

ORDER SETS: A POKA-YOKE FOR CLINICAL DECISIONS

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Poka (unintended mistake) Yoke (avoid) is the Japanese equivalent for “error proofing.” This Lean Manufacturing strategy is more relevant than ever in healthcare today. Why?

FIRST, DO NO HARM

The Supreme Court of India recently ordered one of the largest compensations so far in the country to a girl who lost her vision at birth in a case of medical negligence. The girl, who is now 18 years old, was born prematurely at a government hospital but was discharged from the hospital without a retinopathy test, a must for prematurely born babies. By the time the family discovered the lapse, the girl had lost her vision¹.

Fentanyl is a potent opioid medication used as part of anesthesia. A hospital pharmacist received an order for a ‘fentanyl drip 5,200 mcg per hour,’ which a nurse had just transcribed after accepting a telephone order. The pharmacist called the nurse to clarify the dose. The nurse confirmed that, although the dose was large, she had “read back” the order to the anesthesiologist several times to make sure she had heard the dose correctly. The pharmacist called the anesthesiologist himself, only to find that the intended order was for a fentanyl drip 50 to 100 mcg per hour².

The frequency of preventable medical errors resulting in patient injury and death is staggering. It is estimated that for every 100 hospitalisations, approximately 14 adverse events occur, translating to roughly 43 million avoidable patient injuries worldwide each year. In terms of quality of life for those inadvertently hurt: the loss of nearly 23 million years of healthy life³. And avoidable medical errors don’t just injure patients. Between 200,000 and 400,000 patients die every year in the United States as a result of preventable medical errors,⁴ making avoidable hospital deaths the number three killer of American adults.

These stunning figures clearly directly oppose the fundamental principle of medicine: First, Do No Harm.

THE MEDICAL INFORMATION EXPLOSION

Based on an extrapolation of a 2011 study⁵ the stacking of CD-ROMs holding all of medical information available by 2020 would reach from earth to the moon and a half of the same distance beyond. And the rate of our medical knowledge growth is hard to fathom: by 2020, all that humanity understands about the body, health, and healthcare is projected to double every 73 days⁶. Just to keep up with the Primary Care literature would require a General Practitioner to read for 21 hours every single day⁷!

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DIFFUSION OF KNOWLEDGE TAKES (A LONG) TIME

“Diffusion of medical knowledge” is the acceptance of new scientific discoveries into clinical practice. And such diffusion takes an extraordinarily long time...

Back in the early 19th century, the idea of hand washing prior to examining pregnant women was considered revolutionary, and it was only after decades that hand washing to prevent puerperal fever was universally accepted in clinical practice. But you don't have to look so far back. Take the case of β -blockers, a class of drugs whose beneficial effect in heart attack patients was established almost 30 years ago. Yet today, β -blockers are still widely under-prescribed⁸.

The tragic reality is that even today, it takes an average of 17 years for only 14% of new scientific discoveries to find their way into daily clinical practice⁹. Thus our patients routinely wait to be prescribed drugs or undergo procedures or interventions proven effective decades earlier.

In the end, we have a disastrous collision of realities: all medical knowledge will soon be doubling every 73 days, while it will likely take decades for any new knowledge to routinely be incorporated into patient care.

GOOD CARE PAYS - POOR CARE COSTS

Healthcare is being reformed globally. In particular, the payment models are increasingly moving away from Fee-for-Service (FFS) to Pay-for-Performance (P4P). Full-fledged or partial P4P models are now increasingly being adopted by most of the developed nations, including the USA, UK, and Australia, among others. P4P models aim to encourage care providers (individuals and institutions) to provide better quality care by linking reimbursement (provider payments) to clinical and performance outcomes. The models also penalise medical errors, adverse outcomes, and excessive diagnostic and treatment costs. Thus in the P4P model, providers and healthcare systems risk significant financial penalties if they are unable to avoid adverse clinical outcomes and unnecessary tests and procedures.

To summarise, healthcare is now faced with a new dilemma: a significant burden of preventable medical errors, an explosion in the rate of medical information growth, and the historically slow adoption of new discoveries. Add to this an expanding regulatory environment demanding high-quality care plus the rapid rise of medical malpractice litigation and providers must ask themselves, “Is the practice of medicine no longer humanly possible?”

A SOLUTION TO THE MULTI-FACTORIAL HEALTHCARE DILEMMA

So how do we reduce (and eventually eliminate) preventable medical errors? Providing current, credible, evidence-based information and guidance at all points

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of care is a cornerstone in the answer to this question. In the area of medication errors (a common form of preventable patient injury and death), a system analysis of a large sample of serious mistakes¹⁰ identified 16 major types of causative system failures. All of the top eight were deemed preventable through the provision of better medical information.

Today, **Clinical Decision Support Systems (CDSS)** are being hailed as a major weapon in the battle against preventable medical errors¹¹. And at the heart of the most impactful CDSS lies **evidence-based medicine (EBM)**. Advocated as a method to improve clinical outcomes¹², **the incorporation of EBM into powerful CDSS has the potential to transform healthcare safety and quality**, a true healthcare Poka-Yoke! As such, EBM is the foundation of **evidence-based care**, broadly defined as patient management through the conscientious and judicious use of current best evidence from clinical care research integrated with individual clinical expertise¹³. And to complete the picture, evidence-based care should also include patient preferences, input, and active participation.

Clearly based on the foundations of the healthcare dilemma, in order to be safe, effective, and efficient, today's physicians, nurses, pharmacists, therapists, patients, and other healthcare stakeholders must have real-time, mobile access to current, credible, evidence-based information. While many have been disappointed that Electronic Health Records (EHRs) have not on their own solved the dilemma, it is critical to appreciate that technology is the vehicle through which EBM and other information is delivered, not the primary source of information itself. In the absence of technology (in fact, long prior to the development of computers and the internet), current, credible, evidence-based information allowed the world's leading healthcare providers to deliver high quality, evidence-based care. Today's technology represents a great leap forward in accessing high value care information at points across the globe, with the knowledge provided by EBM integrated into EHRs and available via "the cloud," all as part of CDSS.

Evidence-based care is most impactful when current, credible, evidence-based knowledge is incorporated into the provider workflow; thus, the most advanced CDSS are "workflow-integrated." More importantly, these systems are **evidence-adaptive**¹²; that is, the clinical knowledge within the CDSS continually reflects current EBM from the research literature plus sources of practice expertise. The full potential of a CDSS can be realised when it is seamlessly integrated into the clinical workflow and is evidence-adaptive¹².

ADDRESSING THE KNOWLEDGE GAP THROUGH CDSS: THE POWER OF ORDER SETS

A "Physician Order" is a communication directing a particular service or action to be taken in the care of a specific patient. Medications, diet, physical activities, laboratory tests, radiologic studies, therapies, treatments...all are among the literally dozens of orders written to guide the care of each and every patient by the physician throughout an ordinary day. Thus the physician ordering process is complex and time-consuming. In addition, the continuous explosion of new evidence-based information results in the reality that providers often make mistakes, at best failing to provide the highest value care, and at worst causing

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preventable injuries and deaths. And while computers can address avoidable mistakes from the most mundane sources (such as illegible hand-writing), the greatest threat to patient safety and cost waste is the knowledge gap.

Fortunately, when a physician realises that he or she needs information, CDSS reference solutions provide access to current, credible, evidence-based knowledge (either integrated into an EHR, available over the internet, or in print). Thus by their very nature, reference solutions require that the physician knows he or she doesn't know something.

But medical knowledge is doubling every two months. Clearly many times the physician doesn't know what he or she doesn't know... Thus patients are placed at risk because physicians are unaware that new information and knowledge is available.

Order sets are the best solution to this dangerous problem. Order sets automatically push current, credible, evidence-based information specific to the patient's clinical history and current clinical status directly to the physician at the point of care. Take for example:

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A 52 year old man is admitted for surgical treatment of a right-sided colon cancer. His surgeon regularly operates on such patients, removing that segment of large intestine harboring the malignant tumor. But like many, this surgeon is unaware that this patient's young age and tumor location suggest an inherited syndrome requiring a much more extensive operation to prevent a second cancer over the next decade.

If the surgeon "doesn't know what he doesn't know," how can he look up "inherited colon cancer" in his CDSS reference solution? He can't.

But when the patient is admitted to the hospital, order sets specific for colon cancer patients are automatically pushed to the physician. These order sets can be commercially available or can be created by the hospital, healthcare system, regional, or international experts (physicians, nurses, pharmacists, etc.) and represent the evidence-based guidelines and information on colon cancer. Thus the order sets educate the surgeon and recommend that he order a simple blood test to check for the inherited cancer syndrome. If integrated within an EHR, the physician can actually click on embedded hyperlinks to view the EBM sources of the recommended orders.

The surgeon will likely accept the recommended order and confirm that the patient suffers from the syndrome. Then the surgeon can search the CDSS reference solution and rapidly learn the appropriate surgical procedure for the patient, as well as how to test and screen family members for the inherited syndrome.

Thus order sets address the knowledge gap, including providing the physician with what he "doesn't know he doesn't know."

But there is a risk with evidence-based order sets because clinical knowledge is advancing exponentially. When order sets are implemented but inadequately maintained, they drive providers to practice outdated medicine on a widespread basis¹⁴. Thus it is critical for evidence-based order sets to include a knowledge-base that continually reflects current evidence. In the near future, evidence-adaptive order sets will be empowered through advancements in machine learning and artificial intelligence. Today, much evidence adaption is performed manually, with professionals (using computer systems) to rapidly review new EBM for updating order sets. CDSS which incorporate order sets can reduce medication errors up to 81%¹⁵, and today, order sets represent the most impactful CDSS solution to empower physicians in delivering the highest quality, most cost-efficient evidence-based patient care.

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THE ECONOMIC ARGUMENT FOR ORDER SETS

One of the greatest challenges of healthcare reform worldwide is the reluctance of those paying for technology to invest in EBM and CDSS. The question, of course, is return on investment (ROI). However, the potential ROI of order sets through reduction in adverse drug events (ADE) and unnecessary diagnostic tests alone is projected to be enormous (in one academic hospital estimated at up to \$10 million¹⁶). Although there remains a dearth of high-quality evidence on the cost impact of order sets, many operational benefits which intuitively link to cost reduction have been demonstrated. Including: reductions in overall length of stay; postoperative length of stay; and the total cost for multiple surgical procedures, including total knee arthroplasty, appendectomy, total laryngectomy, cholecystectomy, carotid endarterectomy, gastrectomy, inguinal hernia repair, and colon surgery¹⁷.

University of Kentucky Healthcare (UKHC) adopted a well-known commercial order sets solution in 2013¹⁸, demonstrating improvements in compliance to standard practices and elimination of unnecessary tests. At the University Hospital Frankfurt in Germany, implementation of order sets focused on gastroenterologic care reduced average length of stay and overall physician ordering time while elevating physician satisfaction scores for computerised ordering¹⁹.

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ORDERING BETTER CARE: CONCLUSION

The multi-factorial healthcare dilemma including preventable medical errors, the information explosion, slow knowledge diffusion, a growing regulatory environment, and increasing litigation has rendered Clinical Decision Support Systems indispensable. Order sets are designed not only to answer questions that the physician is asking, but also to answer critical questions that the physician doesn't know he or she should be asking. Founded in current, credible, evidence-based information, order sets are the most impactful of physician CDSS solutions. Combined with reference and other CDSS solutions, order sets have the potential to empower physicians in providing the safest, highest quality, most cost-efficient healthcare; that is, a truly reliable Poka-Yoke.

ABOUT ELSEVIER CLINICAL SOLUTIONS

Elsevier, the world leader in clinical information, is a preferred partner to health care professionals and institutions. With evidence-based content and a suite of solutions including clinical reference, integrated decision support, drug reference, patient engagement, and staff development, Elsevier is dedicated to helping you adopt evidence-based care today and position your organisation for sustainable success.

ABOUT ELSEVIER ORDER SETS

Order Sets by Elsevier is an intuitive, cloud-based solution that enables physicians, clinicians and informaticists to manage, author and review order sets in a collaborative environment. Order Sets content is intended for rapid access to optimal orders at the point-of-care. Elsevier Order Sets combine orderable items with clinical decision support guidance that continually reflects current evidence, making this a true evidence-adaptive solution.

The implementation of Elsevier Order Sets at University of Kentucky Hospital in the USA; University Hospital Frankfurt and LVR-Klinik Langenfeld in Germany; and Monash Health, Australia, bear testimony to the effectiveness of Elsevier's outcomes-driven implementation approach.

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His passion to see transformation through technology led him to volunteer as a quality consultant with the United Nations. He also currently serves as an Assessor on the Panel of the Quality Council of India for the National Healthcare Accreditation Standards body, NABH.



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