

A Matter of Time

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A NOVEL “TIME EATING” CLOCK WAS RECENTLY UNVEILED at Corpus Christi College in Cambridge, England. Sitting atop this clock is Chronophage, a large grasshopper escapement that “eats up every minute of your life, and as soon as one’s gone he’s salivating for the next.” Health care time is certainly not protected from the voracious appetite of Chronophage, but the passage of time in any medical situation is perceived in different ways, depending on who is doing the watching. At many points in the delivery of health care, time seems to disappear altogether; in other situations, it moves slowly, lags a few beats, races ahead, or even lurches forward in a disconcertingly asynchronous manner. In this Commentary, a new perspective on time—improvement time—is discussed in the context of 3 traditional aspects of medical time: clinical research (knowledge) time, patient (illness) time, and clinical practice (disease) time.

Two fundamental concepts of time—one a structured, ordered, and linear entity (the Greek *kronos*); the other a personal and emotional perspective that embodies time in a “soul satisfying and nourishing manner”¹ (the Greek *kairos*)—provide good starting points for considering medical time. As Kern² points out, “the very nature of scientific (*kronos*) time conceals, or cannot supply a useful context for, essential realities of human experience.” However, all 3 aspects of medical time involve both *kronos* and *kairos* in important but fundamentally different ways.

Clinical Research (Knowledge) Time

Quantifiable analysis of clinical events over defined periods provides a foundation for building biomedical knowledge. Clinical research time is therefore closely aligned with the concept of ordered, linear time. Many quasi-experimental and experimental designs³ and statistical methods have been used to evaluate the influence of time on clinical interventions. For example, authors of a randomized clinical trial of rofecoxib for prevention of colorectal polyps made the much-debated assertion, based on a Cox proportional-hazards model, that an increased risk of thrombotic cardiovascular events did not become evident until patients had been taking the drug for at least 18 months.⁴ After an additional 3 years, a final analysis was published demonstrating that the risk persisted for a year after stopping the drug.⁵ The controversy and litigation that erupted surrounding this trial did not center on these structured, time-related findings, however, but on when the manu-

facturer knew the drug caused adverse cardiovascular events, and when the US Food and Drug Administration and the public should have been informed. The structured nature of the study’s time frame was at odds with the patients’ personal and emotional time because the study failed to provide timely answers for their immediate, real-life challenges. Furthermore, because many protocols do not require researchers to offer participants beneficial interventions after a trial has ended, those participants can wait a long time to realize any personal benefits. Moreover, clinical trials often do not keep pace with advances in treatment and technology, rendering their findings obsolete by the time they are published.

Patient (Illness) Time

In contrast to the structured pace of clinical research time, the patient’s experience of time is frequently anything but structured, ordered, and linear. Patient or illness time comes much closer to time’s personal and emotional dimensions. The experience of illness is complex: learning to live with physical pain and dysfunction; adopting the perspective and role of an ill patient; and adapting to lifestyle changes, including emotional distress and a sense of loss.

Even clinicians, who have a keen understanding of diagnostic and treatment processes, find the personal experience of illness shifts their perception of time. One physician, describing the moment she learned her biopsy was positive for cancer, found herself thrown out of her structured physician’s universe of linear time into a “worm-hole,” in which she traveled backward decades into her past life, then vaulted forward to the proximity of her death.⁶ Time in such situations becomes fluid, emotive, and often illogical.⁷ For individuals outside the health care profession, the personal perspective on time becomes even more dominant when they become sick. Most lack the kind of understanding of the health care process or human biology that might mitigate their frustration when, for example, it takes “forever” to get a physician’s appointment, or when they do not feel better “right away.”

Clinical Practice (Disease) Time

Delivering health care at the front lines requires clinicians to bridge the gap between knowledge distilled from clini-

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cal research in structured time and the complex needs of individual patients operating in personal and emotional time. For example, clinicians know that the complications of hypertension or diabetes take years to become clinically apparent but also recognize that patients must be seen at regular, relatively short intervals to have any chance of preventing these complications. They know that minutes count in some situations even though the patient may not understand the need for urgent action. Conversely, they know that complaints can often wait even though the patient, struggling in absolute illness time, is convinced the symptoms require immediate attention. Furthermore, clinicians know that tincture of time often clarifies the diagnosis or allows the effect of a treatment to become apparent.

As if balancing the rigors of clinical research time against the immediate needs of patient time were not challenging enough, new technologies increase the demands on clinicians to address their patients' problems in real time. For example, although "it is still true that medical researchers, physicians and patients live in and rely on public, linear time for important scheduling . . . the pace at which the medical profession can rush patients to places of treatment or rush treatments to patients has been revolutionized as new technologies of transportation and communication modify how we live, and heal, in time."²

Improvement (Performance) Time

The emerging discipline of quality improvement provides an opportunity for clinicians to live and heal in time. Improvement, sometimes referred to as an applied science, consists of systematic, data-guided activities specifically designed to bring about prompt and substantial improvements in the performance of health care processes, resulting in better patient and population outcomes, better systems and processes of care, and better professional development.⁸ Medical quality improvement is practiced, therefore, as close to the actual delivery of service as possible, respecting the critical role of context in interpreting the effectiveness of interventions, and recognizing the circumstances in which a particular intervention is likely to succeed or fail. It frequently involves the use of both qualitative and quantitative methods, as well as statistical inference to understand and respond to what medicine's many different stakeholders want, need, and expect from health care.⁹

Improvement focuses primarily on how efficiently and effectively care actually unfolds with the passage of time. This stands in contrast with clinical trials that focus primarily on efficacy at the end of a defined period, or classic observational studies that generally provide a snapshot of the effectiveness of interventions within a prespecified period. The continuing flow of performance over time is an intrinsic component of improvement. At a technical level, improvement is a learning process that takes place largely through multiple cyclic tests of change, as is true in clinical practice. The measured results from those tests are fed back to individu-

als who can implement the changes and are used to refine the care process further. The quantitative method known as statistical process control records, displays, and analyzes the sequence of events over time. It is therefore frequently used in improvement work to combine the structured time of clinical research with the personal time of illness, creating a single orderly picture of changes in care, typically displayed on a run chart or control chart.

Although improvement time is directly linked both conceptually and operationally to all 3 traditional views of medical time, it is most closely aligned with clinical practice time. Thus, like clinical practice, its focus is not strictly on structured time or personal time alone, but rather on how these 2 very different, and seemingly incompatible, dimensions of time can be amalgamated to solve complex problems in a concurrent fashion.

The responsibility to improve care is an intrinsic part of clinical practice, not simply an add on. As is true for other aspects of clinical practice, improvement is less a physical or biological discipline than a behavioral and social science that brings the epistemology of natural science research methods together with the human needs of patients and clinicians. The urgent need to fix the problems facing the health care system makes it likely that improvement time will play an increasingly important role in medicine. Like all new concepts, improvement time may seem disruptive to the 3 traditional concepts of medical time; however, its roots actually lie within the origins of the scientific method, including planned experimentation and applied statistical methods. Although its elements are not new, improvement time does provide a new and potentially unifying perspective on time in medicine.

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REFERENCES

1. Murray TJ. Personal time: the patient's experience. *Ann Intern Med.* 2000;132(1):58-62.
2. Kern S. Time and medicine. *Ann Intern Med.* 2000;132(1):3-9.
3. Campbell DT, Stanley JC. *Experimental and Quasi-Experimental Designs for Research.* Boston, MA: Houghton Mifflin Co; 1966.
4. Bresalier RS, Sandler RS, Quan H, et al; Adenomatous Polyp Prevention on Vioxx (APPROVE) Trial Investigators. Cardiovascular events associated with rofecoxib in a colorectal adenoma chemoprevention trial. *N Engl J Med.* 2005;352(11):1092-1102.
5. Baron JA, Sandler RS, Bresalier RS, et al. Cardiovascular events associated with rofecoxib: final analysis of the APPROVe trial. *Lancet.* 2008;372(9651):1756-1764.
6. Scannell KA. Leave of absence. *Ann Intern Med.* 2000;132(1):55-57.
7. Bartlett FC. *Remembering: A Study in Experimental and Social Psychology.* London, England: Cambridge University Press; 1932.
8. Batalden PB, Davidoff F. What is "quality improvement" and how can it transform health care? *Qual Saf Health Care.* 2007;16(1):2-3.
9. Scherkenbach WW. *Deming's Road to Continual Improvement.* Knoxville, TN: SPC Press; 1991.