

1 **Online supplementary file 1.**

2 **Search strategy**

3 A three-stage search strategy was adopted for the review. Initially the Population, Concept, Context
4 (PCC) framework was used to generate keywords and synonyms from the review question, which
5 were used in the first search in OVID Medline and EBSCO CINAHL. Papers retrieved through the first
6 search were screened to identify further terms related to key concepts. The second search, using a
7 wider range of terms was then repeated in MEDLINE, CINAHL, at this stage the included databases
8 were extended to include PsychINFO and Web of science due to relevance to the topic. The third
9 search involved a review of the reference lists of all papers selected for the study to identify any
10 additional sources. Full search strings used in each database can be found in table 1.

11 Databases were searched from 1990 onwards as constructs related to workarounds begin to be
12 described within healthcare literature in various forms from 1990 and there is a proliferation in the
13 use of standards, protocols and guidelines being used to control with work of healthcare
14 professionals from this point. The review was not registered a priori. The search was limited to
15 papers published in English language only to allow the review team to effectively review the papers.
16 All electronic database searches were conducted on 22nd April 2022. Searches were run again on 26th
17 January 2024 but no further papers which met the review criteria were found.

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Table 1. Search strings for databases

	Population	Concept	Subject headings	Context	Subject headings
Limits:	1990 – 26.1.24 / English Language only.				
Medline	N/A	(Workaround* or Work* around* or Improvisat* or Violat* or Trade* off* or Trade-off* or Temporary fix or Shortcut* or Short-cut* or short cut* or problem solving or work as done or Deviat* or circumvent* or work simplification* or workflow) not (quality adjusted life year* or cost- benefit analysis or cost effectiveness or quality of life or deviation analysis or axis deviat* or mean deviat* or standard deviat* or index deviat* or human rights violat* or prison violat* or parole violat* or sexual violat* or physical violat* or problem solving education or problem solving self-care)	Problem solving / Work simplification/ Workflow	health care delivery or healthcare delivery or clinical practice or professional practice gaps or practice pattern* or patient safety	Delivery of healthcare (exploded to include or professional practice gaps or practice patterns) / Patient safety/
CINAHL	N/A	Workaround* or "Work* around*" or Improvisat* or Violat* or "Trade* off*" or "Temporary fix" or Shortcut* or problem solving or Deviat* or Circumvent* or workflow or "work as done" not ("quality adjusted life year*" or "cost- benefit analysis" or "deviation analysis" or "axis deviat*" or "mean deviat*" or "standard deviat*" or "index deviat*" or "human rights violat*" or "prison violat*" or "parole violat*" or "sexual violat*" or "physical violat*" or "problem solving education" or "problem solving self-care")	Problem solving/ workflow/	("health care delivery" or "healthcare delivery" or "clinical practice" or "patient safety" or "practice pattern*")	Health care delivery/Practice patterns / Patient safety
PsycInfo	N/A	(Workaround* or Work* around* or Improvisat* or Violat* or Trade* off* or Trade-off* or Temporary fix or Shortcut* or Short cut* or short-cut or problem solving or Deviat* or Circumvent* or work as done or creativity or divergent thinking or heuristics) not (quality adjusted life year* or cost- benefit analysis or deviation analysis or axis deviat* or mean deviat* or standard deviat* or index deviat* or human rights violat* or prison violat* or parole violat* or sexual violat* or physical violat* or problem solving education or problem solving self-care).tw.	Problem solving/ Group problem solving/ Heuristics/ Creativity/ Divergent thinking/ Improvisation	(health care delivery or healthcare delivery or clinical practice or patient safety) .tw.	health care delivery / patient safety
Web of Science	N/A	(workaround* OR "Work* around*" OR improvisat* OR violat* OR "Trade* off*" OR trade-off* OR "Temporary fix" OR shortcut* or "Short cut*" OR short-cut* or "problem solving" OR deviat* OR circumvent* OR "work as done") not ("quality adjusted life year*" or "cost- benefit analysis" or "deviation analysis" or "axis deviat*" or "mean deviat*" or "standard deviat*" or "index deviat*" or "human rights violat*" or "prison violat*" or "parole violat*" or "sexual violat*" or "physical violat*" or "problem solving education" or "problem solving self-care")	N/A	"Delivery of healthcare" OR "delivery of health care" OR "health care delivery" OR "healthcare delivery" or "clinical practice" OR "Patient safety"	N/A

Study selection and eligibility

An iterative approach to developing the inclusion criteria for this review was required due to the challenging and complex nature of the definitions, concepts and boundaries used when describing both workarounds and safety standards. Deviations from a review protocol for a traditional systematic review are rare, but the more iterative nature of the scoping review method allowed for transparent and auditable adaptations in this review.

The first iteration of the inclusion criteria was used by the review team (xx) to screen 10,184 titles and abstracts. At this stage 325 papers were selected for full text review. At full text review the inclusion criteria was further iterated to sensitise to the safety standard workaround concept. The revised criteria achieved 86% agreement between reviewers (xx) surpassing the 75% agreement recommended (19). At this time reviewers identified several included studies were of low quality, quantified workarounds only or solely described safety from a Safety I perspective, which was in contrast to the theoretical underpinnings of the review. Reviewers (xxxx) therefore iterated the review criteria for a final time to include the requirement for the paper to be published in a peer reviewed journal, to include qualitative findings and describe a broad conceptualisation of resilience in healthcare in the introduction, background, or objectives of the paper.

Study selection was conducted by importing search results from the databases into Endnote and then transferring into Covidence. This enabled the review team to collaborate easily during the screening phases of the review and maintain accurate records of decisions made. At this time any discrepancies regarding selection were discussed with a third reviewer (xx). For example, Debono's (1) study was considered for inclusion but did not meet our criteria for the resilient healthcare concept. Similarly, McLeod's study (12) was considered but did not meet our criteria for the standard term.

1 **Table 2. Eligibility criteria.**

	Include	Exclude
Participants	Study participants include registered healthcare professionals or registered healthcare professionals AND non-registered healthcare staff working within a healthcare organisation.	Study participants are limited to non-registered healthcare staff only. Any studies concerned with workarounds performed by patients, family members or informal carers.
Context	Studies published between 1990 -onwards. Studies from any country, written in English. Empirical studies, which use a qualitative or mixed methods design, published in a peer reviewed journal.	Studies concerned with healthcare delivery which is not patient facing.
Concepts	Within this scoping review three concepts have been used to provide a clear focus. All three concepts need to be evident in each paper in the manner described below to be included in the review.	
Concept 1	<p>Workarounds</p> <p><i>'Workarounds' are observed or described behaviours that may differ from organisationally prescribed or intended procedures. They circumvent or temporarily 'fix' an evident or perceived workflow hindrance in order to meet a goal or to achieve it more readily' (9).</i></p> <p>Explicit use of workaround term or a synonym of workaround (where the term is being used to describe an action which is consistent with the definition), in the introduction, background, or objectives of the paper.</p>	<p>Specific deliberate violations, including;</p> <ul style="list-style-type: none"> • Human rights • Sexual/physical • Parole/Prison • Boundary (professional) • Ethical <p>Studies reporting workarounds used in the context of research or education. Studies reporting workarounds used in computer programming, engineering, mathematical or statistical modelling. Studies reporting workarounds used to avoid issues paying for or accessing care. Studies reporting planned problem-solving activities such as QI projects. Studies quantifying variation in clinical care without explore reasons for this or articles solely focussed on patient outcome rather than process through which the outcome was achieved.</p>
AND		
Concept 2	<p>Standards</p> <p>Explicit reference to at least one specific standard or synonym - policy/procedure/protocol/rule designed to promote safety being worked around in the discussion or results section of the paper.</p>	<p>Studies reporting working around: People/ Technology/ Equipment/ Environmental issues unless a standard is explicit in the description of the workaround. Studies reporting on clinical guidelines designed to promote best treatment/ management of clinical condition.</p>
AND		
Concept 3	<p>Resilient healthcare</p> <p>Studies describe a broad conceptualisation of resilience or safety II within introduction, background, or objectives.</p>	<p>Studies which are ONLY safety I focused (which count number of deviations OR only focus on harm OR studies which describe workarounds as something that should never happen OR, as wrong, OR, do not recognise the impact of complexity).</p>

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1 **Data charting**

2 A data charting form was developed by the primary reviewer (x) which followed an adapted form of
3 the template offered in the JBI framework (21) and aligns to the review question and objectives.

4 The data charting form was tested by the primary reviewer (x) and a member of the review team (x)
5 to confirm the form supported the extraction of the data which would answer the review questions.
6 Following testing, the primary reviewer (x) proceeded to extract the data in all selected sources. The
7 form extracted: authors, year of publication, country of study, theoretical perspective, data collection
8 method, clinical setting, participant type and safety standard worked around, circumstances (who,
9 when, what, why) of the safety standard workaround and perceived implications of the safety
10 standard workaround.

11 Table 3 provides a summary of studies included in the review alongside the funding source of each
12 study.

13 **Synthesis**

14 Following guidance from Popay (25), a narrative synthesis has been produced to synthesise data from
15 studies included in this review, with the aim of summarising the current state of knowledge on the
16 use of safety standard workarounds in healthcare.

17 **Table 3. Funding sources for included studies**

Study number	Author	Year	Title	Funding source
29	A. Ashour et al.	2021	Mind the gap: Examining work-as-imagined and work-as-done when dispensing medication in the community pharmacy setting.	National Institute for Health Research (NIHR) Greater Manchester Patient Safety Translational Research Centre.
30	J. Back et al.	2017	Emergency Department Escalation in Theory and Practice: A Mixed-Methods Study Using a Model of Organizational Resilience.	Not reported.
31	A. Barrett	2020	'I can tell you right now, EHR does not improve communication. It does not improve healthcare': understanding how providers make sense of advanced information technology workarounds.	Not reported.
13	V. Blijleven et al.	2017	Workarounds Emerging From Electronic Health Record System Usage: Consequences for Patient Safety, Effectiveness of Care, and Efficiency of Care.	Not reported.
32	G. Bressers et al.	2021	Patient safety in medical residency training: Balancing bravery and checklists.	No funding received.
32	G. De Saint et al.	2010	The natural lifespan of a safety policy: violations and system migration in anaesthesia.	Not reported.
34	K. Dupret	2017	Working around technologies—invisible professionalism?	Not reported.
35	S. Grant et al.	2017	The role of informal dimensions of safety in high-volume organisational routines: an ethnographic study of test results handling in UK general practice.	Medical Research Council (MRC) Population Health Scientist Postdoctoral Fellowship.
36	A. Hakimzada et al.	2008	The nature and occurrence of registration errors in the emergency department.	Not reported.
37	A. Jones et al.	2016	Recognising and responding to 'cutting corners' when providing nursing care: a qualitative study.	Australian Postgraduate Award and a Research Scholarship from the Australian College of Nursing.
38	C. Jones et al.	2018	Understanding procedural violations using Safety-I and Safety-II: The case of community pharmacies	National Institute of Health Research through the NIHR Greater Manchester Patient Safety Translational Research Centre.

39	S. Lee and J. Kang	2021	Unintended Consequences and Workarounds of Electronic Medical Record Implementation in Clinical Nursing Practice	Not reported.
40*	I. Lyons et al.	2018	Errors and discrepancies in the administration of intravenous infusions: a mixed methods multihospital observational study.	National Institute for Health Research (NIHR) grant. The research is also supported by the NIHR Imperial Patient Safety Translational Research Centre.
41	C. Mula et al.	2019	An exploration of workarounds and their perceived impact on antibiotic stewardship in the adult medical wards of a referral hospital in Malawi: a qualitative study	Norwegian Research and Capacity Building for Higher Education (NORHED) Antimicrobial Stewardship Project and the 2016 African Doctoral Dissertation Research Fellowship (ADDRF).
42	A. Mulac et al.	2021	Barcode medication administration technology use in hospital practice: a mixed-methods observational study of policy deviations.	Internally funded.
43	Z. Niazkhani et al.	2011	Evaluating the medication process in the context of CPOE use: The significance of working around the system	Not reported.
44	A. Popescu et al.	2011	Multifactorial Influences on and Deviations from Medication Administration Safety and Quality in the Acute Medical/Surgical Context	Not reported.
45	S. Qian et al.	2018	Medication administration process in a residential aged care home: An observational study	Not reported.
46	L. Rack et al.	2012	Study of Nurse Workarounds in a Hospital Using Bar Code Medication Administration System.	Not reported.
47	N. Sanford et al.	2022	Capturing challenges and trade-offs in healthcare work using the pressures diagram: An ethnographic study	NIHR Imperial Patient Safety Translational Research Centre.
48	B. Schutjser et al.	2019	Double checking injectable medication administration: Does the protocol fit clinical practice?	Dutch Ministry of Health, Welfare, and Sports.
49**	Soares P. Vassilakopoulou et al.	2012	Workaround identification as an instrument for work analysis and design: a case study on ePrescription	Not reported.
50	A. Uema et al.	2020	Adaptive behaviour of clinicians in response to an over-constrained patient safety policy on the administration of concentrated potassium chloride solutions.	Grant-in-Aid for Scientific Research-practical application of resilience engineering theory in patient safety and improvement.

51**	P. Vassilakopoulou et al.	2012	From "Rules to Interpret" to "Rules to Follow": ePrescription in Greece	Partially supported by the European Union (European Social Fund – ESF) and Greek national funds through the Operational Program "Education and Lifelong Learning" of the National Strategic Reference Framework (NSRF) - Research Funding Program: Heracleitus II, investing in knowledge society through the European Social Fund.
52*	J. Vos et al.	2020	Nurses as a source of system-level resilience: Secondary analysis of qualitative data from a study of intravenous infusion safety in English hospitals.	National Institute for Health Research (NIHR) grant. The research is also supported by the NIHR Imperial Patient Safety Translational Research Centre.
53	A. Watt et al.	2019	Resilience in the blood transfusion process: Everyday and long-term adaptations to 'normal' work	Not reported.
54	J. Westphal et al.	2014	Work-Arounds Observed by Fourth-Year Nursing Students.	Supported by Research and Professional Development Fund, College of Nursing, University of Wisconsin Oshkosh.

Reference

1. Debono D, Taylor N, Lipworth W, et al. Applying the Theoretical Domains Framework to Identify Barriers and Targeted Interventions to Enhance Nurses' Use of Electronic Medication Management Systems in Two Australian Hospitals. *Implementation Science*. 2017. 12(42).