SOCIOLOGY OF HEALTH & ILLNESS

*Sociology of Health & Illness Vol. xx No. xx 2018 ISSN 0141-9889, pp. 1–17*
doi: 10.1111/1467-9566.12861

# Neither magic bullet nor a mere tool: negotiating multiple logics of the checklist in healthcare quality improvement

**David Kocman[1,2], Tereza Stöckelová[2], Rupert Pearse[3] and Graham Martin[1,4]**

[1]*SAPPHIRE Group, Department of Health Sciences, College of Life Sciences, University of Leicester, Leicester, UK*
[2]*Institute of Sociology of the Czech Academy of Sciences, Prague, Czech Republic*
[3]*William Harvey Research Institute, Queen Mary, University of London, London, UK*
[4]*The Healthcare Improvement Studies Institute, University of Cambridge, Cambridge,UK*

**Abstract** Over two decades, the checklist has risen to prominence in healthcare improvement. This paper contributes to the debate between its proponents and critics, making the case for an Science and Technology Studies-informed understanding of the checklist that demonstrates the limitations of both the "checklist-as-panacea" and "checklist-as-socially-determined" positions. Attending to the checklist as a socio-material object endowed with affordances that call upon clinicians to act (Allen 2012, Hutchby 2001), the study revisits the efforts of a recent improvement initiative, the Enhanced Peri-Operative Care for High-risk patients trial. Rather than a singularised simple tool, this study discusses four different and relationally enacted logics of the checklist as a stop and check tool, a clinical prompt, an audit tool and a clinical record. Each logic is associated with specific temporality, beneficiaries, relationship with material forms, and interpellates (Law 2002) clinicians to initiate specific actions which can conflict. The paper seeks to make the case for intervention to improve such tools and consciously account for the consequences of their design and materiality and calls for supporting such settings and arrangements in which incoherences collected in tools can be locally negotiated.

**Keywords:** checklist, healthcare improvement, affordances, multiple logics, socio-material infrastructures

## Introduction

In the new millennium, the checklist rose to global prominence in a series of well delivered pilot projects followed by the WHO recommending that all hospitals use this device in surgery (Haynes *et al.* 2009). In the UK, by 2012, around 2000 institutions had tried the checklist in daily practice for procedures in specialisms ranging from surgery and anaesthesia to childbirth and swine flu (Anthes 2015). A best-selling apotheosis of an effort to promote the checklist was Atul Gawande's (2010) *The Checklist Manifesto* which placed the checklist within the


Published by John Wiley & Sons Ltd., 9600 Garsington Road, Oxford OX4 2DQ, UK and 350 Main Street, Malden, MA 02148, USA

wider arena of quality improvement, insisting that doing simple things right and consistently can fix many problems and challenges of modern medicine characterised by an ever-increasing complexity. Simple tools such as checklists were argued to provide far better outcomes than any individual pill or the best-trained surgeon (Gawande 2015). The turn to improving care through checklists was further underpinned by strong theoretical framing in systems thinking, behavioural psychology and epidemiology (Waring *et al.* 2016, Zuiderent-Jerak and Berg 2010) combined with rigorous process control adopted from the manufacturing sector (Hales and Pronovost 2006, Jammer *et al.* 2015, Parry 2014, Pronovost *et al.* 2006). While some research reported mixed messages about its effectiveness (Treadwell *et al.* 2014, Urbach *et al.* 2014), quality improvement in healthcare, with its emphasis on low-tech strategies and mundane artefacts and formal tools to ensure behavioural change (Marshall *et al.* 2013, Parry 2014, Perla *et al.* 2013), provided a fruitful platform for the checklist's rise as a simple yet powerful instrument for standardising clinical practice and improving healthcare outcomes.

The rise of the checklist has not passed unnoticed by sociology. Critical examinations pointed out that the checklist may have been regarded by too many as a "magic bullet" ready to effect positive change irrespective of context (Dixon-Woods *et al.* 2012). Such critique, often drawing on ethnographic insights into how clinical tools work in their environments, argued against attributing improved outcomes solely or primarily to the checklist (Bosk *et al.* 2009). Some argued that promoting checklists as a powerful solution to complex problems was an oversimplification and a distraction (e.g. Catchpole and Russ 2015) – technical solutions could not resolve complex social problems such as behavioural change in healthcare settings (e.g. Bosk *et al.* 2009). Arguably, the key point made by these authors is not that checklists do not work, but that they do not work *alone*. Unlike checklist enthusiasts, critics showed how success of improvement initiatives, rather than technical fixes, relied on an interplay of social factors, cultural values, practices and negotiations. All along, it was arduous work, often laden with emotions (Aveling *et al.* 2013, Dixon-Woods and Martin 2016, Dixon-Woods *et al.* 2012).

In this paper, we contribute to this debate between proponents and critics of the checklist. We suggest that this debate risks generating conceptualisations that oscillate between viewing the checklist in healthcare improvement as either a "magic bullet," or a "mere tool," animated (and dominated) by social forces. We argue that to understand the role and power of checklist in today's healthcare, we need to attend to its materiality in action. To do so, we mobilise insights from Science and Technology Studies (STS) about how mundane artefacts act, and are acted upon, in socio-material arrangements of healthcare. In particular, we draw on the work of Davina Allen on the "affordances" of tools (Allen 2012, Allen *et al.* 2016, Hutchby 2001, Petrakaki *et al.* 2016) and expand it using the notion of "multiple logics" (Law 1994). With this analytical sensitivity, we revisit ethnographic data collected as part of an evaluation of a recent initiative in the British National Health Service (NHS) aimed at improving emergency surgery. Our findings show that in everyday improvement practice, clinicians did not engage with a "simple checklist" endowed with a single set of affordances. We argue that the affordances of the checklist clustered to identifiable different logics inscribed in larger infrastructures of healthcare (and beyond). We show different versions of the checklist that were relationally enacted at different times: the checklist was at one time a stop and check tool, at another time a clinical prompt, an audit tool, or a clinical record. At the sharp end of improvement projects, we also observed an interplay between the logics. This interplay at times created practical tensions for clinicians. Both proponents and critics tend to understand tensions and uncertainties around the checklist as a function of clinical resistance, ignorance or mismanaged projects. We suggest, rather, that tensions were part of the checklist's materiality whereby different logics prompted clinicians to undertake specific actions, within a specific

temporality and for specific beneficiaries. These actions, timescales and audiences were not always incompatible. But often they also created frictions that needed to be negotiated by clinicians in everyday encounters. This allows us to see practical tinkering with the checklist not as singular enactments but as patterned activity whereby the logics are further stabilised (or not) in healthcare. Our findings have implications for understanding the ways improvement tools shape clinical actions.

After further revisiting the checklist debate to add a third theoretical perspective in the next section, and accounting for our methods, we outline findings about how hospital-based improvement teams in our study used a specific tool, which followed the checklist format, the pre-operative "boarding card." In the concluding discussion, we highlight implications for theory and practice.

## Bringing STS to the checklist debate

The rise of the checklist in medical practice provoked a critical response from sociologists and clinicians who pointed out that the checklist enthusiasts and the WHO recommendations may have overstated the significance of the checklist (e.g. Aveling *et al.* 2013, Dixon-Woods *et al.* 2011). Critics revisited one of the successful studies cited by those promoting the checklist, the Keystone improvement programme in Michigan, US, which reported a large and sustained reduction in rates of catheter-related blood stream infections in Intensive Care Units (Pronovost *et al.* 2006). The triumph, which led to 50 per cent reduction in deaths, was ascribed by some to the checklist. The response argued that "the mistake of the simple checklist story was in the assumption that a technical solution (checklists) can solve an adaptive (sociocultural) problem" (Bosk *et al.* 2009: 444). Arguably, checklists were but one component in the composite reality of healthcare, which was "messier" and more complex than checklist proponents imagined. Improvements that worked involved the creation of social networks with a shared sense of mission, whose members were each able to reinforce the efforts of the other to cooperate with the interventions. An *ex post* reconstruction of the Michigan project confirmed that the success of Keystone dwelled in reframing clinical issues as a social problem which involved human action and behaviour, creating social networks to generate a wide buy-in, and using persuasive techniques such as storytelling and "hard data" (Dixon-Woods *et al.* 2011).

Both advocates and critics deployed specific notions of agency in their understanding of the checklist and the role of the context in affecting success of medical actions. Advocates called the checklist a simple and powerful improvement tool, and promoted it as an effective way of managing complexity. To them, success was inherent to the tool while failure may occur as an effect of external influences, namely people mishandling the checklist. If used wisely, checklists are said to be able to reduce ambiguity and enable clinicians to perform required tasks consistently (Gawande 2007, Walker *et al.* 2012). Critics suggest that, rather than a magic bullet, the checklist is dependent for success on the social context of its use. Where advocates of the checklist understood success a function of the checklist and failure a social outcome, critics pointed out that, in fact, *both* failure and success are determined by the interplay of social factors, cultural values, practices and negotiations. In these accounts, the checklist becomes uninteresting compared to the forces that animate (or inhibit) it. Nonetheless, both camps agreed that investing in "social contexts," namely in interventions such as education and coaching of clinicians (Low *et al.* 2012) and effective leadership (Conley *et al.* 2011), need to be understood as key to successful improvement (Bosk *et al.* 2009, Brown and Calnan 2011). After all, both agree that "the main challenge to [implementation] lies within us" (Low *et al.* 2012: 1030).

This accentuation of the social and organisational context in both the "magic bullet" story and its critique has meant that the question of the materiality of the checklist remains under-researched and under-theorised. To advance the debate, we turn to STS, and more specifically to Davina Allen's call for considering how "affordances" of mundane technologies, such as the checklist, relate to the socio-material infrastructure into which they are introduced (Allen 2012: 461). Despite its contested ontology (Parchoma 2014), the concept of affordances has been widely used in studies of medicine (Allen 2012, Petrakaki *et al.* 2016) and other areas (Koed Madsen 2015, Leonardi 2011, Zammuto *et al.* 2007). Following Hutchby, affordances refer to the "functional and relational aspects which *frame, while not determining*, the possibilities for agentic action in relation to an object" (Hutchby 2001: 444, emphasis added). We may think of affordances as material ways of calling upon clinicians: as "interpellating" them towards certain actions and not others (Law 2002). How strong these interpellations become remains open to interactional negotiations where other elements, both human and non-human, intervene. In that respect, affordances come close to the classic STS notion of "materiality" in conveying the idea that technologies exercise agency in the sense they matter more than mere containers for human intentions and meaning (Latour 2005) – while emphasising that any such agency is emergent, rather than inherent to the technology. The checklist as a socio-material object not only emerges in actual enactments, it also has specific consequences in those enactments.

To advance the debate about checklist and its affordances, one of the stories STS have told consistently about objects and technologies, from aircrafts (Law 2002) to bush pumps (de Laet and Mol 2000) and electronic patient records (Petrakaki *et al.* 2016), is that they are rarely "singularised" – well bounded and organized along a single logic (Berg 1997). The STS stories then often use the notion of "logic" in plural, referring to multiple versions of an object, each providing it and those around it with an operational framework for action or a "mode of ordering" (Law 1994). There is no space for technological (or social) determinism (Latour 2005). Each logic can be associated with a different temporality, prescribe specific action and a beneficiary of that action, require an action of a particular speed and rhythm, and make variable demands of others' actions. Logics also have an emergent quality. They do not pre-exist "practice," yet they pre-exist individual practices in the sense of having been enacted in myriad ways before their next enactment. As such they may be learned about and inscribed into tools. We explore the materiality of the checklist through its various logics that may entangle and disentangle those around it, and may also conflict with each other. The checklist, like other technologies, may then perform in incoherent ways (Law 2002).

## The case: checklist as part of the EPOCH trial

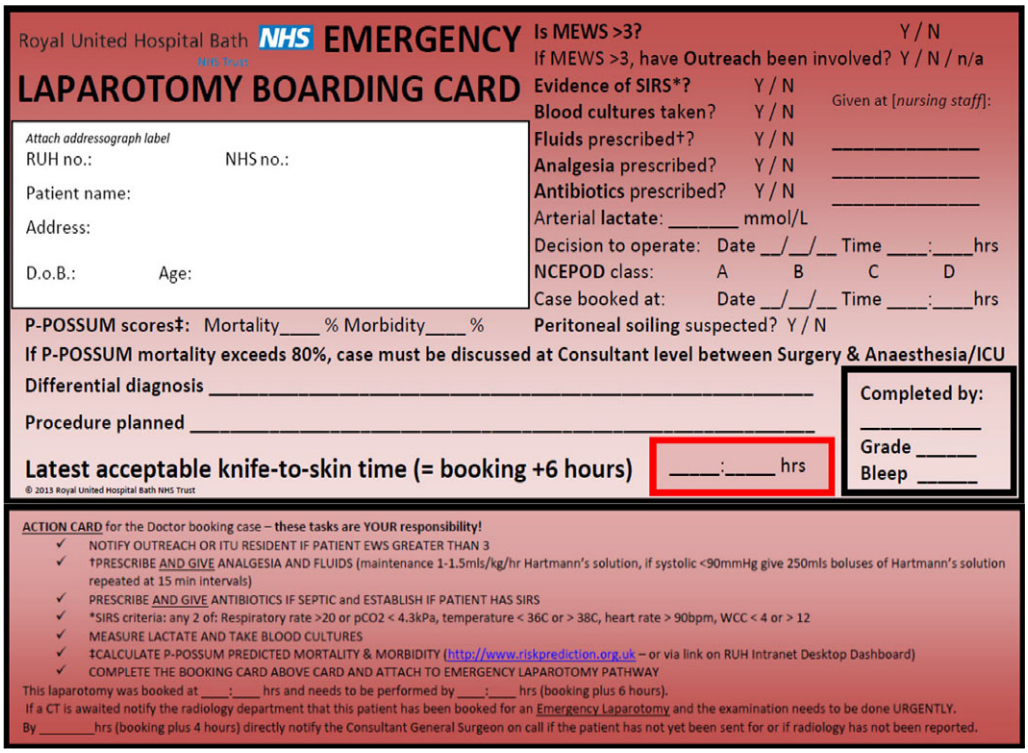
The Enhanced Peri-Operative Care for High-risk patients (EPOCH) trial, launched in 2014, was a major national project to improve emergency general (abdominal) surgery in the UK, with 96 NHS hospitals participating in 15 clusters over an 18-month period. The trial introduced a 36-node list of clinical interventions organised in a care pathway which set out the ideal routemap for pre-operative, intra-operative to post-operative care and patient discharge (Pearse 2014). Implementation of the pathway was supported by a range of strategies and tools devised to that end, and shared by the trial coordinators with participating improvement teams. Clinicians-turned-quality-improvement-leads were prompted to combine evidence-based clinical practice with thinking about "softer skills" of persuasion, taught how to understand variation in data, and how to build up knowledge about instigating change. The care pathway was also subdivided into several "bundles" for ease of implementation and evaluation; the trial

coordinators encouraged improvement teams to use tools such as a "boarding card" to implement a specific bundle of clinical actions into everyday surgical care.

The "boarding card" was a checklist-based tool born out of a list of recommendations published in 2011 by the RCS (2011) and later systematised into a care pathway (Odor and Grocott 2016, Pearse *et al.* 2011). The recommendations were also translated into a prototype "boarding card" tested in an improvement project in southern England (see Figure 1), and widely circulated across clinical communities (Richards *et al.* 2016). The EPOCH trial coordinators encouraged participating hospital teams to adapt the "prototype" boarding card to fit their local improvement needs. As such, the individual checklist-based tools varied in detail while incorporating all interventions included in the pre-operative bundle of the pathway.

## Data and methods

Data used in this paper come from a qualitative sub-study in six hospitals which ran concurrently with the EPOCH trial. The trial itself followed a stepped wedge cluster randomisation format with gradual activation of clusters of hospitals into the trial. The six sites selected for the sub-study were activated at various points, allowing for differences in length of engagement. Consequently, the volume of collected data ranged from 20 interviews and 54 hours' observation in Site 2 to four interviews and 18 hours' observation in Site 6. Across all six sites, 54 interviews and over 200 hours' observation were undertaken. Interviews, mainly with senior clinicians in surgery, anaesthesia and critical care who acted as implementation leads,


Royal United Hospital Bath NHS EMERGENCY
NHS Trust
LAPAROTOMY BOARDING CARD

*Attach addressograph label*
RUH no.: NHS no.:
Patient name:
Address:
D.o.B.: Age:

Is MEWS >3? Y / N
If MEWS >3, have Outreach been involved? Y / N / n/a
Evidence of SIRS*? Y / N
Blood cultures taken? Y / N
Fluids prescribed†? Y / N
Analgesia prescribed? Y / N
Antibiotics prescribed? Y / N
Given at [*nursing staff*]:
Arterial lactate: _____ mmol/L
Decision to operate: Date __/__/__ Time ____:____hrs
NCEPOD class: A B C D
Case booked at: Date __/__/__ Time ____:____hrs
Peritoneal soiling suspected? Y / N

P-POSSUM scores‡: Mortality____ % Morbidity____ %
If P-POSSUM mortality exceeds 80%, case must be discussed at Consultant level between Surgery & Anaesthesia/ICU
Differential diagnosis _____
Procedure planned _____
Latest acceptable knife-to-skin time (= booking +6 hours) ____:____ hrs
Completed by:
_____
Grade _____
Bleep _____
© 2013 Royal United Hospital Bath NHS Trust

ACTION CARD for the Doctor booking case – **these tasks are YOUR responsibility!**
- ✓ NOTIFY OUTREACH OR ITU RESIDENT IF PATIENT EWS GREATER THAN 3
- ✓ †PRESCRIBE AND GIVE ANALGESIA AND FLUIDS (maintenance 1-1.5mls/kg/hr Hartmann's solution, if systolic <90mmHg give 250mls boluses of Hartmann's solution repeated at 15 min intervals)
- ✓ PRESCRIBE AND GIVE ANTIBIOTICS IF SEPTIC and ESTABLISH IF PATIENT HAS SIRS
- ✓ *SIRS criteria: any 2 of: Respiratory rate >20 or pCO2 < 4.3kPa, temperature < 36C or > 38C, heart rate > 90bpm, WCC < 4 or > 12
- ✓ MEASURE LACTATE AND TAKE BLOOD CULTURES
- ✓ ‡CALCULATE P-POSSUM PREDICTED MORTALITY & MORBIDITY (http://www.riskprediction.org.uk – or via link on RUH Intranet Desktop Dashboard)
- ✓ COMPLETE THE BOOKING CARD ABOVE CARD AND ATTACH TO EMERGENCY LAPAROTOMY PATHWAY

This laparotomy was booked at ____:____ hrs and needs to be performed by ____:____ hrs (booking plus 6 hours).
If a CT is awaited notify the radiology department that this patient has been booked for an Emergency Laparotomy and the examination needs to be done URGENTLY.
By _____hrs (booking plus 4 hours) directly notify the Consultant General Surgeon on call if the patient has not yet been sent for or if radiology has not been reported.

Figure 1 *The prototypical emergency surgery "boarding card."* Source: *Richards et al. (2016)*

focused on capturing key nodes of decision-making, factors affecting implementation, actors involved and their understandings, and the implementation tools and strategies they chose to deploy. Observations covered visits to regional meetings organised by the trial coordinators, local teams' implementation meetings, and various gatherings called by the improvement teams.

The overall ethnographic framework focused broadly on challenges to implementation and was not designed to collect systematic data on the checklist. When revisiting the collected material for the purposes of this paper, only data from Site 2 and Site 5 were utilised, as improvement teams in these sites attempted extensively to deploy boarding cards to improve emergency surgery. Data from the remaining sites did not allow for a detailed account of local tinkering with the checklist; they are reported in other outputs (Martin *et al.* 2017). As part of the original ethnography, all interviews were digitally audio recorded, and field notes recorded in a diary at the time of observation, or as soon as possible afterwards. Interview recordings, fieldnotes and within-team debriefs discussing the data collected were then professionally transcribed. Analysis of data was based on the constant comparative method (Charmaz 2007) but informed by theoretical concepts arising from the literature and from discussion within the team. This process allowed the analytical construction of four logics of the checklist: some, such as the logics of "audit" and "stop and check," had already existed in different strands of literature and were also observed in the field. Others, such as the checklist as a clinical record and the checklist as a prompt, emerged because the interviews and observations offered other and more nuanced positions. The authors then critically reflected on the autonomous status of individual logics but also weighted their presence and gravity in interactions between clinicians and the checklist. Separating analytically the range of domains within which logics operated informed this process, as some logics, namely "stop and check" and "prompt," were alike in terms of aims and beneficiaries and only differed in temporality and rhythm (see Table 1).

Ethical approval was given by a NHS Research Ethics Committee, and clearance was provided by the research governance office of each participating organisation before fieldwork began.

## Findings

Invariably, for clinicians, the boarding card represented a "singularised" tool with a common name, printed on a single sheet of paper, which was simple to use and brought together the best of improvement science and clinical knowledge in emergency surgery.

> The boarding card. Dead easy. People like it, it focuses the mind. It's been great. (Consultant in intensive care and anaesthetics, Hospital 5)

Despite the perceived simple nature and singularity of the tool, we account for four different logics that could be identified in interactions between clinicians and the boarding card: stop and check; prompt; audit; and clinical record (see summary in Table 1). After their empirical exposition which follows we then attend to the ways clinicians navigated their improvement work through the various, sometimes conflicting, demands posed by the interplay of logics.

## Checklist as a stop and check

Similarly to aviation where the idea of the checklist originated (Clay-Williams and Colligan 2015), the stop and check logic required clinicians to pause and check whether a set of

Table 1 *Four logics of the checklist*

| *Checklist logic* | *Beneficiary of action* | *Aim* | *Temporality* | *Speed and rhythm of action* | *Record-keeping* |
|---|---|---|---|---|---|
| Stop and check | The clinician | To ensure all items of the list completed and standardise practice | Retrospective | Slow down and check | Not required |
| Prompt | The clinician | To support decision-making and standardise practice | Prospective | Take action which otherwise may not happen | Not required |
| Audit | Improvement team (third party) | To show whether prescribed interventions took place | Retrospective | After the act – find time to record, if only as a tick in a box | Required |
| Clinical record | Clinicians attending to the patient at next steps | To record patient attributes for clinical decision-making | Retrospective/ prospective | Write as you go approach similar to other clinical records to enable clinical steps further on a pathway | Required |

interventions specified on the checklist form had been completed. As such, the checklist was designed to become an important tool to remind an individual – the clinician holding the boarding card in their hands – to check whether either they or colleagues had done what they were meant to. The guiding question was "has this been done?", "have we missed anything important?" in pre-operative assessment and decision-making:

> It's all about optimising the physiology of a patient going for laparotomy. [. . .] So [here we have] highest early warning score in the last 6 hours, [then] systemic inflammatory response syndrome, so this is the patient tachycardia, what's their white count et cetera. [. . .] Antibiotics, have they been given yet, is the patient consented, cross-matched, evidence of coagulopathy, and then there'll be a predicted mortality. (Consultant surgeon, Hospital 2)

The positive argument for using the checklist to stop and check bore the imprint of Gawande and the "human factors" community about how human fallibilities (e.g. cognitive capacity, memory) in pressurised, complex organisations can give rise to "non-compliance." The EPOCH improvement leads promoted checklists as a means of managing complexity and, in doing so, translated these arguments into their local environments.

> It may be that you forgot to take the temperature because you had other things on your mind, and so having the flowchart and the tick boxes, you just go "Oh, I haven't ticked that box, what was that one, oh, that was the temperature one, oh, quickly do that." (Consultant anaesthetist, Hospital 2)

The "temporality" of the stop and check logic was thus looking back before the next clinical step could begin. Stopping and checking required that clinicians craft dedicated time and space for doing so. Local improvement teams introducing the boarding card followed the guidance and located this opportunity in the period immediately before a theatre was to be booked for operation. To support this pause of self-reflection and to ensure clinical interventions on the boarding card were given attention by clinicians, theatre booking systems in Hospital 2 were amended, and administrators and theatre coordinators were instructed not to book operations unless all interventions on the boarding card had been completed.

## Checklist as a prompt

The second logic of the pre-operative checklist – checklist as a clinical prompt – also related to individual clinicians considering clinical interventions. Individually and as a bundle, all interventions on the boarding card made sense to clinicians who deemed them a good standard of care in high-risk emergency surgery. Still, for any individual patient, they may not have deployed every single intervention. The EPOCH trial aimed to reduce variation in care. To that end, the checklist was designed as a tool to instil sameness. Both "stop and check" and "clinical prompt" logics had a role in this effort – both prescribed actions to be taken by clinicians. Where they differed was temporality and rhythm. The stop and check logic operated retrospectively and required clinicians to slow down to recall and reflect, whereas as a prompt the checklist mainly called to action prospectively what might not otherwise happen.

> I'm interested that [clinical interventions] are done. Ultimately we're interested that it's done. It would be a bonus if the checklist has actually been completed; but I think the checklist, from my point of view, is a prompt for people. (Research nurse, Hospital 2)

Some clinicians felt that the checklist as a prompt was there to provide guidance to junior doctors in particular. Others had in mind those providing cover on an early morning shift and those who may otherwise forget or resist taking specified clinical interventions.

> Checklists are good, tick boxes are good, because when people are in a stressful situation or if they're tired or if there are lots of other pressures going on and they're being torn in lots of different directions to do lots of different jobs by lots of different people, that people don't perform well and checklists are a safety mechanism and can really help in that situation. (Consultant intensivist, Hospital 2)

Taken seriously, the checklist was meant to ensure a set of concerted clinical interventions took place every time, everywhere. As such it demanded *all* clinicians, irrespective of seniority, to be obedient in enacting all prescribed interventions deemed right and proper in pre-operative care.

> The more we do it, the easier it will get, the more it becomes established into the fabric of what we do and the easier it will be. But I think in the early days mainly to use it as a prompt and then for the resistant cases we'll need to use a taser and then people will develop an aversion to tasers and will start to do it; even the more reluctant members will start to do it. (Consultant anaesthetist, Hospital 2)

The ideal user of the checklist was therefore a clinician who subscribed to the call of quality and safety to eradicate variation in care. The checklist as prompt had no expiry date: it was not to be overridden by years of clinical experience or by established routinisation of actions.

> [W]e all think we know better, we all think we know how to give an anaesthetic, but really, do we? There's nothing, there's no evidence to suggest that. All the evidence suggests [the need to] minimise variation in practice. And I think – essentially it's a checklist, isn't it, and that's [what] these things are doing. (Consultant in intensive care and anaesthetics, Hospital 5)

Together with the logic of checking, prompts to action were framed as important and indispensable to everyday work even for the most experienced of clinicians, since no-one was deemed immune to the risk of errors and workarounds. When clinicians argued that the checklist helped in dealing with manifold pressures of the workplace, another echo of arguments from Gawande's *Manifesto* could be heard across improvement teams.

### Checklist as an audit tool

Thirdly, improvement teams introduced the boarding card as an audit tool to monitor the implementation of the pre-operative bundle. As such they felt its format allowed for an easy administration, collection and checking to provide information about compliance with newly rolled out processes. The compliance was in turn seen as a precondition of improved outcomes. Therefore, with respect to audit, the prime action associated with the checklist was recording. Where the stop-and-check asked clinicians to initiate a mental verification of their past actions and the prompt logic asked them to act, the audit logic required clinicians to write, tick, and record for the sake of a distant reader. Thus, the beneficiary also changed. Recording for audit did not benefit the clinician and their immediate actions, but a third party who at some point might collect and audit the checklists.

The defining feature of the audit logic was the presumption of a close link between what was recorded and what had happened. As long as the checklists were filled in, clinical interventions listed on the boarding card were deemed actioned. Conversely, the improvement leads often repeated the assumption that "what is not recorded has not happened."

> We've discussed this, and in my mind if the data is not there, it hasn't been done. (Consultant anaesthetist, Hospital 2)

Outside the audit logic, clinicians were ready to problematise such an assumption as simplistic. They could readily recall how actions and recording of those actions were in fact spatially and temporally dissociated, and could take place independently of each other. Clinicians knew that at times, such as in situations of conflicting pressures, prescribed interventions were difficult to complete. Their experiences also suggested that, at other times, recording was implausible or even impossible. Practical dissociation between clinical actions and their recording for audit also meant that, at least in principle, action could take place even when the associated recording did not (or vice versa).

> I did one [emergency laparotomy] recently. I realised that I still hadn't filled out the checklist form because the [patient] was about to die in front of me, so I didn't get the checklist done at the time. But I did it retrospectively [. . .] after theatre. (Consultant anaesthetist, Hospital 2)

Yet when acting within the audit logic, irrespective of their experience with the practical disentanglement between actions and recording, clinicians upheld the ideal of a tight coupling between the two. Only such insistence, tenable or not outside audit, rendered checking compliance through the means of the boarding card meaningful. It promised to inform the improvement team whether implementation was a success or a failure. Thus, when a research nurse in Site 2 was asked to retrieve the boarding card forms for 17 emergency laparotomies and found that only seven had been completed, with only five in full, the local improvement team had a generalised sense of failed clinical *practice* (not just record-keeping).

The ease with which counting could be done was a valued quality of the checklist in its own right. Even though the improvement teams also used other more extensive performance measures to harness knowledge about instilling change in emergency surgery, the allure of auditability was strong among clinicians. They maintained praise of the boarding card as a very "auditable tool,"

> Being a tick box, [the boarding card] is very easily auditable. Because we can send one of our med students away and say, "Count how many boxes have been ticked," and we can plot them on the timeline. We can have a monthly return; put them on a timeline. And what I would love to see is mortality coming down as our intervention rate goes up. (Consultant in anaesthetics and critical care, Hospital 2)

In Site 5, the improvement team discussed whether the boarding card should be incorporated into an existing theatre booking form. In the discussion, one member of the team argued against burdening clinicians with yet another form, and for merging the checklist with the theatre booking form. However, the promise of quick and easy auditability won the argument, and the forms remained separate. This was because recording in the logic of audit was not regarded as burdensome; rather it was constructed as integral to care and a supposedly synergistic extension of the other logics of stop and check and prompt.

## Checklist as a clinical record

On top of audit, some clinicians associated the emergency laparotomy checklist with another way of recording clinical activity. In complex organisational arrangements such as healthcare, clinical records have an indispensable role in decision-making, which often cannot proceed without having specific recorded information at hand (Berg and Bowker 1997). This enabling role in clinical decision-making was what distinguished clinical record from recording for audit. Although both logics involved practices of writing in order to share information with others, in audit these "others" were third parties auditing compliance. The checklist was also meant to be relevant to clinicians and the unfolding process of care there and then. In this respect, the boarding card was equipped to hold patient-specific, clinically relevant information, most importantly the P-POSSUM score calculating the risk of mortality and morbidity, across temporally and spatially separate teams.

> There are possibly two or three registrars involved in seeing a patient at different times of the patient journey. And things can slip … (General surgery registrar, Hospital 2)

Holding such information (such as body temperature or levels of arterial lactate) would also reinforce the agency of the checklist: clinicians would be waiting for the records to inform their actions, and require less coercion to engage with the checklist.

Contrary to these hopes, it soon transpired that, of all four logics, the logic of clinical record was the least pronounced in the *use* of the boarding card. In an environment already populated by a plethora of other forms containing a spectrum of measures that circulated in and out of operating theatres, the boarding card as a record failed to interest clinicians. Although the checklist followed patients through theatres, most of its items were also being recorded elsewhere and thus seen as duplicate: for example, the calculated P-POSSUM score, which EPOCH leads understood as a key measure to inform decision-making pre-operatively, was recorded on the boarding card but also on the National Emergency Laparotomy Audit form which, unlike the checklist, was mandatory for clinicians to complete and which sometimes even served as a reference point for clinicians – i.e. it also served as a clinical record, leaving this logic of the checklist redundant. As a result, no-one was really waiting for the checklist to inform their decision-making. When put to action in the wider infrastructure of records, the checklist ended up yielding comparatively little relevance to keep clinicians interested. As the boarding card failed to move from one pair of hands to another it practically weakened the logic of clinical record.

## Dealing with incoherence

When the boarding card was introduced in participating sites, it was thought of as a singular entity able to perform several roles, from allowing clinicians to stop and check to serving as a clinical record. In practice, however, clinicians involved in the process of implementing the tool started to experience uncertainties when revising the tool for the purposes of audit. The materiality of the form, namely the way individual items on the form were formulated, sat well with some logics and created tensions with others. Within the logic of prompt, clinicians interacted with a sequence of reminders. As the boarding care conveyed "key words" referring to familiar clinical interventions, the exact wording of sentences was of lesser importance. For clinicians the checklist as a prompt simply read: "do the blood sugars," "give antibiotics," "consent the patient" etc. Within the logic of audit, however, this was no longer the case and

the wording of individual prompts gained gravity. Clinicians needed to read the whole sentences and consider more carefully what they meant rather than rely on key words understood as a reminder of good practice and a prompt to action.

Take the case of a specific item of the boarding card, "patient warming." As a clinical prompt, it simply asked clinicians to remember that body temperature mattered and that it ought to be checked. Ideally it would be taken seriously by a knowledgeable and skilled clinician who would then determine a specific action based on their experience and clinical judgement. Compared to the checklist as a prompt, the logic of audit rendered the manoeuvring space for individual action narrower. Whereas a prompt could come in the form of a keyword which elucidated a range of practical options, the wording of an audit question had a certain specificity built into it; and with it came prescriptiveness: the checklist rendered some clinical actions more permissible than others. A clinician used to the relative freedom of prompts, stemming from not being called upon to account for every word, could then become preoccupied with what practice was implied by the wording, and how it related to their and others actions.

> [It says,] "Has active patient warming been undertaken?" Well, no it hasn't. So you put "no" in and it scores badly on the interventions. But, actually, it hasn't been undertaken because the temperature was 39 degrees [Celsius] and you're not going to warm someone who is boiling hot. So [it should really read], "Has avoidance of hypothermia been considered?" [That would mean], they're cold, let's do something about it. But yes it's been considered but they're hot so we're not doing anything about it, but it's still being considered. (Consultant anaesthetist, Hospital 2)

A similar tension was observed in the case of other items on the checklist such as glucose management and administering antibiotics. Each time, the tension manifested itself in terms of specificity and permissiveness of clinical actions and triggered a realisation that prompts were also audit questions. This in turn could trigger critical reflection resulting in an intent to redesign the checklist in order to resolve the tension and re-entangle the materiality of the checklist with a range of logics.

> Glucose monitoring, we should be doing that for everyone. But it says, "Have you done blood glucose monitoring? 'Yes/No'." We should do it for everyone. So that's an easier one to ask. [But] to do the low tidal volume, protective ventilation you need a ventilator that's quite a little bit more intuitive than a lot of the basic ventilators. You can do it, but it may be more difficult and in difficult patients you may spend all your time fiddling with the ventilator. So all we're saying is "Has it been attempted?" and that gets us round the fudge of having a ventilator that's not up to purpose. (Consultant anaesthetist, Hospital 2)

Not all items of the boarding card were seen by clinicians as problematic; some questions, such as those related to calculating a mortality risk score, consenting a patient and recording an early warning score, were deemed to have universality and context specificity balanced – they were to be actioned for all patients regardless of the specifics of the case. But in many cases, the need for an easily completed form that could be audited and for an aide that would prompt action and checking by the individual clinician were in tension.

## Discussion

This study draws upon STS sensibilities to contribute to the existing debate about the checklist and its role in healthcare improvement. It follows Davina Allen's (2012, 2017) call

for examining the mundane technologies used in organising healthcare as socio-material entanglements, and her rendition of the notion of affordances through which the technologies interpellate clinicians. In the case of the EPOCH "boarding card," these interpellations were observed to be less deterministic than implied by the notion of a simple checklist and, at the same time, exercised more gravity than suggested by critics who may tend to focus on the social shaping of clinical actions and tools. Rather than a singlularised simple tool, this study identified four different logics of the checklist, each calling upon clinicians to initiate certain actions: the checklist as a stop and check required only minimum recording, as it mainly asked clinicians to recount clinical steps so far; the checklist as a prompt required clinicians to activate interventions listed as part of a clinical pathway; the checklist as an audit tool expected them to provide ticks and numbers under all listed items; and the checklist as a clinical record sought (though largely failed) to prompt them to write down clinically relevant information, e.g. the mortality risk score, for colleagues to read and act upon.

The tool coupled different logics, yet the multiplicity did not necessarily imply tensions. For example, we did not detect tensions between the checklist as a stop and check tool and a prompt; the materiality of the form in its specific format allowed both to be acted upon: one was prospective, the other retrospective, and their temporalities complemented rather than conflicted with each other. The ill-fated logic of clinical record was rendered irrelevant not by other logics but by other recording devices, such as the National Emergency Laparotomy Audit form, the anaesthetic form and the existing theatre booking form, circulating in perioperative care. Practical use or non-use derived not just from the interaction of logics with each other, however; they arose from interactions with clinicians and the ways the tool was intertwined with the wider textures of healthcare. In this respect, apart from circulation of forms, we saw improvement teams crafting an architecture of support for the checklist as a stop and check by entrusting theatre administrators with the powers not to book operations unless all items on the checklist had been attended to. We also saw how a specific gravity was associated with the checklist as an audit tool due to well-established "audit cultures" (Strathern 2000) within healthcare which affected what the improvement teams wanted the checklist to tell them about compliance and what format the checklist might take. Most broadly, we saw the tool connected to (and formed by) the dreams of quality improvement as a specific approach to realising healthcare, which animated clinicians' will to engage with the boarding card through a promise of improved outcomes further down the line.

Moving back to the material specificity of the boarding card, particular tensions were observed as a relational effect of the format of the checklist and its wording and the in/ability of clinicians to act. We noticed a tension between the logics of prompt and audit. What seemed a simple and obvious form of wording for one purpose could complicate the checklist's use according to the other. As part of the checklist's composition, the logic of prompt allowed for certain flexibility, in contrast to the closed format of audit questions which impacted on how they could be answered and what the answers meant. In audit, all words on the form started to matter – and the wording could belie the checklist's assumed utility and ease of use. In audit specifically, the prime action demanded by the checklist was recording for a third party rather than performing a clinical action there and then. This postponed use of the checklist in audit further complicated clinicians' interaction with the tool as it brought into play questions of evaluation of their performance, and of the improvement project as a whole. Yet even when logics conflicted, it did not need to pose an irresolvable problem. As Allen notes, people interacting with technologies tend to "find ways of managing the constraints and the possibilities that emerge from a technology's

affordance" (Allen 2017: 3). In this respect, we witnessed clinicians tinkering with the design of the boarding card – their strategy was to insert the notion of "consideration" – "has X been considered" rather than "has X been done" – which would allow clinicians to assert clinical judgement and render the checklist applicable as an audit tool at the same time. It is worth noting that the ability to redesign the checklist was specific to the innovative nature of the trial. As such it was conditional and locally crafted. Had the boarding card been rolled out as part of a different initiative with a standardised format, clinicians would need to deploy different coping strategies, such as workarounds, rather than direct re-design.

Such incoherence, as others in STS literature have argued (Law 2002), was not in principle a problem. On the contrary, it was key to resolving tensions in situations when responding to some logics of the checklist led to a struggle to follow others. It also closely related to the acknowledgement that the checklist required adaptation in dynamic and divergent clinical settings, rather than being a fixed untouchable simply to be. This implied recognition that the very simplicity of the "simple checklist" could, ironically, cause complications: what was simple for one logic needed to be carefully unravelled if the checklist was to work in another. In more general terms, success or failure of the checklist was not only in the hands of clinicians; it was also in the hands of the tools – their properties and affordances. In this respect our study suggests to conceptualise the potential of checklists in such way to avoid the all too familiar oscillation between welcoming checklists as simple and powerful tools and the surprise when checklists turn out to be less helpful than anticipated in making change happen. The key is in supporting settings and arrangements in which incoherences inscribed into tools can be locally negotiated. This includes asserting the role of various human intentions in moulding the materiality, and hence the affordances, of the checklist in a way that anticipates its use, its interaction with other actants, and the interpellations that might follow – and thus accommodates and reconciles divergent intended functions as far as possible. This is not to argue that such devices can be "scripted" through meticulous design so that emergent agency is designed out (cf. Oudshoorn and Pinch 2003), but it is to suggest that through iterative development based on practical experience, better checklists – and better approaches to improvement – are possible.

## Conclusion

Previous sociological studies highlight social contexts as key to successful use of the checklist in healthcare improvement. Our STS-informed study suggests that the checklist as a mundane tool comes equipped with affordances that mediate rather than determine entanglements of people and things in organising healthcare. Moreover, rather than a seemingly simple tool with a singularised set of affordances, we identified four logics, each interpellating clinicians to specific actions. When given the opportunity, clinicians managed constraints and negotiated conflicts. In this respect, our study highlights the potential for improvement initiatives to nourish formative reflexivity about the construction of checklists as part of the wider infrastructures of improvement.

*Address for correspondence: David Kocman, Social Science Applied to Healthcare Improvement Research Group (SAPPHIRE), Department of Health Sciences, College of Life Sciences, George Davies Centre, University of Leicester, University Road, Leicester LE1 7RH, UK. E-mail: dk172@le.ac.uk*

## Acknowledgements

We are grateful to staff members in participating sites for their time and frankness in interviews. We are also grateful to Janet Willars for her contribution to fieldwork in one of the case-study sites. The empirical research was funded by the National Institute for Health Research (NIHR) Health Services and Delivery Research (HS&DR) programme (grant number 12/5005/10). David Kocman and Tereza Stöckelová's contributions to the paper were funded by the Czech Science Foundation (grant number 15-16452S). Graham Martin's contribution was also supported by the NIHR Collaboration for Leadership in Applied Health Research and Care East Midlands (CLAHRC EM). The views expressed are those of the authors and not necessarily those of the NHS, the NIHR, the Department of Health, or the Czech Science Foundation.

## Supporting information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

**Appendix S1.** Members of the EPOCH trial group.

## References

Allen, D. (2012) Understanding context for quality improvement: artefacts, affordances and socio-material infrastructure, *Health*, 17, 5, 460–77.

Allen, D. (2017) From polyformacy to formacology, *BMJ Quality and Safety*, 26, 9, 695–7.

Allen, D., Braithwaite, J., Sandall, J. and Waring, J. (2016) Towards a sociology of healthcare safety and quality, *Sociology of Health and Illness*, 38, 2, 181–97.

Anthes, E. (2015) The trouble with checklists, *Nature*, 532, 516–8.

Aveling, E.L., McCulloch, P. and Dixon-Woods, M. (2013) A qualitative study comparing experiences of the surgical safety checklist in hospitals in high-income and low-income countries, *British Medical Journal Open*, 3, e003039.

Berg, M. (1997) Of forms, containers and the electronic medical record: some tools for a sociology of the formal, *Science, Technology and Human Values*, 22, 4, 403–34.

Berg, M. and Bowker, G. (1997) The multiple bodies of the medical record: toward a sociology of an artefact, *Sociological Quarterly*, 38, 3, 513–37.

Bosk, C.L., Dixon-Woods, M., Goeschel, C.A. and Pronovost, P.J. (2009) Reality check for checklists, *The Lancet*, 374, 444–5.

Brown, P. and Calnan, M. (2011) The civilizing process of trust: developing quality mechanisms which are local, professional-led and thus legitimate, *Social Policy & Administration*, 45, 1, 19–34.

Catchpole, K. and Russ, S. (2015) The problem with checklists, *BMJ Quality and Safety*, 24, 9, 545–9.

Charmaz, K. (2007) *Constructing Grounded Theory*. London: Sage.

Clay-Williams, R. and Colligan, L. (2015) Back to basics: checklists in aviation and healthcare, *BMJ Quality and Safety*, 24, 7, 428–31.

Conley, D.M., Singer, S.J., Edmondson, L., Berry, W.R., *et al.* (2011) Effective surgical safety checklist implementation, *Journal of the American College of Surgeons*, 212, 5, 873–9.

Dixon-Woods, M. and Martin, G. (2016) Does quality improvement improve quality?, *Future Hospital Journal*, 3, 3, 191–4.

Dixon-Woods, M.A.R.Y., Bosk, C.L., Aveling, E.L., Goeschel, C.A., *et al.* (2011) Explaining Michigan: developing an ex-post theory of a quality improvement program, *The Millbank Quarterly*, 89, 2, 167–205.

Dixon-Woods, M., McNicol, S. and Martin, G. (2012) Ten challenges in improving quality in healthcare: lessons from the Health Foundation's programme evaluations and relevant literature, *BMJ Quality and Safety*, 21, 876–84.

Gawande, A. (2007) *The Checklist*. New York: The New Yorker.
Gawande, A. (2010) *The Checklist Manifesto: How to Get Things Right*. London: Profile Books.
Gawande, A. (2015) There's no mistake too dumb for us to make! BBC Radio 4.
Hales, B. and Pronovost, P. (2006) The checklist – a tool for error management and performance improvement, *Journal of Critical Care*, 21, 231–5.
Haynes, A.B., Weiser, T.G., Berry, W.R., Lipsitz, S.R., *et al.* (2009) A surgical safety checklist to reduce morbidity and mortality in a global population, *The New England Journal of Medicine*, 360, 5, 491–9.
Hutchby, I. (2001) Technologies, texts and affordances, *Sociology*, 35, 2, 441–56.
Jammer, I., Ahmad, T., Aldecoa, C., Koulenti, D., *et al.* (2015) Point prevalence of surgical checklist use in Europe: relationship with hospital mortality, *British Journal of Anaesthesia*, 114, 5, 801–7.
Koed Madsen, A. (2015) Between technical features and analytic capabilities: charting a relational affordance space for digital social analytics, *Big Data & Society*, 2, 1, 2053951714568727.
de Laet, M. and Mol, A. (2000) The Zimbabwe bush pump: mechanics of a fluid technology, *Social Studies of Science*, 30, 2, 225–63.
Latour, B. (2005) *Reassembling the Social: An Introduction to Actor-Network Theory*. Oxford: Oxford University Press.
Law, J. (1994) *Organizing Modernity*. Oxford: Blackwell.
Law, J. (2002) *Aircraft Stories: Decentering the Object in Technoscience*. Durham and London: Duke University Press.
Leonardi, P. (2011) When flexible routines meet flexible technologies: affordance, constraint, and the imbrication of human and material agencies, *MIS Quarterly*, 35, 1, 147–67.
Low, D., Walker, I. and Heitmiller, E.S. (2012) Implementing checklists in the operating room, *Pediatric Anesthesia*, 22, 1025–31.
Marshall, M., Pronovost, P. and Dixon-Woods, M. (2013) Promotion of improvement as a science, *Lancet*, 381, 419–21.
Martin, G.P., Kocman, D., Stephens, T., Peden, C.J., *et al.* (2017) Pathways to professionalism? Quality improvement, care pathways, and the interplay of standardization and clinical autonomy, *Sociology of Health & Illness*, 39, 8, 1314–29.
Odor, P. and Grocott, M. (2016) From NELA to EPOCH and beyond: enhancing the evidence base for emergency laparotomy, *Perioperative Medicine*, 5, 23.
Oudshoorn, N. and Pinch, T. (2003) *How Users Matter: The Co-Construction of Users and Technologies*. Cambridge: MIT Press.
Parchoma, G. (2014) The contested ontology of affordances: implications for researching technological affordances for collaborative knowledge production, *Computers in Human Behaviour*, 37, 360–8.
Parry, G. (2014) A brief history of quality improvement, *Journal of Oncology Practice*, 10, 3, 196–9.
Pearse, R. (2014) Enhanced peri-operative care for high-risk patients (EPOCH) trial: a stepped wedge cluster randomised trial of a quality improvement intervention for patients undergoing emergency laparotomy. Available at http://www. epochtrial.org/docs/EPOCH%20Protocol%20revision%20V2%200%20280414.pdf (Last accessed 2 October 2017).
Pearse, R.M., Holt, P.J. and Grocott, M.P. (2011) Managing perioperative risk in patients undergoing elective non-cardiac surgery, *British Medical Journal,*, 343, 5759–66.
Perla, R.J., Provost, L.P. and Parry, G.J. (2013) Seven propositions of the science of improvement: exploring foundations, *Quality Management in Healthcare*, 22, 170–86.
Petrakaki, D., Klecun, E. and Cornford, T. (2016) Changes in healthcare professional work afforded by technology: the introduction of a national electronic patient record in an English hospital, *Organization*, 23, 2, 206–26.
Pronovost, P., Needham, D., Berenholtz, S. and Sinopoli, D. (2006) An intervention to decrease catheter-related bloodstream infections in the ICU, *The New England Journal of Medicine*, 355, 26, 2725–32.
RCS (2011) *The Higher Risk General Surgical Patient. Towards Improved Care for a Forgotten Group*. London: The Royal College of Surgeons of England and Department of Health. Available at https://www.rcseng.ac.uk/library-and-publications/college-publications/docs/the-higher-risk-general-surgical-patient/ (Last accessed 5 October 2017).

Richards, S.K., Cook, T.M., Dalton, S.J., Peden, C.J., *et al.* (2016) The "Bath Boarding Card": a novel tool for improving pre-operative care for emergency laparotomy patients, *Anaesthesia*, 71, 974–89.

Strathern, M. (ed.) (2000) *Audit Cultures: Anthropological Studies in Accountability, Ethics and the Academy*. London and New York: Routledge.

Treadwell, J.R., Lucas, S. and Tsou, A.Y. (2014) Surgical checklists: a systematic review of impacts and implementation, *BMJ Quality and Safety*, 23, 4, 299–318.

Urbach, D.R., Govindarajan, A., Saskin, R., Wilton, A.S., *et al.* (2014) Introduction of surgical safety checklists in Ontario, Canada, *The New England Journal of Medicine*, 370, 1029–38.

Walker, I.A., Reshamwalla, S. and Wilson, I.H. (2012) Surgical safety checklists: do they improve outcomes?, *British Journal of Anaesthesia*, 104, 1, 47–54.

Waring, J., Allen, D., Braithwaite, J. and Sandall, J. (2016) Healthcare quality and safety: a review of policy, practice and research, *Sociology of Health & Illness*, 38, 2, 198–215.

Zammuto, R.F., Griffith, T.L., Majchrzak, A., Dougherty, D.J., *et al.* (2007) Information technology and the changing fabric of organization, *Organization Science*, 18, 5, 749–62.

Zuiderent-Jerak, T. and Berg, M. (2010) The sociology of quality and safety in health care: studying a movement and moving sociology. In Bird, C., Conrad, P., Fremont, A.M. and Timmermans, S. (eds) *The Handbook of Medical Sociology*, pp 324–37, 6th edn. Nashville: Vanderbilt University Press.