The definition of an acceptable standard of healthcare has become more focused by the concepts of personalized medicine with targeted and tailored therapy. Variation in surgical care\(^\text{1-4}\) and decision-making\(^\text{5}\) is common. The chances of undergoing surgery may depend as much on where a person lives as on clinical circumstances\(^\text{1,6,7}\). Some patient choices drive variation (for example by seeking ‘exceptional care’, or the belief thereof) as happens with robotic surgery\(^\text{8}\), despite lack of documented benefits and even risk of harm\(^\text{9}\). These circumstances will arise more as patient preferences are expressed and heard (appropriately) in shared decision-making. Meanwhile opponents to standardization consider it diametrically opposed to individualized or patient-centred care\(^\text{10}\) and a one-size-fits-all, narrow-minded exclusionary attitude.

Variation in surgical procedures is not a bad thing but patient outcomes may be unacceptably heterogeneous, especially when delivered beyond the intended use. Unwanted procedures or techniques with inferior outcomes\(^\text{11}\) drive up healthcare costs\(^\text{12}\), but cessation may be challenging. As reported in ‘choosing wisely’ campaigns, standardization rarely involves stopping surgical procedures that may be display low value for healthcare systems. The recent moratorium on transanal total mesorectal excision in Norway demonstrates the need to step back and re-evaluate a procedure based on detrimental outcomes\(^\text{13,14}\). Refinement of patient selection, standardized training, and supervision with evaluation of appropriate outcomes to expected standards are key. This highlights the need for standardization, audit and mature reflection when introducing a new intervention\(^\text{15}\).

Clearly the multicontextual nature of healthcare does not facilitate standardization in every circumstance because patients display biological, psychological, social and cultural diversity. In addition, healthcare professionals have considerably diverse views and perspectives – perhaps defined by the apprenticeship model of training where vertically transmitted approaches to care are ingrained – such that geographical heterogeneity is common. A good example is the approach to managing lateral pelvic sidewall lymph nodes in patients with rectal cancer, where there has been a historical East–West divide. These experiences and tacit knowledge bases constitute ‘mindlines’ as a result of decision maps created by learned behaviour rather than being evidence-based in favour of one or other option.

Variation in treatment options is an integral component of individualized care, where several options – each with its inherent benefits and risks – may lead to a good outcome. The risk–benefit is balanced by the surgeon’s aim for the procedure (such as restoration of function or curative intent), the patient’s expectations, and their collective willingness to compromise between risk, benefit and functional consequences. Decisions are sometimes based more on cultural context (for example, routine diverting stoma with an anterior resection) and risk experience (more likely to divert following a recent anastomotic leak) over the reality of clinical knowledge. Ultimately, the decision is best made by an informed patient with clinician involvement with visual aids or internet-based exploration (if needed) at the point of care. Validated comparisons of the different available treatment options, where feasible, should be the goal of standardized care.

It is not surprising that agreeing on what standardization means specifically is challenging. The WHO has defined it as ‘the process of developing, agreeing upon and implementing uniform technical specifications, criteria, methods, processes, designs or practices that can increase compatibility, interoperability, safety, repeatability and quality’\(^\text{16}\). Standardization can be implemented at several levels in healthcare (Table 1), with some examples published recently\(^\text{17,18}\). Some types of standard may be widespread, whereas others (typically relating to devices) vary considerably and seem to depend on individual surgeon preference\(^\text{19}\).

In theory, most care plans could be standardized within a given institution as standard operating protocols (or procedures), but with some flexibility to encapsulate aberrant disease presentation or variable patient/clinician choices. It is probable that new technologies, smartphones and apps will improve protocol-driven healthcare delivery including perioperative care\(^\text{20}\). Big data, artificial intelligence and machine learning...
Standardization in surgery

Table 1 Four types of standard and application in healthcare

| Type of standard | Specification | Examples |
|------------------|---------------|----------|
| Design           | Structure     | Hospital admission (area, staff, availability), ward care and staffing, patient to nurse ratio, postoperative beds and resources; location of operating theatres to staff/resources (e.g. same or different building); on-call resources; a particular surgical instrument or platform (e.g. robotics) |
| Terminology      | Stability of meaning | ICD codes; TNM staging; consensus definitions of e.g. international classification of abdominal wall planes; type and severity of complications |
| Performance      | Outcome       | Short- and long-term definitions; complications (types, numbers and severity) for a procedure; patient satisfaction (QoL, PROMs); mortality/survival rates |
| Procedural       | Process       | Clinical practice guidelines, such as epigastric hernia guidelines. |

QoL, quality of life; PROM, patient-reported outcome measure.

Fig. 1 Illustration showing the importance of setting standards in order to improve quality and reach the next level of care. This is a continuous process, with standards needed to ensure a rollback of the wheel of continuous improvement.

may be incorporated into the concept of tailored care with standard methodology and parameters as a guiding framework for ‘individualized standardization’ (Fig. 1). The ultimate goal is to merge evidence-based medicine with shared decision-making by using guidelines in conjunction with surgeons’ mindlines and patients’ wishes.

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References

1 Mackay TM, Wellner UF, van Rijssen LB, Stoop TF, Busch OR, Groot Koerkamp B et al.; Dutch Pancreatic Cancer Group and DGAV StuDoQ|Pancreas. Variation in pancreatoduodenectomy as delivered in two national audits. Br J Surg 2019; 106: 747–755.
2 van Maaren MC, Strobbe LJA, Koppert LB, Poortmans PMP, Siesling S. Nationwide population-based study of trends and regional variation in breast-conserving treatment for breast cancer. Br J Surg 2018; 105: 1768–1777.
3 Aber A, Tong TS, Chilcott J, Thokala P, Maheswaran R, Thomas SM et al. Sex differences in national rates of repair of emergency abdominal aortic aneurysm. Br J Surg 2019; 106: 82–89.
4 Delisle M, Pradarelli JC, Panda N, Koritsanszky L, Sonny Y, Lipsitz S et al.; Surgical Outcomes Study Groups and GlobalSurg Collaborative. Variation in global uptake of the Surgical Safety Checklist. Br J Surg 2020; 107: e151–e160.

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5 Kirkegård J, Aahlin EK, Al-Saiddi M, de Haas RJ et al. Multicentre study of multidisciplinary team assessment of pancreatic cancer resectability and treatment allocation. Br J Surg 2019; 106: 756–764.

6 Reames BN, Shubeck SP, Birkmeyer JD. Strategies for reducing regional variation in the use of surgery: a systematic review. Ann Surg 2014; 259: 616–627.

7 Filmann N, Walter D, Schadé E, Bruns C, Keck T, Lang H et al. Mortality after liver surgery in Germany. Br J Surg 2019; 106: 1523–1529.

8 Sheetz KH, Claflin J, Dimick JB. Trends in the adoption of robotic surgery for common surgical procedures. JAMA Netw Open 2020; 3: e1918911.

9 Sheetz KH, Dimick JB. Is it time for safeguards in the adoption of robotic surgery? JAMA 2019; 321: 1971–1972.

10 Paterson-Brown S. Cost-effective surgery for better outcomes. Br J Surg 2018; 105: 11–12.

11 Doyle AJ, Karunanithy N, Hunt BJ. Another nail in the coffin of vena cava filters. Br J Surg 2020; 107: 9–10.

12 Malik HT, Marti J, Darzi A, Mossialos E. Savings from reducing low-value general surgical interventions. Br J Surg 2018; 105: 13–25.

13 Larsen SG, Pfeffer F, Krørner H; Norwegian Colorectal Cancer Group. Norwegian moratorium on transanal total mesorectal excision. Br J Surg 2019; 106: 1120–1121.

14 Wasmuth HH, Faerden AE, Myklebust TA, Pfeffer F, Norderval S, Riis R et al.; Norwegian TaTME Collaborative Group, on behalf of the Norwegian Colorectal Cancer Group. Transanal total mesorectal excision for rectal cancer has been suspended in Norway. Br J Surg 2020; 107: 121–130.

15 McCulloch P, Feinberg J, Philippou Y, Kolias A, Kehoe S, Lancaster G et al. Progress in clinical research in surgery and IDEAL. Lancet 2018; 392: 88–94.

16 Leotsakos A, Zheng H, Croteau R, Loeb JM, Sherman H, Hoffman C et al. Standardization in patient safety: the WHO High 5s project. Int J Qual Health Care 2014; 26: 109–116.

17 Henriksen NA, Montgomery A, Kaufmann R, Berrevoet F, East B, Fischer J et al.; European and Americas Hernia Societies (EHS and AHS). Guidelines for treatment of umbilical and epigastric hernias from the European Hernia Society and Americas Hernia Society. Br J Surg 2020; 107: 171–190.

18 Parker SG, Halligan S, Liang MK, Mysomos FE, Adrales GL, Boutall A et al. International classification of abdominal wall planes (ICAP) to describe mesh insertion for ventral hernia repair. Br J Surg 2020; 107: 209–217.

19 Schmidt L, Andresen K, Öberg S, Rosenberg J. Surgical techniques and convalescence recommendations vary greatly in laparoscopic groin hernia repair: a nationwide survey among experienced hernia surgeons. Surg Endosc 2019; 33: 2235–2241.

20 Sim I. Mobile devices and health. N Engl J Med 2019; 381: 956–968.

21 Ansmann L, Pfaff H. Providers and patients caught between standardization and individualization: individualized standardization as a solution comment on ‘(Re) Making the procrustean bed? Standardization and customization as competing logics in healthcare’. Int J Health Policy Manag 2018; 7: 349–352.