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Implementing standardised flow: navigating operational and professional dependencies

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Abstract

Purpose – The purpose of this study had two aims: (1) to extend insight regarding the challenges of implementing standardised work, via care pathways, in a healthcare setting by considering interactions with other operational (i.e. resource sharing, portfolio alignment) and professional (i.e. autonomous expertise) dependencies and (2) to develop novel insights regarding a specific flow mechanism, the stroke nurse practitioner, a form of flow "pilo" or guide.

Design/methodology/approach – This was a longitudinal case study of implementing the acute stroke care pathway in a National Health Service hospital in England based on 185 hours of non-participant observations and 68 semi-structured interviews. Archival documents were also analysed.

Findings – The combined flow, operational and professional dependency lens extends operations management understanding of the challenge of implementing standardised work in healthcare. One observed practice, the process pilot role, may be particularly valuable in dealing with these dependencies but it requires specific design and continuous support, for which the authors provide some initial guidance.

Research limitations/implications – The research was a single case study and was focussed on a single care pathway. The findings require replication and extension but offer a novel set of insights into the implications of standardised work in healthcare.

Originality/value – In addition to confirming that a multidependency lens adds conceptual and practical insight to the challenges of implementing standardised work in a healthcare setting, the findings and recommendations regarding flow "pilots" are novel. The authors' analysis of this role reveals new insights regarding the need for continued improvisation in standardised work.

Keywords Case study, Flow implementation, Operational dependencies, Standardised work, Professional work

Paper type Research paper

1. Introduction

Attempts to implement standardised work are increasingly common in healthcare; something that is of great interest to operations management (OM) scholars and practitioners. Consider the idea of the "care pathway", an evidence-based optimal timed sequence of interventions for a particular diagnosis, procedure or symptom (Campbell *et al.*, 1998; Ben-Tovim *et al.*, 2007). In addition to ensuring that patients are treated according to best available evidence, a pathway could also be seen as an attempt to create flow, something that is very familiar to all students of "lean healthcare". Lean or flow approaches have reportedly freed up hospital capacity

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(Schonberger, 2018), reducing waiting times, lengths of stay and costs (Costa and Filho 2016). Other researchers observe that as a result of endemic operational dependencies, such as specialist resource sharing (e.g. computer tomography scanner) and portfolio alignment (e.g. integrating multiple care pathways, in a fixed space, equitably, etc.), lean interventions deliver inconsistent outcomes. They have also be shown to deliver predominantly negative impacts on worker satisfaction and to have no significant association with either health outcomes or patient satisfaction (Poksinska *et al.*, 2017; Moraros *et al.*, 2016; Mazzocato *et al.*, 2012). In summary, fundamental questions and challenges for implementing standardised flow in healthcare remain to be explored (Smart *et al.*, 1999, 2009).

In addition to these operational dependencies, patient flow relies on different professional, autonomous specialists (Lewis and Brown, 2012) interacting, creating another form of dependency. To date, the healthcare OM literature has considered these dependencies (i.e. flow, operational and professional) but as distinct phenomena. A broader question of interacting dependencies in the implementation of standardised flow remains under-explored. This leads to our first research question:

RQ1. What happens when standardised flow interacts with other operational (i.e. resource sharing, alignment) and professional (i.e. co-ordinating autonomous expertise) dependencies?

To answer this question, we undertook a longitudinal case study describing the experiences of a UK National Health Service (NHS) general hospital as it implemented a care pathway for acute stroke care. This pathway was very suitable for our research as it combined a flow logic in its design, with specific time objectives (n.b. diagnostic and treatment speed have a significant impact on patient outcomes including mortality). Yet, because of the general hospital setting, still required physicians to compete for access to key shared resources, whilst co-ordinating with a range of adjacent medical specialities.

The implementation of the stroke pathway involved the introduction of a novel flow co-ordination mechanism, namely the role of the Stroke Nurse Practitioner (SNP), designed to act as a pilot to navigate the various system dependencies. This type of process pilot (guide, expediter, etc.) role has received almost no attention in the OM literature and led us to our second research question:

RQ2. How does the process pilot role, intended to support standardised flow, deal with operational and professional dependencies?

The rest of this paper is structured as follows. In Section 2, we present the overall conceptual framework, used *ex ante* to structure our empirical work and, in Section 3 and four, the method and findings. In Section 5, we discuss the RQs and revise our initial framework, introducing some reflections on the role of improvisation in achieving standardised flow. In the final section, we discuss practical implications and make recommendations for further work.

2. Conceptual framework

A care pathway is, on first inspection, a type of standardised flow that is very familiar to OM scholars and practitioners. In order to guide our investigation of the stroke care pathway, we created an initial conceptual model (Figure 1). We considered the pathway as a form of standardised flow based on: (1) guidance regarding the optimal sequence and timing of interlinked activities (Malone and Crowston, 1994; Malone *et al.*, 1999); (2) management of resources to avoid bottlenecks (Yang *et al.*, 2018) and (3) co-ordinating effective information exchange (van Leijen-Zeelenberg *et al.*, 2015). Yet, as discussed in the introduction, any flow implementation interacts with other forms of operational dependency (e.g. resource sharing, alignment).

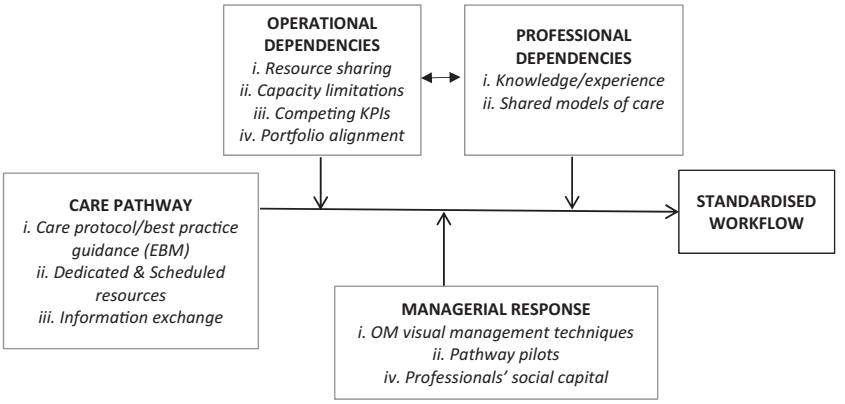

Figure 1.
Ex ante conceptual model

Moreover, professional medical work introduces additional dependencies such as co-ordinating autonomous expertise. As the process of care for a particular patient transitions between different locations (e.g. emergency department (ED), imaging room, etc.), potential information handoff problems follow (Gulliford *et al.*, 2006; Boyer *et al.*, 2012; Dobrzykowski and Tarafdar, 2015). Finally, in any implementation there are also various managerial actions that seek to moderate the interaction between the standardised flow "intent" and these other dependencies.

2.1 Operational dependencies

Care pathways typically share key resources such as computed tomography (CT) scanners or ED staff members. These shared resources are commonly expected to meet different types of demand and to perform multiple activities, with greater or lesser degree of multitasking. Thus, resource sharing can have a range of unintended and sometimes adverse consequences for flow performance. de Souza and Pidd (2011) for example, highlighted how reduced bed occupancy in a lean project for elderly care caused additional problems as the empty beds were filled via a hospital-wide Bed Management System with other patients on different, unrelated, care pathways. Tay *et al.* (2017) stated that if the focus of a system is on maximizing resource efficiency, without reflecting on how the specific resources interact with the other elements of the system, then, this will eradicate the resource efficiency outcome of the whole system. The authors refer to this phenomenon as the "efficiency paradox".

Even the classic OM "bottleneck formula" can be inaccurate. Capacity is often smaller than the bottleneck in "networks", like healthcare, where many tasks are processed by indivisible (human or otherwise) multitasking resources (Gurvich and Van Mieghem, 2015). Brown *et al.* (2003) found that hospital staff scheduling, a typical source of variation in the supply of healthcare services, often led to workloads which adversely affected individuals' ability to learn from (clinical) mistakes and resolve the underlying causes of problems (Tucker and Edmondson, 2003).

In addition to the challenging interaction with various forms of shared resource, specific pathway flows are part of a broader portfolio of activity. Of course, shared resources are themselves a key part of wider portfolio management. Busy multiuse settings, like an ED, are invariably an aggregate strategic priority – often with no real regard to specific care pathways, but multiple pathways mean multiple goals, and healthcare actors (health professionals in particular) have significant autonomy to act without regard for the wider portfolio (Feldman and Rafaeli, 2002; Gittell, 2011). Papadopoulos (2011) found that the full

agenda of "decision makers" prevented them from being able to gather in weekly meetings, undermining the development of lean.

Moreover, resources sharing (especially in public-service models like the UK NHS) can have strongly p(P)olitical dimensions (Grove *et al.*, 2010). Drupsteen *et al.* (2016) show that an over-arching emphasis on resource utilization can create conflict between "resource-providing" departments (such as radiology), focussed on meeting their own performance targets and the "resource-deploying" care pathways. Similarly, Elissen *et al.* (2011) found that scarce resources force practitioners to compete, which inhibits their ability to cooperate effectively, leading to suboptimal use of resources and variations in care. Professional "silos" fragment care (Mann, 2005) and increased pressure to improve specific aspects of in silo performance results in worse system level outcomes (Seung-Chul *et al.*, 2000; de Souza and Pidd, 2011). Grove *et al.* (2010) also note that targets result in "gaming" and data manipulation to report good outcomes while hiding real performance.

2.2 Professional dependencies

As highlighted, standardised flow is often dependent on effective (in this case patient) handovers and yet the literature reports the challenging nature of co-ordinating medical professionals to engage with effective information sharing. Various explanations have been proposed. McDermott and Venditti (2015) found that professionals sometimes do not know what happens after they perform their tasks and how their tasks fit within the overall flow. van Leijen-Zeelenberg *et al.* (2015) ascribed communication failures in six acute care hospital pathways to limited shared understanding of the overall pathway. McKnight *et al.* (2002) found that physicians and nurses had different perceptions of what information was essential for effective communication.

In addition to differential expertise and experience at any specific point along the pathway (Pagell *et al.*, 2015), standardised flow initiatives can actually seem to limit the time available for effective communication (Gerein *et al.*, 2006; Green and Holmboe, 2010). Radaelli *et al.*, 2015 note, with reference to the concept of "stickiness" (Tyre and Hippel, 1997), the high cost of sharing tacit information and further observe that physicians are reluctant to exchange information when they are confronted with practical problems in its transmission. Kc and Terwiesch (2009) found that reduced throughput time can be unsustainable and may come at the expense of increased medical errors. Similarly, Powell *et al.* (2012), found that high-workloads made physicians more likely to miss information on patients' complications, leading to miscoding issues. They explain that when multiple activities compete for the physicians' services and time, then they typically de-emphasize the communication aspects of the care process (Vargas *et al.*, 2015).

2.3 Managerial response

What managerial mechanisms are effective in moderating the interaction between the intended standardised flow and these other dependencies? Drupsteen *et al.* (2016) note that inadequate knowledge regarding the interdependent nature of the process is associated with a lack of process visibility that may suggest a role for classic OM visual management techniques (McDermott and Venditti, 2015; Tezel *et al.*, 2015; Beynon-Davies and Lederman, 2017). McDermott and Venditti, (2015) found that through the process and value stream mapping, healthcare professionals were able to understand the nature of the process and how their tasks fit together, thus work towards lean implementation. General administrative information and communication technology systems, such as bed management software, are often implemented to help manage shared resources and resource utilization (Proudlove *et al.*, 2007) but struggle to accommodate flow dependency (Hellström *et al.*, 2010).

Addressing what we labelled "professional dependencies", Dobrzykowski and Tarafdar (2015) showed that informal social ties are a vital element in healthcare information exchange. Frequent interactions (Nicolini *et al.*, 2012) underpin shared mental models of care and, when professionals are located close together, they have opportunities to synchronise behaviour (Sole and Edmondson, 2002). Edmondson *et al.* (2001, p. 705), in their study of cardiac surgery departments, emphasised how "group-level reflection" taking place "through formal meetings, informal conversation, and shared review of relevant data" contributed to better co-ordination of new practices in an operating room. Similarly, Greenhalgh (2008) showed that successful routines depended on collaborative interactions between staff members. They argue that friendship and reciprocity, developed over time, can enable individuals to cross routine professional and organisational boundaries over time. When professionals have shared knowledge, they tend to share the same goals and trust the work of each other they act in support of the goals of the whole process (Gittell, 2011; Dobrzykowski and Tarafdar, 2015). Mura *et al.* (2016) found that when individuals have stronger social ties, higher degrees of psychological safety allow them to exchange mistake and error related information, seek feedback and to ask questions. Moreover, in environments where boundaries are highly guarded, stronger social ties reduce individuals" opportunistic behaviours (Siemsen *et al.*, 2009).

2.4 Pathway pilots

In addition to the various managerial responses described above, we highlight one particular approach to managing standardised flow implementation; the introduction of specialised employees whose job is to help manage flow (Hunt *et al.*, 2016). These boundary spanning roles are, in theory, able to cross various institutional boundaries that can divide other colleagues (Nasir *et al.*, 2013). Collins *et al.* (2014) found that process champions as subject matter experts promote knowledge amongst employees regarding the process with results in sustaining commitment to improvements. Interestingly and despite the potential of these "pilot" roles, there is limited research exploring their function in healthcare, particularly examining how boundary spanners perform (or should perform) to improve quality of care (Brostrøm *et al.*, 2015).

3. Methods

In order to address our research questions, a single in-depth case study approach was most appropriate (Eisenhardt and Graebner, 2007; Yin, 2014) as it offered the opportunity for focus and intensive data gathering (Voss, 2010; Pellinen *et al.*, 2016). Given the range of constructs under investigation, a key consideration was to control as far as possible for organisational and institutional context. Moreover, the focus over an extended timeframe (28 months) allowed the researchers to become familiar with the workings of the acute stroke pathway and the multiple professionals involved. The fieldwork lasted 28 months, from March 2015 to July 2017.

The selected site was a UK district general hospital, employing about 4,500 staff members and serving an area of approximately 500,000 people. Located in a small city but also serving surrounding towns and villages, the hospital had at the time of the study 732 beds and offers a range of acute services including medicine and surgery, services for women and children, emergency, diagnostic and clinical support services.

The unit of analysis was the acute stroke care pathway. This pathway integrates a wide range of activities that differ substantially in terms of function, space, time and organisational structure: the emergency department (ED), the medical assessment unit (MAU), the acute stroke care unit (ASU) and the radiology department (RD) with an explicit

temporal component (i.e. faster is better for the patient). The standardised acute stroke care pathway, based on a national evidence-based assessment of best practice, was first introduced in 2011 (Campbell *et al.*, 1998). Figure 2 summarises its key stages. Overall, 1,144 suspected stroke patients were admitted during the period of the study.

Table 1 summarises a number of key performance indicators (KPIs) as these are compiled by the Sentinel Stroke National Audit Programme (SSNAP), a national healthcare quality improvement programme that measures the quality and organisation of stroke care in the NHS.

The SNP role was introduced to the hospital of study in March 2015. SNPs are specialist stroke care practitioners responsible for co-ordinating and facilitating the pathway of patients from the time of their arrival in the ED until admission to the acute stroke unit.

Data collection comprised three phases and created four data sources – semi-structured interviews, non-participant observations, archival documents and secondary patient data.

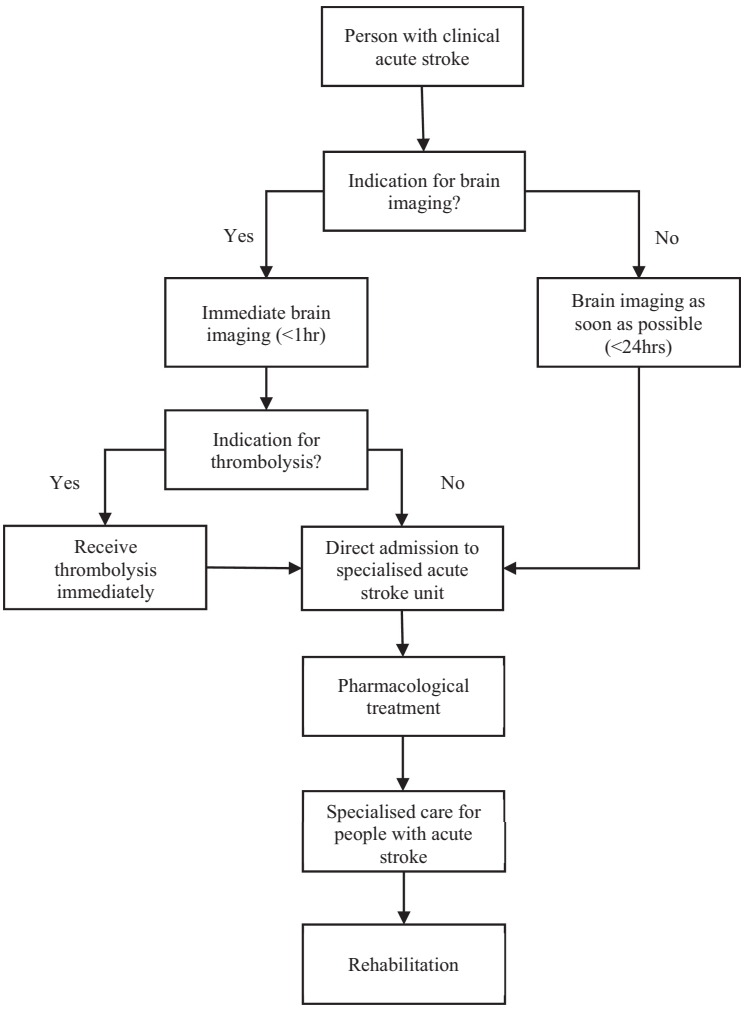

Figure 2.
Official stroke care pathway

Phase one used a snowball sampling technique to build familiarity with the pathway, key resources and professional roles. One researcher conducted 41 interviews with relevant participants (see Table 2). The interviews lasted 30–45 min on average, following a topic guide that covered a range of topics including ideal stroke care pathway, sources of variation and pathway management and improvement. All interviews were recorded and transcribed.

Formal and informal process documents provided by hospital staff members were also collected and analysed. These included nine pathway guidelines, SNAP reports of the years 2014–2016, monthly evaluation reports of SNPs as well as formal documents describing the role of SNPs.

We also conducted 192.5 h of non-participant observation in the ED, the ASU, RD and MAU; "shadowing" the SNPs in particular as they cared for 52 patient instances in total. These observations offered a complement to the retrospective recall of events by interviewees and allowed the researcher to note important contextual information.

SNAAP stroke data		2013–2014 Jul–Sep	2013–2014 Oct–Dec	2013–2014 Jan–Mar	2014–2015 Apr–July	2014–2015 Jul–Sep	2014–2015 Oct–Dec
Proportion of patients directly admitted to a stroke unit <4 h of a clock start	Hospital	27.1%	44.5%	58.1%	49.6%	44.4%	43.2%
	National	58.4%	58.1%	57.8%	58.0%	59.8%	56.9%
Median time between clock start and arrival on stroke unit	Hospital	5:05	4:06	3:55	4:00	4:04	4:11
	National	3:35	3:36	3:38	3:36	3:36	3:41
Proportion of patients who spent 90% of their time in ASU	Hospital	80.0%	83.1%	82.9%	86.0%	86.0%	79%
	National	81.5%	84.2%	83.3%	83.5%	84.3%	83.4%

Note(s): SSNAP: Sentinel Stroke National Audit Programme

Table 1. SSNAP evaluation report 2013–2014 and 2014–2015 for the case study hospital

Hospital department/role of the participant	Interview phases Phase 1: Familiarisation with the process	Phase 2: Evaluation of the pathway map	Phase 3: In-depth interviews (SIT)
Acute Stroke Unit			
Stroke doctor (SD)	6	2	3
Stroke nurse (SN)	3	–	2
Healthcare assistant (HA)	4		
SNP	9	3	3
Clerks	2	–	1
Therapist	4	–	
Emergency department (ED)			
ED doctor (EDD)	3	2	2
ED nurse (EDN)	4	–	3
ED coordinator (EDC)	3	1	
ED assistant (EDA)	3	–	2
Radiology department			
Radiographer	1	–	1
Senior radiologist (SD)	3	–	2
Total	*41*	*8*	*19*

Table 2. Interviews conducted during the field study

Phase two, began with validating a map of stroke care "flow in practice" with further observations and eight additional medical staff interviews. This map was then used as a prompt in an additional 19 semi-structured interviews where Sequential Incident Technique (SIT) was used to elucidate specific incidents that cause variation to the flow.

Phase three, comprised a staff workshop organised on hospital premises. Sixteen people attended, nine members of ASU (three consultants, three SNPs, two registered nurses and one occupational therapist) and seven members of the management team (head of general medicine, manager of ASU, three project managers and the business manager).

The final data set consisted of 26,979 words of observations, approximately 92,500 words of interviews and 198,654 words of archival documents, as well as 16 photos of the hospital environment and nine process maps. NVivo (2010) was used to manage the analysis of such a large data set. We followed an iterative process of open, selective and then theoretical coding. For example, an information exchange issue might be coded by "participants" (e.g. ED, stroke team, etc.), then by "staff availability" at a particular time, and then as "flow – shared resource dependency interaction". The coding scheme was reviewed and developed regularly during data collection phase, with theory from the literature used to underpin the revisions.

4. Findings

The following tables summarise key insights from the interview and observation data, framed by contextual performance data. In Table 3, we present a sample of our coding table, providing a description of the factors that we coded as having an impact on pathway performance.

Tables 4 and 5 summarises the key findings and includes fragments of the qualitative data for illustration of our analysis methods. Table 4 presents the interacting dependencies using the structural elements of the conceptual model and Table 4 the managerial interventions intended to support flow, in part to mitigate the adverse impact of these interactions (purposely or not) . A particular focus in both tables is to highlight evidence relating to the SNP role. In Table 4, we see strong evidence of many anticipated issues, including conflicts centred on shared resources and competing portfolio priorities, differential medical expertise and communication difficulties. Given the pathway had been introduced four years prior to the study, there was a surprising lack of clarity over basic process logic together with an unhelpfully large selection of visual and textual representations of the pathway. We also observed the SNPs negotiating a mixture of operational and professional dependencies, from managing information and knowledge sharing amongst professionals to facilitating resource allocation and scheduling of resources.

In Table 5, we summarise observations on a range of managerial interventions which either helped the system cope with the interacting dependencies (i.e. coherent flow) or, sometimes, had a negative impact (i.e. incoherent flow). The emergent formal and informal distinction also helped add insight to these interventions and the nature of the SNP role – and its limitations – in particular.

5. Discussion

Overall, many of these observations confirmed our *ex ante* insights regarding the challenges associated with standardised flow implementations and echoed many of the (healthcare specific) evaluations of interprofessional collaboration. However, the interacting (flow, operational, professional) dependencies lens did offer additive insights (RQ1). Our interest in managerial mechanisms for supporting standardised flow, and the introduction of the flow "pilot" role (the SNP), specifically (RQ2), generated fascinating and novel findings. As intended, SNPs were repeatedly observed acting to span communication and knowledge

Coded factors	What we observed?	Observed impact on the pathway performance
Visibility (KPIs)	Hospital managers set a number of KPIs to control and improve visibility of the pathway, but these were conflicting with other existing hospital targets and goals	• (Un) availability of focal resources • Pathway knowledge/ interest of professionals
Visibility and clarity (Pathway Protocols and Guidelines)	Unavailability of shared protocols and guidelines amongst professionals	• Information and knowledge exchange
Shared resources	ED and brain-imaging resources, shared between multiple patient groups (i.e. trauma, sepsis etc.) who needed to have their assessment and treatment in critical time range	• (Un)availability of focal resources • Information and knowledge exchange
Co-location	Professionals located closer to each other had the opportunity to interact more frequently	• Information and knowledge exchange • Social capital (i.e. working and social relationships)
Engagement	Pathway adherence strongly linked with individual professional interests and knowledge on the pathway	• (Un)availability of focal resources • Information and knowledge exchange
Portfolio	Interacting priorities: Pathway was confronted with the need to interact with a range of other activities and indeed other specific care pathways	• High-workload • Information and knowledge exchange • (Un)availability of focal resources
Judgement	Variation in professionals knowledge, experience and interest on stroke care, influences the effectiveness and efficiency of their judgement	• Information and knowledge exchange • (Un)availability of focal resources
Improvement initiatives (i.e. meetings, co-design of protocols and guidelines)	Professionals' knowledge and interests on stroke care was strongly related with their involvement in pathway improvement initiatives	• Professionals' engagement in the pathway • Information and knowledge exchange • Social capital
Improvise	SNPs found/created new ways to avoid pathway from being broken down or fix this when happened	• Information and knowledge exchange • (Un)availability of focal resources • Managing KPIs/SNAAP
Authority	Professionals' role was a source of power, enabling them to decide how and when to engage in the pathway	• Information and knowledge exchange • Professionals' engagement in the pathway
Coaching	SNPs coached other healthcare professionals (i.e. stroke and ED nurses, junior ED doctors, etc.) on how to practice stroke care	• Information and knowledge exchange

Table 3.
Ex ante coding table

boundaries among multiple professionals. We also observed frequent interventions – using the informal "authority" of the pathway – in local capacity planning and in the management of resources. More surprising was the limited direct evidence regarding the formal design and

Table 4.
Standardised flow and its interaction with operational and professional dependencies (ASU: Acute Stroke Unit, CT = Computed Tomography, SNP = Stroke Nurse Practitioner, SN = Stroke nurse, ED = Emergency department, EDA = Emergency department assistant, EDD = Emergency department doctor, SD = Stroke doctor, RD = Radiologist, R = Radiographer, OPU = Outpatient unit)

Flow	Dependencies			
	Operational		Professional	
Best practice guidance	**Visibility and clarity:** 9 versions of pathway map: 4 flow diagrams, 3 scripts and a combination of script/ flow diagram. Each department has its own protocols to carry out the work **Visibility (KPIs)**: Overall pathway goal to provide quality care. Individuals also had smaller system targets, (e.g. CT scan within 1 h, etc.) also based on national standards: "We have so many KPIs . . . and all these are conflicting. . ." (SR2)	**Visibility and clarity:** "We have no clear protocol shared between us which complicates our work" (SNP2) **Visibility (KPIs)**: "ED has competing priorities that are conflicting . . . not having ED/stroke consultant available . . . to assess patient and make decision delays process." (SNP2). In many such instances, SNPs spent time walking around, finding doctors, providing a handover for the patient and asking ED doctor to review tests. *[Flow interruptions/Changeovers]*	**Visibility and clarity:** "there is no clear defined pathway which makes a huge difference for the ED staff to know what to do and how to thrombolyse" (SNP1) **Portfolio**: ED staff members report patient data in a different way . . . they are not as interested in the stroke time targets as we are" (SNP3)	**Engagement**: Pathway adherence strongly linked with individual professional interests and knowledge: "some ED doctors are extremely good and will manage . . . as well as any stroke physician. But I know that they are passionate about stroke . . . but not everybody is like that" (SD2) Stroke doctor added: "it's very variable between ED consultants and I feel that . . .some of the ED staff seem to have taken a back seat when it comes to stroke. They let the stroke team sort of steering the process." *[Flow interruptions/Changeovers]*
Dedicated and scheduled resource	**Shared resources**: e.g. CT scan, ED, etc. resources shared with multiple patient groups (i.e. trauma, sepsis, etc.) who also need time critical scan/assess: "If it is delayed it's because maybe the radiologist had a trauma patient to report, something more important" (EDD2). [Flow interruptions/Changeovers] **Portfolio**: Stroke beds reallocated: "often we are on black escalation (full capacity) and it's hard to maintain beds for stroke, a luxury" (EDD1). *[Flow interruptions/Changeovers]*	**Shared resources**: One afternoon SNP3 and EDA transferred patient [36] from RD back to ED. At the entrance of ED, ED coordinator informed SNP3 of bed capacity issue and bed manager had allocated a bed in ASU to an OPU patient. SNP3 got angry and immediately contacted the bed manager and explained that [36] will need the stroke bed, they did not succeed. The OPU patient was already moved in ASU and [36] was waiting 3 h in ED until a bed was made available for him in ASU. *[Flow interruptions/Changeovers]*	**Shared resources**: SNPs assessing a patient with no ED doctor available to assist: "I can assess but I cannot make the final decision on my own" (SNP2). [Flow interruptions/ Changeovers] **Portfolio**: ". . .the general business of the department has an impact because if it is really, really busy and everybody is stretched you might not be able to get your patient seen by the doctor. The doctor might be doing 2 things at once". (SNP2) *[Flow interruptions/Changeovers]*	**Shared resources**: "I feel RD staff set a distance between us (ASUs and ED). They think they own the CT scan and lead the process. Overnight unlikely to get a CT scan within 1h and if they are not thrombolisable sometimes the radiologist will say "How will that change your management?" (EDD1) *[Flow interruptions/Changeovers]*

(*continued*)

Flow	Dependencies			
	Operational		Professional	
	SNP specific			
Information/ knowledge exchange	**Portfolio**: "ED forget to inform us. I just assume pressure, they have so many things they are trying to do" (R1). Stressful and busy environment often impacted effective use of IT systems. *[Flow interruptions/ Changeovers]* **Co-location**: Issues more pronounced with distance "...it is difficult to assess the patient through the phone" (SNP2). Transferring complex information regarding a patient's medical status over the phone was not always an easy and efficient task. Stroke doctors, based in ASU (approx. 600 m from the ED)	**Portfolio**: "ED staff do not always inform us. They are just so busy with volume of work, all the sepsis and other patients that also have... pathways." (SNP3). *[Flow interruptions/Changeovers]*	**Portfolio**: SNP2 returned to ED and no ED staff members available to assist. SNP2, first contacted the stroke team to seek help and then asked ED coordinator: "where has everyone gone? I cannot do everything alone" ED coordinator replied: "I have informed the ED doctor earlier but today is a very busy day..., I will look for the ED doctor and inform him that you are back from RD". SNP2 concluded assessment of [56] with stroke doctor on phone and transferred patient to ASU. No ED staff members were involved. *[Flow interruptions/ Changeovers]*	**Co-location**: Stroke doctors based in ASU, had limited interaction with ED staff and found it difficult to adapt to the ED environment: "I do not know how they work down there" (SD2). [Flow interruptions/Changeovers] **Judgement**: ED doctor/SNP2 start assessing a senior female patient [29] who had arrived in ED earlier. CT scan [results] arrived 5' later. Doctor disagreed with Radiologist judgement. ED contacted stroke doctor to discuss. ED and stroke doctors agreed that CT scan report not accurate. ED doctor walked to RD and discussed with Radiologist. Process lasted more than 1h until a common and final decision for the [29]'s treatment plan was concluded. *[Flow interruptions/Changeovers]*

Table 4.

Table 5.
Managerial response to challenges in implementing and sustaining standardised flow practices (formal and informal)

	Managerial response	
	Formal	Informal
Operational Dependencies	**Improvement initiatives**: (Inter) departmental meetings focussed on flow: "Stroke doctors have regular meetings with radiologists, discuss good/bad cases, pathway evaluation reports and get good communication. We get invited to meetings and the opportunity to meet regularly with stroke team" (R3) **Visibility (KPIs)**: "ED has competing priorities. . . To meet the 4h target they transfer out of the ED to the ward. So, that will come ahead of the stroke. They talk about not meeting their 4h, but no-one cares about the stroke care pathway" (SNP2)	**Coaching**: "The stroke pathway is working very well because the SNP will be involved rather than just being only the ED nurses. You actually have somebody who is specialised on stroke being there to assess with the process" (EDN1) EDC1 added: "The ED nurses are very good but some of them lack confidence. The first few times they need to assess or treat the patient there is a bit of "are we sure we can do this?" and that is where the SNPs have been invaluable, supportive with the staff to do it"	**Social capital**: Shared stroke care knowledge/interest improved co-ordination. e.g. one Mon. Am SNP1 transferred patient [37] back to ED. She sought a specific ED doctor interested on stroke care to assist her. Although busy with the care of another patient, ED doctor received the handover for the patient and advised SNP1 how to proceed	**Authority**: Shaped boundaries and information exchange: "I have a very different relationship with the bed managers . . . Because of what I do, they respond very differently to me." (EDC1) **Engagement**: Influenced professionals' knowledge sharing and efforts for improvement: "I think part of the problem is that it is very difficult to get the ED staff to all sit together and discuss issues. They have some many patient groups to care of. Stroke is not their priority or what they are mainly interested about." During the study period, no ED staff members were present in any interdepartmental meetings. Although ED staff members were invited to the meetings, these were mainly happening between radiology and ASU

(*continued*)

Table 5.

	Managerial response			
	Formal		Informal	
Professional dependencies	**Improvement initiatives**: In addition to stroke professionals, an ED doctor and ED coordinator participated in the design of three pathway artefacts SD3 added: ". . . nursing wise it matters who is there, I think Y who is involved in a lot of projects related to stroke and she is aware of what the priorities are. The level of awareness of importance and priorities of stroke down there is patchier for the nurses in the ED." **Visibility and clarity**: developed and used by experts in each professional group but people with varying levels of expertise use them	**Co-location**: SNPs had high levels of interaction (e.g. tasked to inform all ED staff members of arrival of stroke patients) and consequently, were more familiar with the working approach of other professionals **Improvise**: "Hunt the doctor" would involve walking around ED, finding doctors who were available to assist: "Sequence might involve 2–3 different ED doctors, for different medical tests, for the same patient. I often run down here to talk to them because the phones are not being answered (SNP1)" **Authority**: "I feel that since we started, some ED staff seem to have taken a back seat when it comes to stroke. While I think the patient should be our centre of attention. I should not need to tell them what they should do." (SNP2)	**Authority**: One Sunday morning ED nurse asked SNP2 to check patient [47] admitted with "slight confusion". SNP2 was reluctant to assess immediately. "I do not want to get involved with patients . . . with limited symptoms of stroke . . . whenever I go down [to] ED, I do everything for the patient and still in the end, the patient is diagnosed without a stroke." In case [47] ED doctor did not diagnose stroke and the patient was discharged. [47] was readmitted the following day, diagnosed by ED doctor as stroke and followed pathway Judgement: To avoid delays or inaccurate decision-making, SNPs would contact ED/ASU stroke doctor whom they judged to be knowledgeable and experienced in the pathway: "It is the ED doctor who should assess the patient, but we can also alert our stroke consultant, because our stroke doctors have more experience about thrombolysis and patient outcome than ED doctors" (SNP3)	**Authority**: "At the weekend we have problems getting a scan booked because sometimes the radiologist can be rude and cranky. So, things like that do not help." (SNP2) SNP1 added: "I really do not like this radiographer, she is always very rude to me. But, I cannot do anything about it; I really do not have any choice" **Co-location**: When the SNPs faced issues with ED senior doctors; they voiced their concerns and showed their annoyance to stroke team colleagues, but not to the ED doctors directly. We also observed several discussions between ASU practitioners and RD staff during their interdepartmental meetings, about lack of collaboration from ED staff members
	SNP specific			

management of the role (cf. White *et al.*, 2017). Consequently, individual pilots approached the task in (sometimes very) different ways, contingent on their own personalities, status, social capital, etc. Indeed, we found their work was often primarily characterised by its improvised nature, with variable consequences in terms of ultimate performance. In this chapter, we further elaborate on these observations and with reference to the H (O) M theoretical framing we try to answer our two research questions.

5.1 What happens when standardised flow interacts with other operational (i.e. resource sharing, alignment) and professional (i.e. co-ordinating autonomous expertise) dependencies?

The data reinforce and clarify many of the benefits and challenges of standardised flow identified in the HOM literature. For example, when flow meant that professionals were located close to each other, information and knowledge sharing was more efficient. Practitioners who had the opportunity to interact more frequently, and thus to develop better social capital, working and social relationships (e.g. SNPs within the ASU stroke team), were more motivated to voice and share any issues or concerns they had with their work. In addition, those improvement initiatives where practitioners engaged in formal and informal conversations were important for supporting knowledge sharing, and consequently increasing practitioner motivation to engage in further efforts for standard flow (McDermott and Venditti, 2015).

Conversely, although process mapping techniques can be effective in making the pathway more visible and clear (van Raak *et al.*, 2008; Hellström *et al.*, 2010; Hayes *et al.*, 2011; McDermott and Venditti, 2015). Well-established challenges associated with mapping (i.e. graphical or text based, level of analysis, composition of the mapping teams, etc.) were even more acute in this professional environment. In a healthcare setting, process maps (and other artefacts (Pentland and Feldman, 2008) like textual descriptions can help span knowledge boundaries, improve visibility and clarity of the process (i.e. roles, sequence, etc.), increase shared understanding of the distinct value added by different professions and, hence, enhance intergroup communication (McDermott and Venditti, 2015). However, this only appears to hold when "artefacts" are developed and co-ordinated in a structured and integrated manner.

5.2 Flow interruptions/changeovers

There was evidence of the effect that compliance with best practice guidance had on reducing ad-hoc task interruptions. In line with experimental studies that show task interruptions can lead to longer processing times – Bo *et al.*, (2019) estimate 20% of total processing time per patient is associated with changeovers – our interviews suggested the standard protocol helped with localised co-ordination efficiency. Medical professionals are typically categorised as specialists performing specialist tasks, but our observations confirm that they are also involved in a range of quite mundane and generalist tasks – including a great deal of basic simultaneous and asynchronous "changeovers". The collaborative process of prioritising and switching between collaborative and individual tasks affect treatment times. This aligns with research that has investigated the impact of standardised handovers in surgery (Wayne *et al.*, 2008) and other structured communication protocols such as checklists (Lingard *et al.*, 2008) and structured interdisciplinary rounds. Even with the "guide rails" of standardised flow, medical staff members have considerable autonomy to use their individual judgement to decide when and how to engage and commit in various collaborative tasks. The stroke care pathway, built on the combined expertise of multiple professionals with varied knowledge and skills, provided fertile ground for the combined effect of autonomy and variations in knowledge, competency and engagement to influence the standard stroke care flow. Stroke flow is predicated on the effective and efficient administrative and medical information

exchange between those professionals and although social capital could enhance communication, the high workload due to multiple activities, different location etc. frequently resulted in outcomes that are more dysfunctional.

5.3 Multifaceted dependencies

The fundamentally interactive character of the various operational dependencies comes through very strongly in the analysis of the data. Many of the factors that impact the outcome of one process dependency, appear to influence other process dependencies as well (see Tables 4 and 5). As the above discussion illustrates, standardised flow can have a positive impact on efficiency, but attempts to implement it whilst ignoring simultaneous resource sharing (including multitasking people and shared IT systems) dependencies can create additional "vicious cycle" challenges. In its most frequent manifestation, limited availability of key people repeatedly interrupted flow. When specific practitioners were unable to carry out their tasks, in order to proceed with the pathway, other "potentially eligible" staff members were interrupted; even when the effect of prioritising one flow was interruptions in others. Hospital portfolio and resource sharing led to an increased bottleneck "busy-ness" of professionals and subsequent high workload, with its concomitant adverse effects on the number of interruptions and changeovers, reinforcing additive workload and flow issues. Achieving standardised flow in one pathway in a (highly utilized) shared resource management system propagated sequence variation to other pathways and, via increased variability, may have actually diminished the effective capacity (and quality) of critical resources (c.f. Coeira *et al.*, 2002; McDermott and Venditti, 2015). During one observation session, ASU nurses were moved elsewhere by the hospital staff manager during early and night shifts based on the (erroneous) assumption that the number of stroke patients arriving at the unit would be lower at those times. Equally, one SSNAP audit found approximately 20% of stroke beds in the case study hospital, were being used for non-stroke patients to avoid breaching other hospital priorities. These interacting priorities, with differentiated intermittent audit/enforcement cycles, only exacerbated the challenge of isolating dedicated capacity necessary to support standardised flow.

Similarly, we observed as much competition as collaboration (Collins *et al.*, 2014). Hospital managers try to enhance pathway visibility by setting specific KPIs, aligned with best practice guidance. But, misalignment of the pathway targets with the other pre-existing portfolio targets and goals, induced more competition than collaboration. For example, despite the central role of specific shared resources in standardised flow, resource-holding departments involved in the care of multiple patient types, such as Radiology, continued to make portfolio decisions; where the use of the specific resource, rather than the stroke pathway objectives, was the foremost consideration.

5.4 Managerial response

Most of the pathway "ingredients" above are managerial in nature, but this section reflects on the specific responses to try and ensure coherent stroke care pathway "flow". Outside the SNP/pilot role, discussed in greater depth in Section 5.2, what was most striking was the lack of evidence of properly designed support mechanisms. For example, although the need for the stroke care pathway to draw on shared resources is explicitly recognised in the formal guidance, in practice, the hospital responded to this challenge in a disconnected manner. We have shown the ad-hoc and highly varied attempts to increase flow visibility with the addition of specific (mandatory) KPIs to the hospitals' measurement portfolio, then subject to external audit and reporting (e.g. SNAAP). However, even with this external pressure, managerial response was limited. There were some improvement initiatives, such as inter/

departmental meetings and some attempts at classic "continuous improvement work", but these were rarely part of a coherent deployment of activities and communication.

An institutional lens may offer some explanation. The pathway implementation was responding to a range of external (to the pathway) institutional pressures. Although a logical evidence-based guide in its own right, the standardised flow for stroke care was officially adopted in response to a range of external pressures. It was also an explicit accounting mechanism with specific coercive consequences. This idea of "enforcing" best practice may have served to undermine key legitimation processes and, consequently, institutional change. Likewise, there was ample evidence regarding the role of agency (and resistance) in legitimate change. It was clear that for many professionals the pathway, far from being seen as a neutral scientific best practice, played into established managerial and professional boundary skirmishes (e.g. specialities, medical/surgical, doctor/nurse, medical/administrative, etc.). Healthcare professionals draw on a common body of regulated (in this case by nine UK statutory bodies and the General Medical Council) knowledge, values and standards, which influences and defines their knowledge, skills and expertise. If any "improvement" is seen as a vehicle for "empire building", a way to broaden specific professional span of influence, then this exacerbates the negative aspects of the interacting dependencies; increasing resource competition, impinging on professional responsibilities and judgements and amplifying (dysfunctional) political dynamics (Drupsteen *et al.*, 2016).

5.5 How does the process pilot role, intended to support standardised flow, deal with operational and professional dependencies?

The process pilot role (SNP) was a particularly intriguing response and co-ordinating mechanism for aligning sharing and flow interactions and connecting care professionals. It justifies an extended discussion, as this type of role has received almost no attention in the OM literature. It is an interesting hybrid between formal and informal managerial response. The pilot worked in connecting the relevant aspects of the pathway flow model, to try to ensure coherent stroke care pathway "flow". Particularly, the SNPs works in improving pathway clarity and managing the multilevel institutional pressures. From numerous points of view, this was an effective approach. As already noted above, there is a known exchange challenge (Radaelli *et al.*, 2015; Mura *et al.*, 2016) with professional knowledge (tacit, situational, etc.: Alvesson, 2001) that is resistant to the traditional OM recipe of explicit formalisation and standardisation. However, there is a positive relationship between professionals' relationships and subsequent willingness/motivation to exchange information and knowledge, which improved collaboration and effective process management (Gittell, 2011; Hayes *et al.*, 2011; Tucker and Singer, 2015). This allows for timely adjustment to unexpected variation (Gittell, 2011; Dobrzykowski and Tarafdar, 2015; Mura *et al.*, 2016). Clearly, the role is a critical integrator.

In many ways, without the pilot there is no meaningful pathway in any consistent sense. The SNPs tie together different professional groups, argue for adhering to or ignoring KPIs, manage external audit (such as SNAAP), using the informal "authority" of the pathway to facilitate pathway co-ordination through negotiation of resource allocation and scheduling, coach and help professionals to build shared understanding, the specific knowledge and needs of the pathway, etc. Yet despite the advantages of this informality, the other side of this was the frequent contestation and near permanent improvisation surrounding the role. From SNPs interrupting their work to undertake adjacent administrative and clinical work (cf. Sangster-Gormley *et al.*, 2011), preventing them from facilitating the pathway of their patients, to the near daily and often heated, arguments around resource availability and prioritisation.

Here we are not talking about variable medical judgement but adaptations and improvisations to the pathway flow itself. This notion of improvisation (Weick, 1998) has

been applied to a range of phenomena, from teamwork and creativity to product innovation (e.g. Moorman and Miner, 1998, 2001; Kamoche *et al.*, 2003) and the hospital Emergency Room (Batista *et al.*, 2016). However, despite its importance in co-ordinating healthcare processes, its role in the healthcare and operations management bodies of literature is under-explored. In Figure 3, the scope of the role and the extent of the observed improvisation is indicated by a series of dotted lines between all the relevant aspects of the pathway flow model.

Our findings reveal a strong element of SNPs' improvisation as either a spontaneous response or development of a routine, being a critical mechanism in managing the pathway flow (Batista *et al.*, 2016). For example, in response to the challenge of obtaining precise admissions information (including stroke patients being wrongly admitted to the MAU), the SNPs created their own informal, temporary "walkabout" routines to facilitate flow. SNPs were going to ED every 1–2 h to ask informally about patient arrivals, reminding the ED staff members that they are there, and that they should be informed if any patient arrives with suspected stroke, etc. Similarly, when there was a delay of professionals reporting the medical diagnostic reports, SNPs would ring them more than once, or walk down to the relevant department (i.e. Radiology, laboratories, etc.) and demand professionals to provide the relevant information the soonest possible in order to facilitate flow.

Here too, adjacent dependencies shaped the extent and effectiveness of improvisation. Reduced stroke bed availability (at times due to non-stroke patients been admitted to the ASU), for example, frequently led SNPs to try to "sort this out". Similarly, faced with CT scan delays, SNPs would go into the small room and "discuss" with the radiographer how to move things faster. These improvisations also impact professional dependencies. Negotiating ad-hoc bed arrangements "face-to-face" on the ward (sometimes marshalling the support of other stroke nurses) would often result in quite heated disputes with the hospital bed managers. Similarly, there were several instances when SNPs went directly to stroke doctors

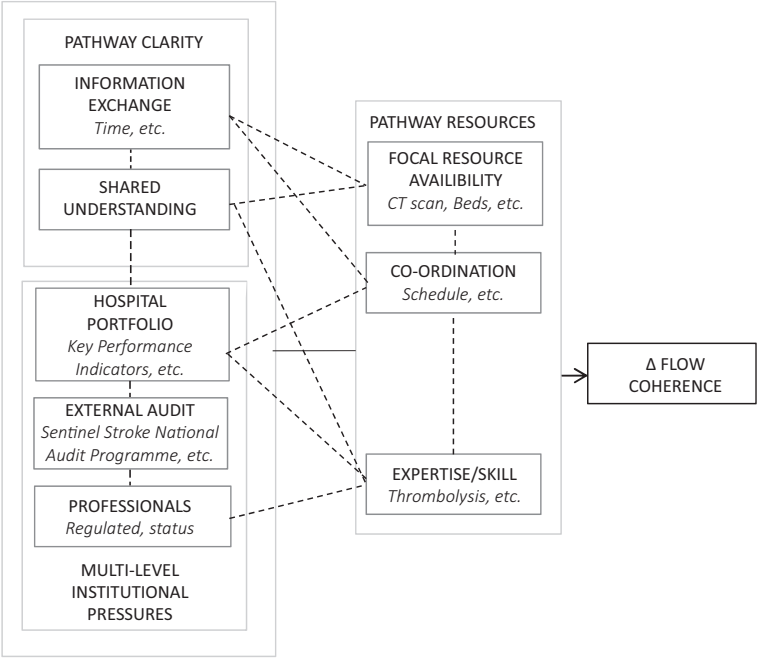

Figure 3.
Observed scope of the improvised Stroke Nurse Practitioner/ pilot role

to facilitate a patient move without informing the ED staff who were officially in control. There was also improvised auditing, such as participants challenging the actions of others. A nurse challenging a doctors' stroke expertise and experience would typically be inappropriate, but the pathway principle is clear that it would be wrong to draw an inexperienced doctor into stroke care. Such improvisations, no matter how well justified/intentioned, could exacerbate interprofessional communication challenges.

6. Conclusions

Before reflecting on the key conclusions of the work, it is important to note that this study has several limitations. In particular, it was an exploratory study and although extant literature was used to frame the investigations, there was no formal hypothesis development or testing. The empirical setting offered the invaluable opportunity to investigate clinical care pathway implementation, but it was a case study of a single care pathway in a single organisation and this can lessen the external validity of the study and generalisability of the findings. Equally, although the research employed formal data collection protocols (triangulation, coding, etc.) derived from a conceptual framework itself informed by literature, interpersonal differences (i.e. native language, cultural assumptions, educational background, etc.) between the researchers and the participants can never be completely eliminated.

Noting these potential limitations, we believe that the whole paper is studying a clearly society important problem, contributing to the optimization of healthcare processes flow. Insights from this paper will contribute to the production of better patient outcomes for stroke patients, including survival and post-discharge quality of life. This paper draws conclusions and makes theoretical and practical implications in two key areas. First, the study clarifies and confirms that standardised flow implementation (RQ1) requires negotiation between flow, operational and, particularly in this healthcare setting, professional dependencies. In conceptual terms, this emphasizes the need for a multidimensional and multilevel model of "process" management; a perspective that exists in the (H)OM literature but is not widely deployed. Viewing implementation as a multidependency puzzle also provides a useful contingent framework for understanding (in research and practice) the networked capacity questions that characterise most healthcare systems composed of shared and/or multitasking resources. Gurvich and Van Mieghem (2015) highlight the need in such circumstances to match task priorities with the collaboration levels defined by the capacity network's collaboration architecture. Without such a collaboration centric logic, our findings confirm that even if a standard flow design is sometimes coherent, it can quickly become incoherent when implemented in a setting with multiple other care pathways and patient activity. Autonomy frequently led to minimally shared mental models of care, different perspectives on the best interests of the patient, and (often highly dysfunctional) competition between individuals and groups potentially causing a negative effect both on its effectiveness (i.e. accuracy in decision-making) and efficiency (i.e. changeovers, timeliness, use of resources, etc.). In practice, managing standardised work in a setting with professional autonomy requires multifaceted managerial interventions, which create the structural (e.g. knowledge interdependencies) and cognitive (e.g. shared goals) conditions to facilitate and motivate knowledge sharing (Radaelli *et al.*, 2015).

Second, the process pilot (RQ2), although poorly designed and, like other boundary spanner roles, frequently contested, was observed to be an effective mechanism for aligning flow and other dependencies and connecting care professionals. Interestingly, and echoing the organisational routines literature (Feldman and Pentland 2003), significant levels of deviation persisted even in the midst of this attempt to create a highly formalised routine. Even with the "in principle" (ostensive) pathway acting as both a guide to implementation (e.g. role creation, training, diagnostic scripting, scheduling, etc.) and an accounting

mechanism (i.e. reviewing the pathway, feeding into audits, etc.) we observed significant forms of adaptation and, especially around the SNP/pilot role, extensive improvisation (cf. Batista *et al.*, 2016).

The novelty of this contribution derives from the fact that, the role of process "pilot", which is under-explored in H(O)M, can constitute a bridge between the ostensive and performative (improvisational) aspects of healthcare processes, which provides a "realm" of operational performance, where coherence of flow can be achieved. In practice, the role of process pilots should be designed with a better realisation of the situated organisation and the multifaceted nature of the healthcare processes. This will enable better integration of their role at the workplace. Complete integration may improve the use of pilots' knowledge and skills, as well as enable them to build the required resources (i.e. relationships etc.) to manage the dynamic and complex nature of healthcare processes.

Finally, we would highlight further work aligned with our key conclusions. First, in this study we deliberately sampled a pathway where patients (and their carers, families, etc.) had a limited impact on the flow process. Would similar effects be observed in longer duration pathways where patients' characteristics matter significantly (e.g. psychiatry) or indeed in more complex care processes? Second, this was a preliminary exploration of the role of process pilot in a specific care pathway and hospital. We observed patterns of action and evidence of extensive improvisation, but it was not the focus of our theorizing. Future research could more fully conceptualise (expediter, chasers, negotiators, customer care, guides, etc.) and investigate these roles and the process of improvisation in so-called standardised work, in a range of other settings.

References

Alvesson, M. (2001), "Knowledge work: ambiguity, image and identity", *Human Relations*, Vol. 54 No. 7, pp. 863-886.

Batista, M.D.G., Clegg, S., Pina e Cunha, M., Giustiniano, L. and Rego, A. (2016), "Improvising prescription: evidence from the emergency room", *British Journal of Management*, Vol. 27, pp. 406-425.

Ben-Tovim, D., Bassham, J., Bolch, D., Martin, M., Dougherty, M. and Szwarcbord, M. (2007), "Lean thinking across a hospital: redesigning care at the Flinders Medical Centre", *Australian Health Review: A Publication of the Australian Hospital Association*, Vol. 31 No. 1, pp. 10-15.

Beynon-Davies, P. and Lederman, R. (2017), "Making sense of visual management through affordance theory", *Production Planning and Control*, Vol. 28 No. 2, pp. 142-157.

Bo, Y., Dawande, M., Huh, W.T., Janakiraman, G. and Nagarajan, M. (2019), "Determining process capacity: intractability and efficient special cases", *Manufacturing and Service Operations Management, INFORMS Institution for Operations Research and the Management Sciences*, Vol. 21 No. 1, pp. 139-153.

Boyer, K.K., Gardner, J.W. and Schweikhart, S. (2012), "Process quality improvement: an examination of general vs. outcome-specific climate and practices in hospitals", *Journal of Operations Management*, Elsevier, Vol. 3 No. 4, pp. 325-339.

Brostrøm, K.M., Sofie Kjaer Joensen, A. and Thorsen, T. (2015), "The challenges of boundary spanners in supporting inter-organizational collaboration in primary care. A qualitative study of general practitioners in a new role", *BMC Family Practice*, Vol. 15 No. 1, p. 17.

Brown, L., Tucker, C. and Domokos, T. (2003), "Evaluating the impact of integrated health and social care teams on older people living in the community", *Health and Social Care in the Community*. Vol. 11 No. 2, pp. 85-94.

Campbell, H., Hotchkiss, R., Bradshaw, N. and Porteous, M. (1998), "Integrated care pathways", *BMJ (Clinical research ed.)*, Vol. 316 No. 7125, pp. 133-137.

Coiera, E.W., Jayasuriya, R.A., Hardy, J., Bannan, A. and Thorpe, M.E. (2002), "Communication loads on clinical staff in the emergency department", *Medical Journal of Australia*, Vol. 176 No. 9, pp. 415-418.

Collins, K.F., Muthusamy, K. and Carr, A. (2014), "Total quality management and business excellence Toyota production system for healthcare organisations: prospects and implementation challenges", *Total Quality Management*, Vol. 0 No. 7–8, pp. 905-918.

Costa, L.B.M. and Filho, M.G. (2016), "Lean healthcare: review, classification and analysis of literature", *Production Planning and Control*, Vol. 27 No. 10, pp. 823-836.

de Souza, L.B. and Pidd, M. (2011), "Exploring the barriers to lean health care implementation", *Public Money and Management*, Vol. 31 No. 1, pp. 59-66.

Dobrzykowski, D.D. and Tarafdar, M. (2015), "Understanding information exchange in healthcare operations: evidence from hospitals and patients", *Journal of Operations Management*, Vol. 36 No. 1, pp. 201-214.

Drupsteen, J., van der Vaart, T. and Van Donk, D.P. (2016), "Operational antecedents of integrated patient planning in hospitals", *International Journal of Operations and Production Management*, Vol. 36 No. 8, pp. 879-900.

Edmondson, A.C., Bohmer, R.M. and Pisano, G.P. (2001), "Disrupted routines: team learning and new technology implementation in hospitals', *Administrative Science Quarterly*, Vol. 46 No. 4, p. 685.

Eisenhardt, K.M. and Graebner, M. (2007), "Theory building from cases: opportunities and challenges", *The Academy of Management Journal*, Vol. 50 No. 1, pp. 25-32.

Elissen, A.M.J., Van Raak, A.J.A. and Paulus, A.T.G. (2011), "Can we make sense of multidisciplinary co-operation in primary care by considering routines and rules?", *Health and Social Care in the Community*, Vol. 19 No. 1, pp. 33-42.

Feldman, M.S. and Pentland, B.T. (2003), "Reconceptualizing organizational routines as a source of flexibility and change", *Administrative Science Quarterly*, Vol. 48 No. 1, pp. 94-118.

Feldman, M.S. and Rafaeli, A. (2002), "Organizational routines as sources of connections and understandings", *Journal of Management Studies*, Vol. 39 No. 3, pp. 309-331.

Gerein, N., Green, A. and Pearson, S. (2006), "The implications of shortages of health professionals for maternal health in sub-saharan africa", *Reproductive Health Matters*, Vol. 14 No. 27, pp. 40-50.

Gittell, J.H. (2011), *Relational Coordination: Guidelines for Theory, Measurement and Analysis*, available at: https://heller.brandeis.edu/relational-coordination/ (accessed 26 June 2019).

Green, M.L. and Holmboe, E. (2010), "Perspective: the ACGME toolbox: half empty or half full?", *Academic Medicine*, Vol. 85 No. 5, pp. 787-790.

Grove, A.L., Meredith, J.O., MacIntyre, M., Angelis, J. and Neailey, K. (2010), "UK health visiting: challenges faced during lean implementation", *Leadership in Health Services*, Vol. 23 No. 3, pp. 204-218.

Greenhalgh, T. (2008), "Role of routines in collaborative work in healthcare organisations", *BMJ*, Vol. 337 No. 7681, pp. 1269-1271.

Gulliford, M.C., Naithani, S. and Morgan, M. (2006), "Measuring continuity of care in diabetes mellitus: an experience-based measure", *The Annals of Family Medicine*, Vol. 4 No. 6, pp. 548-555.

Gurvich, I. and Van Mieghem, J.A. (2015), "Collaboration and multitasking in networks: architectures, bottlenecks, and capacity", *Manufacturing and Service Operations Management*, Vol. 17 No. 1, pp. 16-33.

Hayes, G.R., Lee, C.P. and Dourish, P. (2011), "Organizational routines, innovation, and flexibility: the application of narrative networks to dynamic workflow", *International Journal of Medical Informatics*, Vol. 80 No. 8, pp. e161-e177.

Hellström, E., Åslund, J. and Nielsen, L. (2010), "Horizon length and fuel equivalents for fuel-optimal look-ahead control", *IFAC Proceedings Volumes*, Vol. 43 No. 7, pp. 360-365.

Hunt, C.M., Spence, M. and Mcbride, A. (2016), "The role of boundary spanners in delivering collaborative care: a process evaluation", *BMC Family Practice*, Vol. 17 No. 1, p. 96.

Kamoche, K., Pina e Cunha, M. and Da Cunha, J.V. (2003), "Towards a theory of organizational improvisation: looking beyond the jazz metaphor", *Journal of Management Studies*, Vol. 22 No. 5, pp. 733-764.

Kc, D.S. and Terwiesch, C. (2009), "Impact of workload on service time and patient safety: an econometric analysis of hospital operations", *Management Science*, Vol. 55 No. 9, pp. 1486-1498.

Lewis, M.A. and Brown, A.D. (2012), "How different is professional service operations management?", *Journal of Operations Management*, Vol. 30 Nos 1–2, pp. 1-11.

Lingard, L., Regehr, G., Orser, B., Reznick, R., Baker, G.R., Doran, D., Espin, S., Bohnen, J. and Whyte, S. (2008), "Evaluation of a preoperative checklist and team briefing among surgeons, nurses, and anesthesiologists to reduce failures in communication", *Archives of Surgery*, Vol. 143 No. 1, pp. 12-17.

Malone, T.W. and Crowston, K. (1994), "The interdisciplinary study of coordination", *ACM Computing Surveys*. Vol. 26 No. 1, pp. 87-119.

Malone, T.W., Crowston, K., Lee, J., Pentland, B., Dellarocas, C., Wyner, G., Quimby, J., Osborn, C.S., Bernstein, A., Herman, G., Klein, M. and O'Donnell, E. (1999), "Tools for inventing organizations: toward a handbook of organizational processes", *Management Science*, Vol. 45 No. 3, pp. 425-443.

Mann, L. (2005), "From silos to seamless healthcare: bringing hospitals and GPs back together again", *The Medical journal of Australia*, Vol. 182 No. 1, pp. 34-37.

McDermott, C.M. and Venditti, F.J. (2015), "Implementing lean in knowledge work: implications from a study of the hospital discharge planning process', *Operations Management Research*, Vol. 8 No. 3–4, pp. 118-130.

McKnight, L., Stetson, P., Bakken, S., Curran, C. and Cimino, J. (2002), "Perceived information needs and communication difficulties of inpatient physicians and nurses", *Journal of the American Medical Informatics Association*, Vol. 9 No. 6, pp. S64-S69.

Moorman, C. and Miner, A.S. (1998), "Organizational improvisation and organizational memory", *Academy of Management Review*, Vol. 23 No. 4, pp. 698-723.

Moorman, C. and Miner, A.S. (2001), "Organizational improvisation and Learning: a field study paula bassoff", *Administrative Science Quarterly*, Vol. 46 No. 2, pp. 304-337.

Mazzocato, P., Holden, R., Brommels, M., Aronsson, H., Bäckman, U., Elg, M. and Thor, J. (2012), "How does lean work in emergency care? A case study of a lean-inspired intervention at the Astrid Lindgren Children's hospital, Stockholm, Sweden", *BMC Health Services Research*, Vol. 12 No. 1, p. 28.

Moraros, J., Lemstra, M. and Nwankwo, C. (2016), "Lean interventions in healthcare: do they actually work? A systematic literature review", *International Society for Quality in Health Care*, Vol. 28 No. 2, pp. 150-165.

Mura, M., Lettieri, E., Radaelli, G. and Spiller, N. (2016), "Behavioural operations in healthcare: a knowledge sharing perspective", *International Journal of Operations and Production Management*, Vol. 36 No. 10, pp. 1222-1246.

Nasir, L., Robert, G., Fischer, M., Norman, I., Murrells, T. and Schofield, P. (2013), "Facilitating knowledge exchange between health-care sectors, organisations and professions: a longitudinal mixed-methods study of boundary-spanning processes and their impact on health-care quality", *Health Services and Delivery Research*, Vol. 1 No. 7, pp. 1-170.

Nicolini, D., Mengis, J. and Swan, J. (2012), "Understanding the role of objects in cross-disciplinary collaboration", *Organization Science*, Vol. 23 No. 3, pp. 612-629.

Pagell, M., Klassen, R., Johnston, D., Shevchenko, A. and Sharma, S. (2015), "Are safety and operational effectiveness contradictory requirements: the roles of routines and relational coordination", *Journal of Operations Management*, Vol. 36 No. 1, pp. 1-14.

Papadopoulos, T., Radnor, Z. and Merali, Y. (2011), "The role of actor associations in understanding the implementation of lean thinking in healthcare", *International Journal of Operations & Production Management*, Vol. 31 No. 2, pp. 167-191.

Pellinen, J., Teittinen, H. and Järvenpää, M. (2016), "Performance measurement system in the situation of simultaneous vertical and horizontal integration", *International Journal of Operations and Production Management*, Vol. 36 No. 10, pp. 1182-1200.

Pentland, B.T. and Feldman, M.S. (2008), "Designing routines: on the folly of designing artifacts, while hoping for patterns of action", *Information and Organization*, Vol. 18 No. 4, pp. 235-250.

Poksinska, B.B., Fialkowska-Filipek, M. and Engström, J. (2017), "Does Lean healthcare improve patient satisfaction? A mixed-method investigation into primary care", *BMJ Quality and Safety*, Vol. 26 No. 2, pp. 95-103.

Powell, A., Savin, S. and Savva, N. (2012), "Physician workload and hospital reimbursement: overworked physicians generate less revenue per patient", *Manufacturing and Service Operations Management*, Vol. 14 No. 4, pp. 512-528.

Proudlove, N.C., Black, S. and Fletcher, A. (2007), "OR and the challenge to improve the NHS: modelling for insight and improvement in in-patient flows", *Journal of the Operational Research Society*, Vol. 58 No. 2, pp. 145-158.

Radaelli, G., Lettieri, E. and Masella, C. (2015), "Physicians' willingness to share: a TPB-based analysis", *Knowledge Management Research and Practice*, Vol. 13 No. 1, pp. 91-104.

Schonberger, R.J. (2018), "Reconstituting lean in healthcare: from waste elimination toward 'queue-less' patient-focused care", *Business Horizons*, Vol. 61 No. 1, pp. 13-22.

Seung-Chul, K., Ira, H., Karl, K.Y. and Thomas, A.B. (2000), "Flexible bed allocation and performance in the intensive care unit", *Journal of Operations Management*. Vol. 18 No. 4, pp. 427-443.

Siemsen, E., Roth, A.V., Balasubramanian, S. and Anand, G. (2009), "The influence of psychological safety and confidence in knowledge on employee knowledge sharing", *Manufacturing & Service Operations Management*, Vol. 11 No. 3, pp. 429-447.

Smart, P.A., Maull, R.S. and Childe, S.J. (1999), "A reference model of 'operate' processes for process-based change", *International Journal of Computer Integrated Manufacturing*, Vol. 12 No. 6, pp. 471-482.

Smart, P.A., Maddern, H. and Maull, R.S. (2009), "Understanding business process management: implications for theory and practice", *British Journal of Management*, Vol. 20 No. 4, pp. 491-507.

Sole, D. and Edmondson, A. (2002), "Situated knowledge and learning in dispersed teams", *BMJ*, Vol. 13 No. 2, pp. S17-S34.

Tay, H.L., Singh, P.J., Bhakoo, V. and Al-Balushi, S. (2017), "Contextual factors: assessing their influence on flow or resource efficiency orientations in healthcare lean projects", *Operations Management Research*, Vol. 10 Nos 3-4, pp. 118-136.

Tezel, A., Koskela, L., Tzortzopoulos, P., Formoso, C.T. and Alves, T. (2015), "Visual management in Brazilian construction companies: taxonomy and guidelines for implementation", *Journal of Management in Engineering*, Vol. 31 No. 6.

Tucker, A.L. and Edmondson, A.C. (2003), "Why hospitals don't learn from failures: organizational and psychological dynamics that inhibit system change", Vol. 45 No. 2, pp. 55-72.

Tucker, A.L. and Singer, S.J. (2015), "The effectiveness of management-by-walking-around: a randomized field study", *Production and Operations Management*, Vol. 24 No. 2, pp. 253-271.

Tyre, M.J. and Hippel, E.V. (1997), "The situated nature of adaptive learning in organizations", *Organization Science*, Vol. 8 No. 1, pp. 71-83.

van Leijen-Zeelenberg, J., van Raak, A., Duimel-Peeters, I., Kroese, M., Brink, P. and Vrijhoef, H. (2015), "Interprofessional communication failures in acute care chains: how can we identify the causes?", *Journal of Interprofessional Care*, Vol. 20 No. 4, pp. 320-330.

van Raak, A., Paulus, A., Cuijpers, R. and te Velde, C. (2008), "Problems of integrated palliative care: a Dutch case study of routines and cooperation in the region of Arnhem", *Health and Place*, Vol. 14 No. 4, pp. 768-778.

Vargas, I., Mogollón-Pérez, A.S., De Paepe, P., da Silva, M.R.F., Unger, J.P. and Vázquez, M.L. (2015), "Do existing mechanisms contribute to improvements in care coordination across levels of care in health services networks? Opinions of the health personnel in Colombia and Brazil", *BMC Health Services Research*, Vol. 15 No. 1, p. 213.

Voss, C. (2010), "Case research in operations management", *International Journal of Operations and Production Management*, Vol. 22 No. 2, pp. 195-219.

Wayne, J.D., Tyagi, R., Reinhardt, G., Rooney, D., Makoul, G., Chopra, S. and DaRosa, D.A. (2008), "Simple standardized patient handoff system that increases accuracy and completeness", *Journal of Surgical Education*, Vol. 65 No. 6, pp. 476-485.

Weick, K.E. (1998), "Improvisation as a mindset for organizational analysis", *Organization Science*, Vol. 9 No. 5, pp. 543-555.

White, D.L., Torabi, E. and Froehle, C.M. (2017), "Ice-breaker vs standalone: comparing alternative workflow modes of mid-level care providers", *Production and Operations Management*, Vol. 26 No. 11, pp. 2089-2106.

Yang, B., Milind, D., Woonghee, T.H., Ganesh, J. and Mahesh, N. (2018), "Determining process capacity: intractability and efficient special cases", *Manufacturing Service Operations Management*, Vol. 21, pp. 139-153.

Yin, R.K. (2014), *Applications of Case Study Research*, SAGE, California, CA.

Further reading

Loch, C.H. and Terwiesch, C. (2005), "Rush and be wrong or wait and be late? A model of information in collaborative processes", *Production and Operations Management*, Vol. 14 No. 3, pp. 331-343.

van Leijen-Zeelenberg, J.E., *et al.* (2016), "The impact of redesigning care processes on quality of care: a systematic review", *BMC Health Service Research*, Vol. 16 No. 1, p. 1.

Wegner, D.M., Raymond, P. and Erber, R. (1991), *Transactive Memory in Close Relationships*, available at: https://scholar.harvard.edu/files/dwegner/files/wegnererberraymond1991.pdf (accessed 30 November 2018).

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