Reducing Waste in US Health Care Systems

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AN EPIDEMIC OF WASTE BLIGHTS THE US HEALTH CARE delivery system. Despite a huge dedication of resources to health care in the United States, the medical system does not deliver safe, effective, efficient, patient-centered, timely, and equitable care as recommended by the Institute of Medicine.[1]

Specifically, the US health care system is not safe: 50 000 to 100 000 or more lives are lost each year because of medical error,[2] and 42% of respondents to a public survey reported experience with poorly coordinated, inefficient, or unsafe care.[3]

The system is not effective: 45% of recommended care is not provided, without regard to presence or type of insurance payment,[4] and Medicare and Medicaid, which pay for about half of the compensated care in this country, do not significantly reward higher-quality care outcomes or clinicians.

The system is not efficient: three fourths of adults believe the US health care system needs either fundamental change or complete rebuilding and that expanding insurance and controlling costs should be top priorities for federal action.[3] Health problems among US working-age individuals and their families cost an estimated $260 billion in lost productivity each year.[5]

The system is not patient-centered: half of middle-income and lower-income families report serious problems paying for health care and insurance coverage.[5]

The system is not timely: an estimated 16 million Americans are considered underinsured because they have high out-of-pocket costs relative to their income. Lack of adequate coverage makes it difficult for individuals to obtain the health care they need and burdens them with large medical bills when they do receive care.[6]

And the system is not equitable: nearly 47 million US residents do not have health insurance—1.4 million more than last year, or 15.9% of the US population, according to the Census Bureau 2006 annual report on the well-being of Americans.[6]

The US health care delivery and financing systems urgently need redesign, including refocusing on patients as the primary "customers," emphasizing clinical and service outcomes as value, using evidence-based biomedical interventions as tools, and adopting rigorous quality improvement methods to achieve efficiency in clinical microsystems.

Macrosystem Interventions

Macrosystem interventions are beyond most medical centers or physician groups; however, the Department of Veterans Affairs (VA) health care system is a notable exception. In the 1990s, compelled by public outcry and potentiated by bold leadership, the VA reduced acute care beds and admissions by 55%, increased primary care services by 50%, and implemented innovative information systems. In the 2000s, the VA has emerged as a quality leader.[7] Bodenheimer[8-11] outlined a series of strategies for cost containment, including restricting diffusion of technological innovations, reducing supply of care resources, global budgeting, and implementing chronic-disease management programs. Other macrosystem initiatives include the Leapfrog Group's agenda to reduce preventable medical errors and improve the quality and affordability of health care[12] and the Institute for Healthcare Improvement's 5 Million Lives Campaign, an initiative to engage US hospitals in a commitment to implement changes in care proven to improve patient care and prevent avoidable deaths.[13]

Microsystem Interventions

However, influence and energies to change health care systems have the most impact on a small scale. Physicians' clinical careers are centered mostly in clinical microsystems. Therefore, it is essential to seek deep understanding of patients' needs, with end-to-end process redesign involving all functions in health care organizations. An important starting point is elimination of waste in local care systems.

There are conceptual and operational benefits of framing the problem as "too much waste" rather than "too little efficiency." A call for efficiency does not convey commitment to patient satisfaction and social justice. The managed care movement has been faulted for sacrificing satisfaction and social justice in pursuit of financial efficiency. Important intangible values survive in compartments sometimes labeled as inefficiency: listening, relationship building, learning, reflection, and knowledge sharing. Waste re-

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duction, by recovering resources, may enable inclusion of intangibles and access for underserved individuals, without making any other individual worse off. In fact, unnecessary tests, procedures, and treatments may be placing the "overserved" in harm's way. For these reasons, a campaign to identify and eliminate waste may provide better focus and is more unifying and mobilizing than exhortations to be more efficient.

Health care delivery is an intuitive, interpersonal, and complex realm. Many quality improvement methods being implemented in health care settings arose in manufacturing settings and center on mechanistic processes supporting assembly of automobiles or electronic appliances. These rule-based methods are powerful in their ability to reliably deliver best practices in settings where they have been established. However, they neither encompass the situational, experiential, and interpersonal nature of clinical knowledge, nor do they nurture the practical wisdom of patient care. Judicious process improvement, by elimination of waste, would free time and resources for the decision making, reflection, expert management, discovery of unique patient goals, and relationship building that are central to excellent patient care. By enabling these "soft competency" activities, quality improvement methods may transcend their mechanical origins and applications. Use of these improvement methods can help ensure healthy patients and health care that is more satisfying to patients and clinicians.

Lean Improvement Approaches

Virginia Mason Medical Center has settled on the Lean Production methods of Ohno and the Toyota Global Production System to eliminate waste. Through this "lean" lens, waste is seen as "any activity that does not serve the valid requirements of the customer." The customer is defined as "that individual or entity that monetarily pays for the product or service." Waste is usually identified in 7 critical areas (TABLE).[14] Critical tools as described below include rapid process-improvement workshops (5-day multidisciplinary events preceded by 4 to 6 weeks of preparation), Kaizen events (1- to 2-day, narrowly focused improvement cycles), and the patient safety alert system, among others.

The lean improvement perspective has stimulated multiple innovations and has provided the discipline to implement others. Most changes are minor or moderate in scope and do not require significant capital investment. Return on assets is difficult to quantify with certainty but is certainly substantial, as illustrated by several of these innovations at Virginia Mason Medical Center.

Waste of Overproduction. Inpatient internal medicine teams are developing "1-piece-flow" bedside rounds, with the attending physician, resident physicians, nurses, and relevant ancillary workers seeing each patient together. Interviews, physical examination, test and image review, order writing, communication with consultants and family members, and electronic medical record documentation are completed in the presence of the patient. Less time is spent in transportation and meaningless repetition, and more time is spent with patients, to the delight of clinicians, patients, and patients' families.

Primary care physician flow stations, designed using lean concepts, have reduced patient waiting times from 10 to 5 minutes by decreasing walking and by providing continuous work flow, visual control of supplies, external setup of physician tasks, and U-shaped work stations.

Waste of Time on Hand (Waiting). The average time from breast cancer diagnosis to initiation of treatment has decreased from 21 days to 11 days. Patients undergoing infusion treatment for cancer also have experienced decreased waiting time from arrival to time of treatment completion, from 240 minutes to 90 minutes.

Turnaround time for reporting of test results (from the time a patient's results are available to mailing the results) in our largest primary care site has been sharply reduced. In 2003, each clinician averaged 1800 test results waiting to be reported, and none were reported in less than 3 days. In 2006, with the use of electronic medical records, 89% of test results were reported in less than 3 days.

Gastroenterologic endoscopy processes have been addressed in at least 12 rapid process-improvement workshops. Access to the gastroenterology clinic has increased 50%, with waiting times for new patients reduced from 15 to 7.5 days. Patients' average procedure cycle times from arrival to discharge were reduced from 2.5 to 1.5 hours. Net margin per endoscopy room has been increased 48% by reducing room turnaround time from 35 to 18 minutes, in turn enabling savings of $2 million in capital expenditures by eliminating the need for construction of additional procedure rooms.

Efforts to eliminate waste from emergency department processes have reduced by 57% the total hours in which new emergency department patients are diverted from our hospital to other facilities, from 692 to 302 hours per year in 2006. During each hour of such diversion, an average of 1 patient is diverted to another facility. The main intervention required physicians to enter orders in the electronic medical record within 15 minutes of patient arrival.

Waste of Processing. By redesigning processes and technology, the Virginia Mason Hyperbaric Oxygen Center reduced its workday by 50%, increased the number of patients per attendant by 100%, and eliminated waiting times for hyperbaric oxygen treatment. Emergency treatments no longer require cancellation of scheduled cases. Margin has increased by 330%.

Waste of Movement. Visual control (shadow boards) of anesthesia instruments and drug supply in the operating rooms has reduced errors in anesthesia and simplified restocking. On a shadow board, each device or drug overlies its picture. Any absence, addition, or substitution in the procedure supply kit is instantly apparent and easily correctable.

Waste of Making Defective Products. Ventilator-acquired pneumonia (VAP) can be decreased through the use of VAP care bundles that include 4 components: elevation of the head of the bed to between 30° and 45°, daily "sedation vacation" and daily assessment of readiness to be extubated, peptic ulcer disease prophylaxis, and deep vein thrombosis prophylaxis (unless contraindicated). The first 2 components are directed toward preventing VAP; the lat-

Table. Ohno's 7 Wastes as Applied to Health Care*

Waste	Description	Examples in Health Care	Process Remedies at Virginia Mason Medical Center
Waste of overproduction	Producing what is unnecessary, when it is unnecessary, and in an unnecessary amount	Fragmented, parallel care: separate resident, attending, social services, pharmacy, and care management rounding cycles; making photocopies of a form that is never used; providing copies of reports to people who have not asked for them and will not actually read them; processing piles of documents that then sit at the next work station; cc's on e-mails	Multidisciplinary bedside rounds, with contemporaneous documentation and order entry by portable wireless computer; primary care physician flow stations incorporate many lean principles
Waste of time on hand (waiting)	Waiting for materials, operations, conveyance, inspection; idle time attendant to monitoring and operation procedures, rather than just-in-time supply or "pull production"	Patients waiting to see their physician; office staff batching test results for patients; waiting on the phone to schedule appointments; early-morning admits for surgeries that won't be performed until later in the day; waiting for support services such as internal transport; waiting for office equipment (computer, photocopier, etc) to be repaired before being able to do work; waiting for a meeting that is starting late	Patients are advised at point of care when tests will be available, and test results are reported as they become available; emergency department physicians enter orders in the electronic medical record within 15 minutes of patient arrival
Waste in transportation	Conveying, transferring, picking up/setting down, piling up, and otherwise moving unnecessary items; problems concerning conveyance distances, conveyance flow, and conveyance utilization rate	Moving individual files from one location to another; moving supplies into and out of a storage area; moving equipment for surgeries in/out of operating and procedure rooms; patients receiving chemoradiation treatment traveling 1220 horizontal feet and 25 vertical floors per episode	Travel for chemoradiation reduced 55%, to 544 feet and 12 floors, by providing injections and dressing changes in radiation oncology department; instead of patients or supplies traveling to and from isolated process villages, the input proceeds through the operations in single-piece-flow in 1 short space
Waste of processing	Unnecessary processes and operations traditionally accepted as necessary	Hard copies of memos already sent by e-mail or posted on intranet; redundant capture of information at admission; multiple recording and logging of data; writing by hand, when direct input to a word processor could eliminate this step; producing paper hard copy when a computer file is sufficient; patients waiting for preapproval of urgent treatments	Hyperbaric oxygen indications negotiated with payers, who have agreed to waive preapproval; redesign of chamber to allow emergency cases without canceling scheduled patients; eliminate medication lists on electronic medical records progress notes
Waste of stock on hand (inventory)	Inventory waste is when anything—materials, parts, assembly part—is retained for any length of time, including not only warehouse stock but also items in the factory that are retained at or between processes	Office supplies in hallways; expensive clinical supplies and implants that can be ordered on a just-in-time basis; charge slips piled up to be dictated; unnecessary instruments in operating room kits	Surgeons now accept only those instruments that are frequently used, or 25 instruments, in the operating room kit
Waste of movement	Movement that is unnecessary, that does not add value, or that is too slow or too fast	Physicians and nurses leaving patient rooms for common supplies or information	Common supplies are stocked in hospital, operating, and outpatient rooms, with visually controlled restocking system; computer access in outpatient examination rooms and wireless portable computers for inpatient rooms
Waste of making defective products	Waste related to costs for inspection of defects in materials and processes, customer complaints, and repairs; passing defects down to a coworker or patient, rather than the defect producer "feeling the pinch"	Iatrogenic illness; fixing errors made in documents; misfiling documents; dealing with complaints about service; mistakes caused by incorrect information or miscommunication; handwritten orders; sending out bills with an incorrect address	Ventilator-acquired pneumonia bundles decreased annual incidence from 40 to 5 cases; patient safety alerts; computerized clinician order entry

*Adapted from Ohno.[14]

ter 2, toward preventing other complications associated with mechanical ventilation.[15] After implementation of VAP bundles in 2002, VAP cases have decreased from 40 per year in 2000 to 4 in 2005 and 5 in 2006. Assuming that VAP carries a 14% attributable mortality, 10 lives were saved in 2005-2006.[16] Patients, payers, and the medical center avoided an estimated $1.7 million in VAP-related costs by compulsory implementation of VAP bundles.[17]

In the manufacturing setting, the commitment to producing "zero defects" led to a "stop the line" policy, in which production stops when a defect or delay is detected, to prevent customers or coworkers from experiencing adverse consequences. Supervisors are ever present on the shop floor, ready to immediately assist workers when a delay or defect is detected. The corollary in our medical center is the patient safety alert. When a dangerous or unstable clinical situation is identified, an alert is called, with immediate response from managers up to the senior vice president and the physician chief of the relevant clinical department. An immediate investigation occurs, with immediate corrective action. Since 2001, more than 4700 such events have occurred, averaging 3 per month in 2001 to 250 per month in 2006. The clinical staff is much more vigilant, and patients most likely are safer.

Rapid-response teams (medical emergency teams) may save patients, the delivery system, and society unnecessary costs, hospital occupancy, morbidity, and mortality. Since July 2004 our team has responded to more than 1300 calls from clinicians, mostly nurses, who recognize that a patient is in distress but has not sustained a cardiopulmonary arrest. Calls to the team occur, on average, 55 times per 1000 discharges. Approximately 45% of these responses have resulted in transfer of unstable patients to a higher or more appropriate level of care. This has become a useful early detection method for patients predicted to be at higher risk of cardiac or respiratory compromise, so they can be cared for in a setting more likely to meet their acute needs.

National Efforts to Eliminate Waste From Medical Care

Collective action at the national level is necessary to transform health care financing to recalibrate individuals and entities that pay for health care products and services to better serve patients and support social justice. Local action also is needed to reduce waste.

Too much money, too many people, too much floor space, and too much human effort are lost in the health care system. In part due to waste, the medical care system is unable to fully serve the health care needs of society. The current US health care system provides neither timely access to the haves, nor equitable distribution to the have-nots. How many of the 47 million uninsured individuals in the United States could receive care if health care professionals and organizations were more respectful of resources? How many roads, schools, or primary care clinics could be constructed with the resources now being wasted?

Individual physicians and health care managers must not tolerate this waste but must learn to recognize and relentlessly pursue value. There are many promising methods for reducing waste; each clinician and each health care system must choose one, and commit to it. Patients and the medical profession depend on success in these efforts, which will occur when the "safe, effective, efficient, patient-centered, timely, and equitable" care set out as a goal by the Institute of Medicine[1] can be provided to each patient.

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