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What's the difference between a hospital and a bottling factory?

Efficient processes are essential to good and cost effective care. But health services need to look beyond manufacturing for models, argue **A Morton** and **J Cornwell**



Various commentators have argued for interventions to improve processes in the delivery of health care by drawing attention to experience and practice in other industries—for example, airlines or vehicle manufacturing. A common and natural objection to this line of argument is that health care is different, and so the potential to learn from other sectors is limited. We have sympathy with both claim and counterclaim and explore in this article some features of health care that distinguish it from other industries.

Background

The health service is increasingly looking to the manufacturing sector for ideas to improve its processes.¹⁻³ The *BMJ*, for example, has published articles drawing on lean thinking, the theory of constraints, and six sigma.^{4,5} Within the NHS, the Modernisation Agency and, subsequently, the Institute for Innovation and Improvement have championed this way of thinking about the delivery of health care. Their work, and that of Don Berwick and others at the US Institute of Healthcare Improvement, has resulted in the identification of common systems failures in the healthcare setting and provided clear, detailed prescriptions for overcoming such failures.⁶⁻⁸

Although this approach has resulted in real improvements to patient care, it tends to focus attention away from some of the most distinctive features of health care. Drawing on both health economics and medical sociology, we highlight some of these features by comparing a hospital and a bottling factory. Hospitals are similar to bottling factories in that they are built around a set of interconnected processes, and if these processes do not run smoothly, or if they are poorly coordinated as a system, the organisation will fail to deliver. But it is instructive to contrast hospitals with bottling factories in three key respects: unpredictability, the professional nature of their production class, and their

orientation to service rather than production. Inevitably, the features we draw attention to reflect our own judgment; a recent series of papers on complexity science provides a complementary perspective.^{9,10}

Unpredictability

We take the notion of unpredictability to have two components. The first is irreducible variability. Manufacturing philosophies such as six sigma teach the analysis and elimination of variability, and this theme is echoed in the writings of the NHS modernisers.¹¹ Variability is a pervasive problem in all production environments, but factories do at least deal with standardised inputs and so variability tends to be internally generated and controllable. In hospitals, on the other hand, since the patient's response to treatment will always be to some extent unpredictable, the only way to eliminate variability completely would be to eliminate patients. Because of this, hospitals have to be able to recognise atypical cases and suspend standard operating procedures in dealing with them. This sort of issue arises in other settings, such as post offices with automated mail sorting and address reading systems. Some handwritten addresses are machine readable, but a considerable proportion are so non-standard that the machine gives up and channels the letter to a human operative. Unavoidable variability does not constitute an argument against standardisation or even automation, but it does highlight the importance of building exception handling into the system.

Task ambiguity is the second component of unpredictability. Whereas the path of a bottle through the factory can be mapped out in advance, in hospitals establishing the patient's diagnosis is an important part of the processing. Until diagnosis is complete, it may be unclear whether a condition is life threatening or trivial, or even what organ

system is affected. Although UK referrals come through primary care, a general practitioner's letter may be limited, incomplete, or unhelpful. This characteristic has more in common with garages than bottling factories. There is considerable formal similarity between the diagnostic tools deployed in health care and repair shop; indeed one of the classic psychological studies of expert fallibility and the importance of structured tools for diagnosis comes from a study of car mechanics.¹² Successful repair shops are thus likely to have more to teach hospitals about fast, accurate, objective diagnosis than factory settings.

Professional nature of the production class

The professional nature of the production class in hospital has attracted the attention of many observers. Despite the erosion of medical autonomy in recent years,¹³ doctors have far more freedom to exercise their judgment than assembly line workers and will continue to do so into the foreseeable future. Some writers on hospital processes seem either to ignore the health professions or suggest that hospitals can be de-professionalised and an orderly scientific management system imposed. However, the reason doctors enjoy professional discretion in their work is not bloody mindedness or political astuteness on the part of professional organisations but the nature of medical technology.¹⁴ The human body is complex, and the ability of lay people (whether patients or managers) to question medical judgment is and always will be highly circumscribed. This makes running a hospital more akin to running a university: despite decades of research on pedagogy, what makes a good teacher cannot be completely codified; and successful learning is co-produced between teacher and student, with the student having an active role.

In a competitive environment, universities face a similar challenge to hospitals, in that survival depends on their customers' assessment of a product that is hard to evaluate and setting expectations about the relative

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contribution of customer and provider to successful outcomes is important. The literature on evaluation of teaching in higher education^{15 16} may be a better resource here than manufacturing quality measurement.

But hospitals differ from many other professional organisations, including universities, in the intensive interdisciplinarity required in much clinical work, which may involve not just medicine but nursing, anaesthetics, physiotherapy, clinical psychology, and the legions of other professionals, paraprofessionals, and non-professionals who staff the modern hospital. Hospitals are, and have to be, genuinely interdisciplinary: to provide surgery or to organise discharge and after-care, different professionals have to work together; to care for patients with comorbidities, doctors have to work across specialty boundaries. Indeed, in this respect, hospitals may resemble bottling plants (where engineers, marketers, and logisticians have to collaborate) more than universities, as in universities, cross disciplinary collaboration is optional.

Cutting edge science, like patient care, does not respect professional or disciplinary boundaries. In this respect, hospitals are like the laboratories of a high technology firm, where chemical engineers, physicists, computer scientists, and mathematicians find themselves forced to find a way to work together. Experience in this setting suggests that when multifunctional

teams are engaged in some shared enterprise—such as managing the patient journey—having some sort of shared representation (such as a map of the patient pathway) may help facilitate cross profession communication but that it needs to be complemented by data sharing, forums for informal interaction, and translation by individuals who can engage with multiple communities.¹⁷

Service orientation

In hospitals, as in other service industries,¹⁸ production means dealing with patients or customers directly. This makes a difference because patients care about subtle aspects of delivery¹⁹: are the staff aware of my needs? was I listened to and respected? These considerations can conflict with operating efficiency if this is narrowly conceived—for example, the formation of good working doctor-patient relationships may be compromised in a hospital that insists on merging consultant waiting lists for repeat outpatient appointments. However, the particular service mission of hospitals brings complexities not found in most other service industries. For example, the organisation of the hospital has to accommodate patients' visitors. Although these visitors are not the main customer, they can have an important role in delivery of care, interpreting what is going on for the patient, arranging for the delivery of care after discharge, and acting as an advocate.²⁰

Law courts are similar in this respect: defendants, like patients, are typically accompanied by anxious friends, relatives, and miscellaneous hangers-on. Legal scholars have analysed the role of the “friend” in a litigation setting, whose role may range from “sympathetic supporter” to semi-formal legal adviser, and have attempted to clarify the rights and responsibilities of both litigants and judges and magistrates with regard to such friends.²¹ In clarifying the role of the visitor in a hospital setting, it seems more natural and productive to look to the legal literature rather than manufacturing.

The presence of visitors is, however, an expression of a more fundamental fact about hospitals: they are the settings for some of the most important events in people's lives—for the times of both greatest joy and greatest loss. The customers in hospitals are routinely asked to undress, some are unconscious, most feel vulnerable, and many are distressed or fearful. They inspire strong emotions in staff: compassion, pity, admiration, or, sometimes, contempt.²² The organised religions are perhaps the only candidate organisations that routinely touch so closely the raw fundamentals of human experience. As they do with religious figures, patients expect personal authenticity and engagement from their healthcare providers and can sense the disaffection and cynicism that over-reliance on extrinsic motivators such as financial and performance targets can generate.



Conclusion

Although hospitals do have some things in common with bottling factories, there are many ways in which they are different. But hospitals are not unique. As we have seen, for practically all of the dimensions of complexity discussed here there are natural comparators in other industries. We suggested mail processing for ideas about exception handling; repair shops for ideas about diagnosis; universities for ideas about evaluation; science laboratories for ideas about interprofessional collaboration; courts for ideas about accommodating friends and family; and the organised religions for ideas about the provision of comfort. We hope our reflections will be a stimulus for a creative search for alternative comparator industries and organisations from which lessons can be learnt rather than a reason for resisting change. And certainly, none of this means that process improvement is impossible or impractical. Indeed, because the stakes are so high in hospitals it is important to get the processes right. After all, the worst that can happen in a bottling factory is a few broken bottles.

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ANSWERS TO ENDGAMES, p 465. For long answers use advanced search at bmj.com and enter question details

CASE REPORT

Fever in the vaccinated returning traveller

- 1 Having excluded malaria, the symptoms described in a traveller returning from the Indian subcontinent suggest a diagnosis of enteric fever. Paratyphoid may be the more likely diagnosis because she received the typhoid vaccine and is relatively well.
- 2 Blood, stool, and urine cultures should be undertaken. The diagnosis of enteric fever relies on recovery of the pathogen from the patient; however, a diagnosis of "presumed" enteric fever should be made if cultures are negative but the clinicopathological presentation is consistent with this disease.
- 3 Prompt initiation of empirical antibiotics after discussion with a microbiology or infectious disease consultant. Antipyretics should be given as needed and careful attention paid to adequate rest, hydration, and electrolyte balance.
- 4 Patients must be counselled on meticulous hand hygiene and proper sanitation. Patients should be advised that their carrier status, and that of close contacts, will be assessed in the community. Decisions regarding exclusion from work or school should be made by those experienced in public health medicine.
- 5 Enteric fevers are notifiable diseases, and it is the statutory duty of doctors in England and Wales to notify "forthwith" the person responsible for epidemiological data collection at the local Health Protection Unit. Medical practitioners in Scotland and Northern Ireland have similar duties.

PICTURE QUIZ

Unusual computed tomography findings in a patient presenting with acute abdominal pain

- 1 This patient has mesenteric ischaemia.
- 2 The computed tomogram shows portal venous gas and pneumatosis intestinalis—that is, air within the liver and bowel wall, respectively—and some intra-abdominal fluid. These signs are consistent with bowel ischaemia.
- 3 The most common cause of acute mesenteric ischaemia is thrombosis or thromboembolism within the superior mesenteric artery. Atherosclerosis and cardiac arrhythmias are the greatest risk factors.
- 4 Surgical resection is the main treatment for bowel infarction. In this case, however, the patient was managed conservatively