Commentary: Making Sense: Duty Hours, Work Flow, and Waste in Graduate Medical Education

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Parsimony, and not industry, is the immediate cause of the increase of capital. Industry, indeed, provides the subject which parsimony accumulates. But whatever industry might acquire, if parsimony did not save and store up, the capital would never be the greater.

Adam Smith, *The Wealth of Nations*, book 2, chapter 3[1]

Abstract

In 2003, the Accreditation Council for Graduate Medical Education implemented resident duty hour limits that included a weekly limit and limits on continuous hours. Recent recommendations for added reductions in resident duty hours have produced concern about concomitant reductions in future graduates' preparedness for independent practice. The current debate about resident hours largely does not consider whether all hours residents spend in the educational and clinical-care environment contribute meaningfully either to residents' learning or to effective patient care. This may distract the community from waste in the current clinical-education model. We propose that use of "lean production" and quality improvement methods may assist teaching institutions in attaining a deeper understanding of work flow and waste. These methods can be used to assign value to patient- and learner-centered activities and outputs and to optimize the competing and synergistic aspects of all desired outcomes to produce the care the Institute of Medicine recommends: safe, effective, efficient, patient-centered, timely, and equitable. Finally, engagement of senior clinical faculty in determining the culture of the care and education system will contribute to an advanced social-learning and care network.

Crises in Graduate Medical Education and Health Care

Medical practice, particularly the period of residency education, is characterized by long work hours and a greater reliance on human cognition and vigilance than is required in many other occupations. A December 2008 report by the Institute of Medicine (IOM)[2] recommended an increase in duty hour restrictions for the more than 105 000 US residents and fellows. Five years earlier, the Accreditation Council for Graduate Medical Education[3] instituted common limits on resident duty hours. Implementing them required major changes in many programs and institutions, and the medical-education community's response to the recent IOM recommendations has been worry that future restrictions may compromise resident competence and preparedness for independent practice.

The discussion of resident hours unfolds against a backdrop of the nation's struggle with twin crises of health care access and cost that will require dramatic reform of the delivery and financing systems. For the system as a whole, reform to enhance access while keeping costs affordable will need to include identification and reduction or elimination of sources of inefficiency and waste. Similarly, discussions about the relationship between duty hours, resident learning, and preparation for practice must examine whether all hours residents spend in an educational or clinical context contribute meaningfully to learning or patient care. In short, we must address sources of waste in graduate medical education.

Themes in the debate about resident hours include preservation of the 80-hour work week and the 24-hour overnight call and, for some, nostalgia for the long hours residents have worked in the past. These themes distract from the astonishing waste in the current clinical-education model, as do conversations that contrast the hours faculty members endured in their own training (and perhaps now spend in practice) with those of current residents. These aspects of the debate conflate the emphasis on tradition, dues paying, and fairness with the need for safety, sustainability, and pedagogical impact.

Identify and Label Waste

Bentley et al[4] classified waste in health care, distinguishing between administrative waste (the added cost of benefits management, transactions, marketing, and regulatory compliance), clinical waste (that results when the cost of services outweighs their benefits), and operational waste.

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DOI: 10.4300/JGME-D-09-00052.1

The latter includes duplication of services, wait and down times, use of expensive equipment and personnel when lower-cost alternatives exist, and errors requiring added care. Operational waste appears to be the particular problem in settings that provide graduate medical education. Toyota's Lean Production methods[5] seek to identify and reduce operational waste, identified as "any activity that doesn't serve the valid requirements of the customer." The Toyota approach categorizes operational waste into the 7 critical areas shown in the TABLE; it also offers examples of waste in the resident learning environment. Overproduction, time on hand, transportation, and overprocessing certainly occur in other sectors of the health care industry; yet they are particularly common in teaching settings, where an inefficient blend of clinical and educational activities blights both domains. These practices may contribute to a secondary type of waste: many medical students, compelled to observe and mimic duplicate rounds, purposeless waits and delays, and system inefficiencies in their introductory clinical clerkships, become frustrated and discouraged from choosing "hassle-intensive" disciplines such as primary care. A recent survey found that fewer than 20% of senior medical students reported that their internal medicine clerkship experience made a career in general medicine attractive, and nearly 50% indicated it made subspecialty practice more appealing.[27] Another study showed that the current practice environment for internists was the strongest factor discouraging students from a general-medicine career.[28]

Redirect the Pinch

Clinical processes in teaching hospitals rely heavily on resident industry, in an environment where system level solutions to system level problems are the exception rather than the norm. Myriad intrinsically wasteful countermeasures (work-arounds) result.

One enabler of this waste is the use of stipends for residents. This fixed-compensation model does not assign a variable cost to institutional budgets for added duty hours imposed on residents by system inefficiencies. Consequently, residents "feel the pinch" from defective work flow more acutely than faculty, nurses (whose added hours carry a cost to the institution), or administrators.

Another enabler is marginalization of residents as system experts and change agents. Although residents are knowledgeable, intelligent, and invested system observers ("It's crazy how they do things around here!"), their effectiveness in improving systems is impaired by power gradients and by flawed scheduling that assigns them randomly to short rotations in clinical systems with poorly defined team roles. Residents are seen as "renters" rather than "owners" in these clinical environments.

Inadequate, untimely, or marginally qualified supervision of clinical trainees directs the pinch to patients and learners. It allows learners' potentially flawed judgments and interventions to prevail, reducing efficiency, safety, and the residents' own education, as well as that of junior learners they supervise. Clinical wisdom, robust system-based practice, team skills, and advanced teaching skills are essential to achieving a reliable care platform and an optimal learning environment. For this reason, experienced master clinicians must routinely serve as part of an interdisciplinary team to ensure that high-level observation, feedback, competency assessment, and positive role modeling occur. Senior clinical faculty members at the bedside must mindfully demonstrate the culture of the care system, because that culture ultimately determines the behavior of those who function in it. Masterful supervision is vital to creating clinical microsystems that are advanced social-learning and care networks and that harness the intelligence and energy of residents and others to address sources of waste.

Optimal Care and Learning

The discussion about accommodating reduced hours in residency has generally focused on off-loading resident work lost under existing or proposed limits to other providers, in a system that seeks to uncouple learning from service demands. This countermeasure does not address the negative consequences of residents practicing in inefficient, wasteful systems.[29] It may reduce their learning, add to their frustration with the clinical system, and breed a cynicism that damages the physician-patient bond and undermines the professionalism their teachers seek to inculcate. There is evidence[30] that residents who learn clinical medicine in an environment with few or no constraints on resource use will know less about appropriate use of medical resources, perpetuating wasteful habits across generations.

A tradition that has perpetuated punishing duty hours has also produced an unwelcome byproduct: patients and regulators who are fearful that care by residents may not be safe. The IOM recommendation and other efforts to regulate resident hours have been the result of intrusions that imperil self-determination in our profession. Perhaps labor-management relationships between resident collective-bargaining units, government, and teaching hospitals (as is the current practice in Canada) could help. Alternatively, if residents' time in training, their energy, and their work hours were assigned substantial economic value, would their contribution to teaching hospitals be managed differently? It is not clear whether legislated directives forcing work hour changes following the European model would improve safety.[31] If they do, this may come at the expense of learning and further the deprofessionalization of medical education and practice. It may attenuate residents' experience, prolong their education, and result in less-than-proficient clinicians entering practice.

Making Sense

There is a middle road. Quality improvement methods will draw our attention away from the "upper and lower control

TABLE **Operational Waste in Graduate Medical Education**

Category of Waste[6]	Example in Medical Education	Process Remedy
Overproduction Producing more than is needed, generating unnecessary inventory, or moving at a faster pace than necessary, often due to a "batch-and-queue" or "push" production line rather than one "piece flow" or "pull"	• Separate intern, resident, attending, social services, pharmacy, care management, and coding staff rounding cycles • Teams making clinical presentations outside the patient's room and needing to repeat everything at bedside • Physical examinations routinely and slavishly performed that are irrelevant to the clinical problem	• Multidisciplinary bedside rounds, with contemporaneous documentation and order entry by portable wireless computer[7,8]
Time on Hand Waiting for inputs, rather than just-in-time supply or "pull" production	• Patients and families waiting for physician visits • Residents, other clinicians, and patients waiting for tests, images, and prescriptions • Residents and ward staff waiting for attending staff • Providers interrupted by unnecessary phone calls • Interns, consultants, and nurses waiting "on hold" for each other to return telephone calls	• Rounding schedule incorporates result availability and advises patient, family, and interdisciplinary team when bedside rounds will occur; days are planned accordingly, and interruptions decrease dramatically[9,10] • Interdisciplinary bedside rounds, text paging, and cell phones minimize paging[11]
Transportation Patients or supplies traveling to and from isolated process villages	• Patients transported for tests or procedures and unavailable to team • Unnecessary data transfer between the EMR and paper records for rounds, handovers, case presentations, and bedside teaching	• Continuous, one-piece flow of information, decision making, communication, documentation, and teaching at bedside[12–15] • Case presentation time is reduced by 50%; patient verification occurs contemporaneously
Overprocessing Performing more operations than are necessary to make a product that meets the customer's needs	• Added tests and procedures due to communication and coordination problems; • Reduced emphasis on interviewing and physical diagnosis • Effects on resident learning	• Enhanced coordination; faculty supervision[16,17] • Interdisciplinary-team involvement in diagnosis and treatment planning[8,12]
Stock on Hand Unnecessary inventory waiting for processing or waiting for customer demand to materialize	• Shadow charts, printed notes, task lists, and any documents extracted or prepared for one-time use or solely for use in the education process • Residents on duty during hours of low demand	• Computers-on-wheels at bedside[18] • EMR, computerized physician order entry, and one-piece flow obviates need for crib sheets and task lists[7,8,18] • Work hours and demand are shaped to enhance care and learning[19]
Movement Working ahead of demand, unnecessary operations, changing hands, and transfers of care	• Physicians traveling to visit patients on many different floors, buildings, or care units • Physicians and nurses leaving patient rooms for common supplies • Rotation schedules that require residents to change clinical settings every 30 days, reducing their ability to understand and make recommendations for improvement in their clinical and learning environment	• Team patients localized to geographically localized cells[19] • Extended exposure to a given setting to facilitate learning, including learning about clinical improvement[20]
Defective Products Passing defects down to a coworker or patient, rather than the defect producer "feeling the pinch"	• Unsafe and variable handovers • Errors by inadequately trained or unsupervised trainees • Residents with inadequate or poorly assessed core competencies	• Improved, streamlined handovers[21–24] • Real-time supervision, with concurrent observation, assessment, feedback, and remediation[25,26]

Abbreviation: EMR, electronic medical record.

limits'' of duty hours, redirecting us to seek a deeper understanding of work flow and waste. A few institutions[32–34] are using lean-production methods to identify and recover waste and reduce the dehumanizing hassles of residents' work. These methods can be used to assign value to patient- and learner-centered activities and outputs in order to produce care the IOM[35] recommends: safe, effective, efficient, patient-centered, timely, and equitable. Proper valuations will assist in optimizing the competing and synergistic aspects of all desired outcomes. It will also allow the systematic identification and elimination of ''non–value-adding'' activities (waste). The ''enlightened parsimony'' called for by Adam Smith can then be achieved.

Innovation in graduate medical education policy and practice is integral to solutions for health care cost and access, as resident physicians provide a significant amount of care for patients with access problems. In addition, the current financial crisis and the compelling long-term interest in containing growth in health care expenditures will affect the goals of medical practice; the next generation of physicians will need to view cost and access as a duality, jointly driving prudent decisions to allocate the most good

to the maximum number of individuals. A balanced agenda of access, cost, safety, and learning will need to supplant much of current health care decision making.

Eliminating wasteful practices will reduce the financial burdens of sponsoring institutions, clinical departments, training programs, and payers. Recovered resources can be redeployed to improve care, expand access, and improve educational outcomes. Waste in graduate medical education will never be entirely eliminated, but it can be effectively managed, minimizing its pernicious effects on learners and their patients. Effective leadership and management must reform traditional medical culture, directing it away from deception and hubris and toward openness, humility, shared responsibilities, collaboration, and a revitalized sense of professionalism. Our defects must be regarded as treasures—not to be passed along to our customers but to be studied, understood, and addressed, with the new knowledge passed down as reminders of our sacred trust.

Eliminating waste is important for another, less-tangible reason: to free the "soul of the physician." Patient care depends on the soul of the doctor, whether learner, mentor, or model.[36,37] Professionalism, self-awareness, self-respect, personal fulfillment, and career sustainability are fundamental to this soulfulness. Therefore, priorities must be balanced. In service to our patients, the new learning environment must value clinical outcomes, safety, and the work that is necessary to achieve these outcomes. In parallel, care systems must balance adequate sleep, alertness, attention, rest, self-care, and reflection, with ample clinical experience and behaviors integral to good health care: bedside conversations, assessment and development of knowledge, wisdom, and expert clinical skills. In this balance hangs professional development, and the physician recruitment and retention essential for our health care system. Unfortunately, these values are now too often "more honored in the breach than in the observance."

Enlightened parsimony, rather than enlarged industry or reduced expectations for care or educational outcomes, will deliver us from the twin health care crises of cost and access. This parsimony should be addressed to the work lives of medical learners and educators, without undue distraction from extraneous forces, whether they be the IOM's recommendations, work hour regulations, or exploitative organizational pressures.

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