   (prevent*):ti
23   #17 or #18 or #19 or #20 or #21 or #22
24   (educat* or train* or learn* or teach* or class* or workshop* or lecture* or module* or self-study or studying):ti,ab,kw
25   (program* or project* or intervention or initiative*):ti,ab,kw
26   (competenc* or knowledge* or skill*):ti,ab,kw
27   ((behav* NEAR/3 (chang* or modif* or improv*))):ti,ab,kw
28   ((practice NEAR/3 (chang* or modif* or improv*))):ti,ab,kw
29   ((quality NEAR/3 (improv* or manag* or chang*))):ti,ab,kw

30   MeSH descriptor: [Health Personnel] explode all trees and with qualifier(s): [education - ED]

31   MeSH descriptor: [Education, Continuing] explode all trees

32   MeSH descriptor: [Inservice Training] explode all trees

33   MeSH descriptor: [Professional Competence] explode all trees

34   MeSH descriptor: [Practice Patterns, Physicians'] explode all trees

35   MeSH descriptor: [Practice Patterns, Nurses'] explode all trees

36   #24 or #25 or #26 or #27 or #28 or #29 or #30 or #31 or #32 or #33 or #34 or #35

37   #16 and #23 and #36

CINAHL search terms (1 January 2014 to 23 October 2018)

S38   S37 NOT S36

S37   S16 AND S23 AND S34 Limiters - Published Date: 20000101-20181231

S36   S16 AND S23 AND S34 Limiters - Published Date: 20000101-20181231; English Language; Clinical Queries: Review - High Specificity

S35   S16 AND S23 AND S34

S34   S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33

S33   (MH "Practice Patterns") OR (MH "Prescribing Patterns")

S32   (MH "Professional Competence+")

S31   (MH "Education, Continuing+") OR (MH "Staff Development")

S30   (MH "Health Personnel+/ED")

S29   TI ((quality N3 (improv* or manag* or chang*)) OR AB ((quality N3 (improv* or manag* or chang*))

S28   TI ((practice N3 (chang* or modif* or improv*))) OR AB ((practice N3 (chang* or modif* or improv*)))

S27   TI ((behav* N3 (chang* or modif* or improv*))) OR AB ((behav* N3 (chang* or modif* or improv*)))

S26   TI (competenc* or knowledge* or skill*) OR AB (competenc* or knowledge* or skill*)

S25   TI (program* or project* or intervention or initiative*) OR AB (program* or project* or intervention or initiative*)

S24   TI (educat* or train* or learn* or teach* or class* or workshop* or lecture* or module* or self-study or studying) OR AB (educat* or train* or learn* or teach* or class* or workshop* or lecture* or module* or self-study or studying)

S23   S17 OR S18 OR S19 OR S20 OR S21 OR S22

S22   TI prevent*

S21   TI (infection* N2 control*) OR AB (infection* N2 control*)

S20   TI (((infection* or cauti or cautis or uti or utis or bacteriuria or pyuria or cystitis) N2 rate*)) OR AB (((infection* or cauti or cautis or uti or utis or bacteriuria or pyuria or cystitis) N2 rate*))

S19   TI (((infection* or cauti or cautis or uti or utis or bacteriuria or pyuria or cystitis) N5 (reduc* or decreas* or prevent*))) OR AB (((infection* or cauti or cautis or uti or utis or bacteriuria or pyuria or cystitis) N5 (reduc* or decreas* or prevent*)))

S18   (MH "Infection Control+")

S17   (MH "Catheter-Related Infections+/PC") OR (MH "Urinary Tract Infections+/PC")

S16   (S1 OR S10 OR S15)

S15   S13 AND S14

S14   TX infection*

S13   S11 OR S12

S12   TI (((urin* or bladder* or indwelling) N3 catheter*)) OR AB (((urin* or bladder* or indwelling) N3 catheter*))

S11   (MH "Catheters, Urinary+")

S10   S6 AND S9

S9   S7 OR S8

S8   TI ((((urin* or bladder*) N2 infection*) or cauti or cautis or uti or utis or bacteriuria or pyuria or cystitis)) OR AB ((((urin* or bladder*) N2 infection*) or cauti or cautis or uti or utis or bacteriuria or pyuria or cystitis))

S7   (MH "Urinary Tract Infections") OR (MH "Bacteriuria")

S6   S2 OR S3 OR S4 OR S5

S5   (MH "Catheters")

S4   TI catheter*

S3   TI (((catheter related or catheter associated) N2 infection*)) OR AB (((catheter related or catheter associated) N2 infection*))

S2   (MH "Catheter-Related Infections")

S1   (MH "Urinary Tract Infections, Catheter-Related")

PsycINFO search terms (1 January 2014 to 23 October 2018)

1   ((catheter related or catheter associated) adj2 infection?).ti,ab.

2   catheter*.ti.

3   1 or 2

4   (((urin* or bladder*) adj2 infection?) or cauti or cautis or uti or utis or bacteriuria or pyuria or cystitis).ti,ab.

5   3 and 4

6   ((urin* or bladder? Or indwelling) adj3 catheter*).ti,ab.

7   infection*.mp.

8   6 and 7

9   5 or 8

10   ((infection? Or cauti or cautis or uti or utis or bacteriuria or pyuria or cystitis) adj5 (reduc* or decreas* or prevent*)).ti,ab.

11   ((infection? Or cauti or cautis or uti or utis or bacteriuria or pyuria or cystitis) adj2 rate?).ti,ab.

12   (infection? Adj2 control*).ti,ab.

13   prevent*.ti.
14   10 or 11 or 12 or 13
15   (educat* or train* or learn* or teach* or class* or workshop* or lecture? Or module? Or self-study or studying).ti,ab.
16   (program* or project? Or intervention or initiative?).ti,ab.
17   (competenc* or knowledge* or skill?).ti,ab.
18   (8ehave* adj3 (chang* or modif* or improv*)).ti,ab.
19   (practice adj3 (chang* or modif* or improv*)).ti,ab.
20   (quality adj3 (improv* or manag* or chang*)).ti,ab.
21   continuing education/ or exp inservice training/
22   professional competence/
23   15 or 16 or 17 or 18 or 19 or 20 or 21 or 22
24   9 and 14 and 23

Appendix C: Merged matrices showing links between theoretical domains framework and behaviour change techniques

Note: this appendix contains the following abbreviations: CAUTI = catheter-associated urinary tract infections, TDF = theoretical domains framework, BCT = behaviour change technique.

Column 3 shows linked BCTs as proposed in Cane J, Richardson M, Johnston M, Ladha R, Michie S. 'From lists of behaviour change techniques (BCTs) to structured hierarchies: comparison of two methods of developing a hierarchy of BCTs.' British Journal of Health Psychology 2015: volume 20, issue 1, pages 130 to 150.

Column 4 shows BCTs as proposed in Michie S, Johnston M, Francis J, Hardeman W, Eccles M. 'From theory to intervention: mapping theoretically derived behavioural determinants to behaviour change techniques.' Applied Psychology 2008: volume 57, issue 4, pages 660 to 680.

COM-B component	TDF domain	Linked BCTs proposed by Cane and others (2015) include:	Linked BCTs proposed by Michie and others (2008) include:	Linked BCTs (merged) include:
Capability (Psychological)	Knowledge	- Information on health consequences - Biofeedback - Antecedents - Feedback on behaviour	- Information on health consequences - Information on social or environmental consequences - Information emotional consequences - Salience of consequences	- Information on health consequences - Biofeedback - Antecedents - Feedback on behaviour - Information on social or environmental consequences - Information emotional consequences - Salience of consequences

COM-B component	TDF domain	Linked BCTs proposed by Cane and others (2015) include:	Linked BCTs proposed by Michie and others (2008) include:	Linked BCTs (merged) include:
Capability (Psychological)	Memory, Attention, Decision Making	• none	• Self-monitoring of behaviour • Self-monitoring of outcome of behaviour • Action planning prompts and cues	• Self-monitoring of behaviour • Self-monitoring of outcome of behaviour • Action planning • Prompts and cues
Capability (Psychological)	Behavioural Regulation	• Self-monitoring of behaviour	• Goal setting (behaviour) • Goal setting (outcome) • Behavioural contract • Action planning (including implementation intentions) • Prompts and cues	• Self-monitoring of behaviour • Goal setting (outcome) • Goal setting behaviour • Behavioural contract • Action planning (including • Implementation intentions) • Prompts and cues
Capability (Physical and Psychological)	Skills	• Graded tasks • Behavioural rehearsal or practice • Habit reversal • Body changes • Habit formation	• Graded tasks • Behavioural rehearsal or practice • Goal setting (outcome) • Goal setting (behaviour) • Monitoring by others without feedback • Self-monitoring	• Graded tasks • Behavioural rehearsal or practice • Habit reversal • Body changes • Habit formation • Goal setting (outcome)

COM-B component	TDF domain	Linked BCTs proposed by Cane and others (2015) include:	Linked BCTs proposed by Michie and others (2008) include:	Linked BCTs (merged) include:
			• Reward (outcome) • Self-reward • Incentive • Material reward • Non-specific reward • Demonstration of the behaviour (modelling) • Generalisation of target behaviour	• Goal setting (behaviour) • Monitoring by others without feedback • Self-monitoring • Reward (outcome) • Self-reward • Incentive • Material reward • Non-specific reward • Demonstration of the behaviour (modelling) • Generalisation of target behaviour
Opportunity (social)	Social Influences	• Social comparison • Social support (unspecified) • Social support (emotional) • Social support (practical) • Information about others' approval	• Social processes of encouragement, pressure or support • Demonstration of the behaviour (modelling)	• Social comparison • Social support (unspecified) • Social support (emotional) • Social support (practical) • Information about others' approval • Vicarious consequences or reinforcement

COM-B component	TDF domain	Linked BCTs proposed by Cane and others (2015) include:	Linked BCTs proposed by Michie and others (2008) include:	Linked BCTs (merged) include:
		• Vicarious consequences or reinforcement • Restructuring the social environment • Identification of self as a role model • Social reward		• Restructuring the social environment • Identification of self as a role model • Social reward • Demonstration of the behaviour
Opportunity (physical)	Environmental Context and Resources	• Restructuring the physical environment • Discriminative (learned) cue • Prompts and cues • Avoidance or changing exposure to cues for the behaviour • Restructuring the social environment	• Environmental changes (for example, objects to facilitate behaviour) that is, adding objects to the environment	• Restructuring the physical environment • Discriminative (learned) cue • Prompts and cues • Avoidance or changing exposure to cues for the behaviour • Restructuring the social environment • Adding objects to the environment
Motivation (Reflective)	Beliefs about consequences	• Information about emotional consequences	• Self-monitoring of behaviour	• Information about emotional consequences • Salience of consequences

COM-B component	TDF domain	Linked BCTs proposed by Cane and others (2015) include:	Linked BCTs proposed by Michie and others (2008) include:	Linked BCTs (merged) include:
		• Salience of consequences • Covert sensitization • Anticipated regret • Information about social or environmental consequences • Pros and cons • Vicarious reinforcement • Threat • Comparative imagining of future outcomes	• Self-monitoring of outcome of behaviour • Information on health consequences • Feedback on behaviour • Biofeedback • Feedback on outcome(s) of behaviour • Persuasive communication (credible source) • Information on social or environmental consequences • Salience of consequences • Information emotional consequences	• Covert sensitization • Anticipated regret • Information about social or environmental consequences • Pros and cons • Vicarious reinforcement • Threat • Comparative imagining of future outcomes • Self-monitoring of behaviour • Self-monitoring of outcome of behaviour • Information on health consequences • Feedback on behaviour • Biofeedback • Feedback on outcome(s) of behaviour • Persuasive communication (credible source)

COM-B component	TDF domain	Linked BCTs proposed by Cane and others (2015) include:	Linked BCTs proposed by Michie and others (2008) include:	Linked BCTs (merged) include:
Motivation (Reflective)	Beliefs about capabilities	• Verbal persuasion to boost self-efficacy • Focus on past success	• Motivational interviewing (that is, verbal persuasion to boost self-efficacy) • Self-monitoring of behaviour • Self-monitoring of outcome of behaviour • Graded tasks • Problem solving • Goal setting (behaviour) • Goal setting (outcome) • Coping skills • Behavioural practice and rehearsal • Social support (unspecified) • Social support (emotional) • Social support (practical) • Feedback (behaviour) • Feedback (outcome) • Self-talk	• Verbal persuasion to boost self-efficacy • Focus on past success • Self-monitoring of behaviour • Self-monitoring of outcome of behaviour • Graded tasks • Problem solving • Goal setting (behaviour) • Goal setting (outcome) • Coping skills • Behavioural practice and rehearsal • Social support (unspecified) • Social support (emotional) • Social support (practical) • Feedback (behaviour) • Feedback (outcome) • Self-talk

COM-B component	TDF domain	Linked BCTs proposed by Cane and others (2015) include:	Linked BCTs proposed by Michie and others (2008) include:	Linked BCTs (merged) include:
Motivation (Automatic)	Optimism	• Verbal persuasion to boost self-efficacy	• none	• Verbal persuasion to boost self-efficacy
Motivation (Automatic)	Social professional role and identity	• none	• Social support (unspecified) • Social support (emotional) • Social support (practical)	• Social support (unspecified) • Social support (emotional) • Social support (practical)
Motivation (Automatic)	Intentions	• Commitment • Behavioural contract	• Commitment • Behavioural contract	• Commitment • Behavioural contract
Motivation (Automatic)	Emotions	• Reduce negative emotions • Information about emotional consequences • Self-assessment of affective consequences • Social support (emotional)	• Reduce negative emotions • Conserving mental resources	• Reduce negative emotions • Information about emotional consequences • Self-assessment of affective consequences • Social support (emotional) • Conserving mental resources
Motivation (Automatic)	Reinforcement	• Threat • Self-reward • Differential reinforcement	• none	• Threat • Self-reward • Differential reinforcement

COM-B component	TDF domain	Linked BCTs proposed by Cane and others (2015) include:	Linked BCTs proposed by Michie and others (2008) include:	Linked BCTs (merged) include:
		• Incentive • Thinning • Negative reinforcement • Shaping • Counter conditioning • Discrimination training • Material reward • Non-specific reward • Response cost • Anticipation of future rewards or removal of punishment • Punishment • Extinction • Classical conditioning		• Incentive • Thinning • Negative reinforcement • Shaping • Counter conditioning • Discrimination training • Material reward • Non-specific reward • Response cost • Anticipation of future rewards or removal of punishment • Punishment • Extinction • Classical conditioning
Motivation (Automatic)	Goals	• Goal setting (outcome) • Goal setting (behaviour) • Review of outcome goal(s)	• goal setting (outcome) • goal setting (behaviour) • problem solving • social support (unspecified) • social support (emotional)	• Goal setting (outcome) • Goal setting (behaviour) • Review of outcome goal(s) • Review behaviour goals

COM-B component	TDF domain	Linked BCTs proposed by Cane and others (2015) include:	Linked BCTs proposed by Michie and others (2008) include:	Linked BCTs (merged) include:
		• Review behaviour goals • Action planning (implementation intentions)	• Social support (practical) • Feedback (behaviour) • Feedback (outcome) • Motivational interviewing (that is, verbal persuasion to boost self-efficacy) • Stress management (that is, reduce negative emotions; conserving mental resources) • Persuasive communication (that is, verbal persuasion to boost self-efficacy) • Reward (outcome) • Self-reward • Incentive • Material reward • Non-specific reward	• Action planning (implementation intentions) • Problem solving • Social support (unspecified) • Social support (emotional) • Social support (practical) • Feedback (behaviour) • Feedback (outcome) • Verbal persuasion to boost self-efficacy • Reduce negative emotions • Conserving mental resources • Reward (outcome) • Self-reward • Non-specific reward

Appendix D: List of most frequent barriers and facilitators identified in the previous CAUTI report

Note: this appendix contains the following abbreviations: CAUTI = catheter-associated urinary tract infections, TDF = theoretical domains framework, BCT = behaviour change technique, VAP = ventilator-associated pneumonia.

COM-B component	TDF Domain	Theme	Frequency (n= 25 studies max)	Barrier; facilitator or mixed	Behavioural phase	Example quote(s) [Setting; Study ID]
Capability (psychological)	Knowledge	Lack of knowledge of clinical guidelines and local procedural documents	3	Barrier	All	"Nurses lack of knowledge of evidence-based guidelines for: routine catheter maintenance; urinary catheter indications; bladder scanning; and intermittent catheterization." [Secondary Care; S2] "40% of the Burn ICU nursing staff was not aware of the nurse driven catheter removal protocol that exists within our hospital." [Secondary Care; S19]
Capability (psychological)	Knowledge	Lack of information regarding placement	2	Barrier	Insertion, post-	"Physicians are often unaware that urinary catheterization has been

COM-B component	TDF Domain	Theme	Frequency (n= 25 studies max)	Barrier; facilitator or mixed	Behavioural phase	Example quote(s) [Setting; Study ID]
		and duration of catheter insertion			insertion maintenance	excessively prolonged in their patients." [Secondary Care; S11] "Physicians were often not aware that patients had an indwelling catheter." [Tertiary Care; T1]
Capability (psychological)	Knowledge	Lack of awareness of the risks associated with use of urinary catheters	2	Barrier	All	"…So it's just making them [nurses] understand that there is a relationship between bladder infections and urinary tract infections and [urinary] catheter days…" [Secondary Care; S1]
Capability (psychological)	Knowledge	Lack of knowledge of how to manage patients without catheterisation	1	Barrier	Pre-insertion	"Not knowing how to manage critically ill patients in ICU without using indwelling urinary catheter." [Secondary Care; S15]
Capability (psychological)	Knowledge	Knowledge of how to manage bacterial infections resulting from urinary catheterisation	1	Facilitator	Post-insertion maintenance	Knowledge of how to manage catheter-associated bacteriuria: "The mean knowledge score was 57.5%, or slightly more than one-half of the questions answered correctly. The mean knowledge

COM-B component	TDF Domain	Theme	Frequency (n= 25 studies max)	Barrier; facilitator or mixed	Behavioural phase	Example quote(s) [Setting; Study ID]
						score was 57.5%, or slightly more than one-half of the questions answered correctly.'" [Tertiary Care; T3]
Capability (psychological)	Memory, Attention and Decision Making	Pre-emptively deciding to insert a catheter due to likely subsequent catheterisation	3	Barrier	Insertion	"Also I think at the back of my mind is the likelihood is that they're going to get catheterised in the near future any way when they hit the wards for a management reason." [Secondary Care; S17]
Capability (psychological)	Memory, Attention and Decision Making	Catheterisation decisions based on non-medical criteria	1	Barrier	Pre-insertion	"Nonmedical criteria often determined urinary catheter placement decisions, with catheters being used to manage patients with incontinence." [Secondary Care; S6]
Capability (psychological)	Memory, Attention and Decision Making	Patient symptoms prompt investigation and treatment of possible CAUTI	1	Facilitator	Post-insertion maintenance	"I usually order a urine culture on catheterized patients when there is a change in urine colour, cloudiness, or odour." [Tertiary care; T3]

COM-B component	TDF Domain	Theme	Frequency (n= 25 studies max)	Barrier; facilitator or mixed	Behavioural phase	Example quote(s) [Setting; Study ID]
Capability (psychological)	Memory, Attention and Decision Making	Absence of standardised CAUTI diagnostic criteria to help decision-making	1	Barrier	Post-insertion maintenance	"Lack of clear, standardised criteria used to define CAUTI, to distinguish between symptomatic and asymptomatic CAUTI and to report outcomes." [Primary Care; p1]
Capability (psychological)	Memory, Attention and Decision Making	Reminders and prompts	1	Facilitator	Removal	"Hospital epidemiologist in post was significantly and positively associated with: i) Urinary catheter reminder or stop-order/nurse-initiated catheter discontinuation." [Secondary Care; S4]
Capability (psychological)	Behavioural regulation	Audit and feedback on CAUTI metrics	2	Facilitator	All	"One hospital even made it a point to collect urinary tract infection (UTI) data on patients 7 days post discharge to use as evidence for their staff that urinary catheters (and hence their actions related to the use of urinary catheters) do cause infections." [Secondary Care; S1]

COM-B component	TDF Domain	Theme	Frequency (n= 25 studies max)	Barrier; facilitator or mixed	Behavioural phase	Example quote(s) [Setting; Study ID]
Capability (psychological)	Behavioural regulation	Inconsistent monitoring of compliance with guidelines	1	Barrier	All	"Inconsistent monitoring of compliance with evidence-based guidelines." [Secondary Care; S2]
Capability (physical)	Skills	Poor urinary catheter insertion technique	2	Barrier	Insertion	"Urinary catheters were being inserted by nursing staff that did not demonstrate proper insertion technique and by medical students and residents who were untrained in catheter placement." [Secondary Care; S6]
Opportunity (physical)	Environmental Context and Resources	Limited and inconsistent documentation and records	6	Barrier	All	"Lack of medical documentation for use of urinary catheters was significantly associated with inappropriate catheter use." [Secondary Care; S8] "The level of detail recorded was variable both within and between service groups. Of the patients with a CAUTI, the date diagnosed, method of diagnosis (for example, urine culture) and antibiotic

COM-B component	TDF Domain	Theme	Frequency (n= 25 studies max)	Barrier; facilitator or mixed	Behavioural phase	Example quote(s) [Setting; Study ID]
						treatment given were recorded in over 85% of cases, although the causative organism was reported in under 40%. However, it was rarely possible to confirm whether the CAUTI was symptomatic or asymptomatic." [Primary Care; P1]
Opportunity (physical)	Environmental Context and Resources	Transitions of care	5	Barrier	All	"Transferences to ward from intensive care unit accounted for 6% of inappropriate catheterisations." [Secondary Care; S13] "Staff turnover barrier to implementation of CAUTI reduction program." [Care homes; C1]
Opportunity (physical)	Environmental Context and Resources	Lack of time to perform alternatives to urinary catheterisation	3	Barrier	Pre-insertion	"Being too busy to be able to assist a patient to the bathroom." [Secondary Care; S1]

COM-B component	TDF Domain	Theme	Frequency (n= 25 studies max)	Barrier; facilitator or mixed	Behavioural phase	Example quote(s) [Setting; Study ID]
Opportunity (physical)	Environmental Context and Resources	Unavailability of medical alternatives to urinary catheterisation	2	Barrier	Pre-insertion	"Lack of medical alternatives, (for example, a bladder scanner that could help determine the need for a catheter) that may be contributing to these decisions." [Secondary Care; S1]
Opportunity (physical)	Environmental Context and Resources	Choice and availability of urinary catheters	2	Mixed	Pre-insertion	"Supply of urinary catheters being available in bedside supply carts added convenience and may have influenced their decision to insert one." [Secondary Care; S18] "In acute care catheter availability was often limited to samples supplied by company representatives or the limited supply held in hospital pharmacies. In the community availability could be limited by a formulary. Of the prescribing nurses, 54% had unlimited choice of catheters, while 43% were restricted in their

COM-B component	TDF Domain	Theme	Frequency (n= 25 studies max)	Barrier; facilitator or mixed	Behavioural phase	Example quote(s) [Setting; Study ID]
						choice." [Secondary care; Community Care; SC20]
Opportunity (social)	Social Influences	Requests from patients and their carers	5	Barrier	Pre-insertion	"Pressure of requests by the patient or the family for catheters: 'The family says, "Well my mum really needs it in. . . . Mum can't get up, mum can't walk, she's incontinent [of urine].'" [Secondary Care; S1]
Opportunity (social)	Social Influences	Lack of peer support and buy-in	4	Barrier	All	"Facility leads new to their positions often found it hard to gain buy-in, mainly due to a lack of relationship with the staff." [Care Homes; C1] "As a charge nurse explained: "If you don't have the doctors on board you're just going to be beating your head against the wall." [Secondary Care; S1]
Opportunity (social)	Social Influences	Physicians dictate nurses' practice	3	Barrier	All	"My supervising physician generally prefers to treat positive

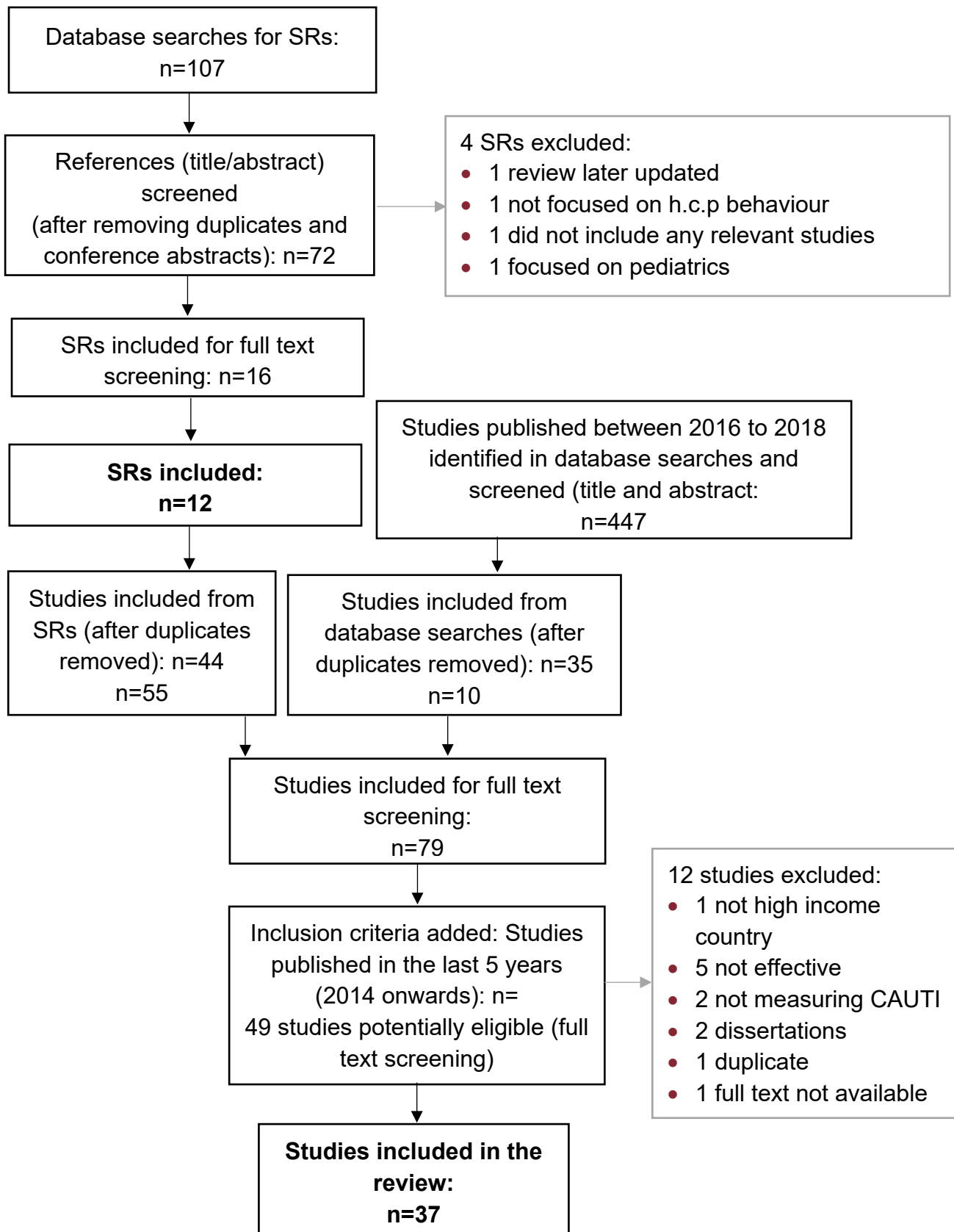| COM-B component	TDF Domain	Theme	Frequency (n= 25 studies max)	Barrier; facilitator or mixed	Behavioural phase	Example quote(s) [Setting; Study ID]
						urine cultures in catheterized patients." [Tertiary Care; T3] [Nurse:] "…You can keep asking, 'Can I pull the Foley?' and they'll [physicians] just say, 'Leave it in.'" [Secondary Care; S1]
Opportunity (social)	Social Influences	Cultural norms regarding standard catheterisation practice for specific patient groups	3	Barrier	Pre-insertion, Insertion	"The biggest challenge was changing the culture of practice of inserting indwelling urinary catheter in all ICU patients." [Secondary Care; S15]
Opportunity (social)	Social Influences	Local champions	2	Facilitator	All	"Presence of an emergency physician champion to establish indications for urinary catheter placement resulted in fewer orders for catheters." [Tertiary Care; T1]
Opportunity (social)	Social Professional Role and Identity	Having a hospital epidemiologist in post	2	Facilitator	Removal	"Hospital epidemiologist in post was significantly and positively associated with: i) Urinary catheter reminder or stop-order/nurse-

COM-B component	TDF Domain	Theme	Frequency (n= 25 studies max)	Barrier; facilitator or mixed	Behavioural phase	Example quote(s) [Setting; Study ID]
						initiated catheter discontinuation." [Secondary Care; S4]
Opportunity (social)	Social Professional Role and Identity	Acceptance of responsibility for urinary catheterisation decision making	2	Barrier	Pre-insertion	"Nurses felt that the decision to maintain an indwelling catheter was up to the physician and did not consider it within their scope of practice." [Tertiary Care; T2]
Opportunity (social)	Social Professional Role and Identity	CAUTI guidelines not perceived as relevant across hospital departments	1	Barrier	All	"I looked at the criteria set forward indications for [urinary] catheter use. I think my gut reaction was that perhaps some of those were not as applicable in the Emergency Department setting… that maybe they were more devised for the inpatient setting." [Secondary Care; S1]
Opportunity (social)	Social Professional Role and Identity	Nurses leading change in urinary catheterisation practice	1	Facilitator	All	"We're really changing it [practice] from the bottom up, which I think is a great idea. We're the ones doing the work so we're the ones that

COM-B component	TDF Domain	Theme	Frequency (n= 25 studies max)	Barrier; facilitator or mixed	Behavioural phase	Example quote(s) [Setting; Study ID]
						make that change." [Secondary Care; S7]
Motivation (reflective)	Beliefs about Consequences	Convenience and ease of monitoring	5	Mixed	All	"Catheters inserted for convenience purposes, for example, to accurately measure a patient's urine output or to avoid frequent transfers to a bedpan or a bedside commode." [Secondary Care; S18] "Perception that urinary catheters are a potential source of harm not convenient and benign." [Secondary Care; S7]
Motivation (reflective)	Beliefs about Consequences	Perceived severity of CAUTI	2	Mixed	All	"Perception by nursing staff of urinary catheters and urinary tract infections as benign was quite common." [Secondary care; S1] "Perception that urinary catheters are a potential source of harm not convenient and benign." [Secondary care' S7]

COM-B component	TDF Domain	Theme	Frequency (n= 25 studies max)	Barrier; facilitator or mixed	Behavioural phase	Example quote(s) [Setting; Study ID]
Motivation (reflective)	Beliefs about Consequences	Lack of perceived benefits to interventions targeting CAUTI	2	Barrier	All	"Physicians did not realize the value or benefits of supporting program implementation." [Care Homes; C1]
Motivation (reflective)	Beliefs about Consequences	Improved patient hygiene	1	Facilitator	Pre-insertion	"You don't want them lying in their own urine…It's not a great for someone who's wet with potential pressure areas and lying in their own wee." (ED consultant physician) [Secondary Care; S17]
Motivation (reflective)	Beliefs about Consequences	Pros and cons of reusable catheters	1	Mixed	Pre-insertion, Insertion	"Major concerns included the perceived increased risk of urinary tract infection and increased patient burden. Potential advantages included increased patient choice, cost savings and reducing the fear or likelihood of running out of catheters." [Secondary Care; Community care; SC20]

COM-B component	TDF Domain	Theme	Frequency (n= 25 studies max)	Barrier; facilitator or mixed	Behavioural phase	Example quote(s) [Setting; Study ID]
Motivation (reflective)	Beliefs about capabilities	Nurse empowerment	1	Facilitator	All	Empowering nurses to identify and address CAUTI improvement opportunities: "[We're] really changing it [practice] from the bottom up, which I think is a great idea. We're the ones doing the work so we're the ones that make that change." [Secondary Care; S7]
Motivation (reflective)	Beliefs about capabilities	Confidence in investigating and managing CAUTI	1	Facilitator	Post-insertion maintenance	"I feel confident in knowing when to order a urine culture on catheterised patients…how to manage bacteriuria in catheterised patients…and that I can apply asymptomatic bacteriuria guidelines to my patients." [Tertiary Care; T3]
Motivation (reflective)	Goals	CAUTI is not a priority	2	Barrier	All	"… it's difficult to find people that are excited about getting Foleys out of patients; other things take higher priority like central lines and VAP." [Secondary Care; S1]

Appendix E: Prisma flowchart (accessible text alternative below)

Database searches for SRs:
n=107

↓

References (title/abstract) screened
(after removing duplicates and conference abstracts): n=72

→

4 SRs excluded:
- 1 review later updated
- 1 not focused on h.c.p behaviour
- 1 did not include any relevant studies
- 1 focused on pediatrics

↓

SRs included for full text screening: n=16

↓

**SRs included:
n=12**

Studies published between 2016 to 2018 identified in database searches and screened (title and abstract:
n=447

↓

Studies included from SRs (after duplicates removed): n=44
n=55

Studies included from database searches (after duplicates removed): n=35
n=10

↓

Studies included for full text screening:
n=79

↓

Inclusion criteria added: Studies published in the last 5 years (2014 onwards): n=
49 studies potentially eligible (full text screening)

→

12 studies excluded:
- 1 not high income country
- 5 not effective
- 2 not measuring CAUTI
- 2 dissertations
- 1 duplicate
- 1 full text not available

↓

**Studies included in the review:
n=37**

31

Appendix E: PRISMA flowchart of selection process of research studies of interventions accessible text alternative

This PRISMA flowchart describes the stages of identifying and selecting systematic reviews and primary studies to identify interventions shown to be effective in research studies at reducing CAUTI incidence or rate. There were 4 stages to the selection process, identification, screening, eligibility and included articles. These stages were repeated for systematic review and primary studies identification and screening respectively.

Systematic reviews

Stage 1: Identification
Records were identified through database searching (107 records).

Stage 2: Screening
The 107 records identified through database searching in Stage 1 were then subjected to a title and abstract screening. A total of 35 records were excluded at this stage, after removing duplicates, protocols and conference abstracts. This left a total of 72 records to be reviewed. A total of 16 systematic reviews were carried forward for full test screening after preliminary eligibility criteria was applied.

Stage 3: Eligibility
The 16 systematic review records retained at the end of the preliminary screening were subjected to a full-text eligibility assessment. A total of 4 reviews were excluded at this stage, for the following reasons; 1 was excluded because the review was later updated, 1 did not focus upon H.C.P behaviour, 1 did not include any relevant studies, and 1 because it was focused on pedriatrics. This left a total of 12 systematic reviews to be carried forward to Stage 4.

Stage 4: Included
No further exclusions were made at this stage, leaving 12 systematic reviews included within the review.

Individual studies

Stage 1: Identification
Records were identified through database searching (447 records). A further 44 records were identified within the included systematic reviews included within the review.

Stage 2: Screening

The 447 records identified through database searching in Stage 1 were then subjected to a title and abstract screening. A total of 412 records were excluded at this stage, leaving a total of 35 records to be reviewed. Preliminary inclusion criteria was then applied to the 79 total individual studies, providing a total of 49 studies which were carried forward to stage 3.

Stage 3: Eligibility

The 49 records retained at the end of the preliminary screening were subjected to a full-text eligibility assessment. A total of 12 articles were excluded at this stage, for the following reasons; 1 was not from a high income country, 5 were not effective, 2 did not measure CAUTI, 2 were dissertations, 1 was a duplicate, and 1 articles full text was not available. This left a total of 37 studies to be carried forward to stage 4.

Stage 4: Included

No further exclusions were made at this stage, leaving 37 individual studies included within the review.