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Desktop Medicine

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Concepts of disease are essential to defining what medicine is. By the 20th century, the dominant concept was pathology in an individual: the foundation for the bedside model of medicine. Bedside medicine organizes the physician-patient relationship around the chief complaint guided history and physical; and medical training that emphasizes laboratory-based sciences, physical diagnosis and the bedside presentation.

Since the middle of the 20th century, however, a new model has emerged: desktop medicine. This term describes how a desk with a networked computer is transforming medical science and, in turn, medical practice. The desktop is the space where researchers discover risk-factor based diseases and where physicians diagnose and treat patients with these diseases.

In developed nations, desktop diseases such as dyslipemia occupy a substantial portion of a physician's practice, are leading causes of morbidity and mortality, and have attracted the attention of policymakers. Medicare will soon require an annual personalized health risk assessment.[1] Physicians, researchers and educators face a challenge: how to integrate desktop medicine into training and practice so that physicians can practice it?

The features of desktop medicine: Desktop diseases are discovered when studies show a factor (e.g. blood pressure) is associated with a negative health event (e.g. stroke), and then a clinical trial shows that an intervention upon that risk-factor reduces the risk of that event.[2] Key technologies are networked computers that perform rapid, multivariate analyses of large datasets. These sciences and technologies permit researchers to discover

the characteristics of persons at risk and to create prediction models that assess whether a patient is at sufficient risk that a physician ought to intervene. For example, the NCEP's "Risk Assessment Tool" integrates seven factors to determine a person's ten-year heart attack risk.[3]

Diagnosis and treatment in desktop medicine differ from the bedside exercise of the chief complaint initiated history and physical. In desktop medicine, the clinician begins with gathering risk-factors from history, exam and studies. The clinician then uses these risk-factors to determine whether the patient is at sufficient risk to recommend treatment. This exercise of gathering risk-factors and then assessing how well they predict health outcomes and the benefits of reducing those risk factors (e.g. taking a statin) is "clinical-actuarial correlation." The FRAX criteria for the diagnosis of osteoporosis illustrate this. A physician gathers a patient's 12 clinical risk-factors, enters them into an on-line model, and receives the patient's ten year probability of a fracture and therefore whether to recommend treatment.[4]

Desktop medicine has begun to transform how physicians diagnose bedside diseases. Risk measurements compete with signs and symptoms and encompass progressively milder stages of disease. For example, Alzheimers disease is transforming from a diagnosis based upon disabling cognitive declines, to a quantified memory deficit and a biomarker of neurodegeneration. Concepts of treatment as risk management are also transforming the care of bedside diseases. Patients who recover from a bedside disease often enter into years of monitoring for other diseases (e.g. colitis that requires screening for cancer).[5]

Integrating desktop medicine into training: The salience of risk in desktop disease discovery, diagnosis and treatment suggests that the MCAT should measure skills in probabilistic reasoning and decision-making, thereby encouraging students to major in desktop sciences such as statistics and psychology. The core medical curriculum needs revision as well. The USMLE needs to test basic sciences such as epidemiology, decision sciences and biomarker-focused laboratory sciences, and how well students apply probability to clinical practice and managing information. These changes will attract students who are interested in desktop medicine.

Integrating desktop medicine into medical practice: Desktop and bedside medicines differ in the role of the patient's chief complaint to organize the clinical encounter. The desktop encounter begins with an approach called "running the numbers first."[6] This involves performing a risk assessment *before* soliciting the patient's chief complaint.

Advocates of this approach contend that when physicians begin with the chief complaint they can neglect the care of desktop diseases and thus inadequately treat these diseases, such as failing to intensify treatment in patients with uncontrolled hypertension. Critics argue that it is at odds with the principles of primary care; specifically, patient-centered care grounded in soliciting a chief complaint.[7]

A contentious debate does not necessarily mean one side is wrong. Physicians need skills in how to incorporate desktop and bedside approaches into the office visit and how to shape patients' expectations for a visit, especially for new patients and patients with both bedside and desktop diseases.

Talking about desktop diseases: Bedside diseases are categorical. Disease is either present, or it is not. In contrast, desktop diseases are dimensional, as risk is a continuum. The argument follows that when risk data are available, physicians should talk about disease not as a category, but as a probability.[8] Rather than a disease label compelling treatment (*"I have cancer; take it out."*), a risk estimate allows physicians and patients to practice clinical-actuarial correlation (*"My chance of cancer death is too low to justify surgery."*)

This approach presents challenges. As patients have more access to their own risk data via electronic resources and self-measurement of biomarkers, physicians lose exclusive control over organizing the medical encounter. In addition, both physicians and patients have cognitive biases in how they reason through risk information. Each may transform calculated risks into markedly different values. This personalized representation can affect decision-making in a manner that is contrary to the goals of risk reduction.[9]

To address these challenges, medical training needs to include how to help patients to appreciate their relevant risks and effectively manage these risks. Just as bedside medicine developed methods to help physicians and patients understand and appreciate symptoms (*"How many flights of stairs can you climb before you get short of breath?"*), desktop medicine needs to develop techniques to help patients think about and act upon their risks. This desktop manner will include skills that cultivate the expectation of the opposite of risk: the probability of a future good outcome, or, in a word, hope.

Talking about desktop treatments: Clinical-actuarial correlation and running the numbers first identify patients who need interventions to reduce risks, but patients often fail to adopt them. Instead, they have a bias to maintain behaviors that achieve short-term goals but long-term harms. Essential to desktop treatment is physicians improving their skills in how to change this bias. Approaches such as payments for medication adherence will require physicians to learn how to talk with patients about using monetary incentives to treat disease.[10]

Summing up: Desktop medicine does not so much change medicine as explain the way it is. Training physicians to practice it is especially important for the care of patients with competing risks, such as the elderly.

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Table: Comparing bedside and desktop models of medicine. These characteristics are not exclusive to one model as, for example, both models use statistics. Instead, this table juxtaposes each model's essential characteristics.

	Bedside Model	***Desktop Model***
Concept of disease	Disease as pathology in an individual. *Examples*: Alzheimers disease, congestive heart failure, ulcerative colitis, influenza pneumonia	Disease as a risk of future impairment in an individual. *Examples*: diabetes, dyslipemia, hypertension, osteoporosis. Also, early stages of bedside diseases such as ACC/AHA Stage A heart failure which describes "high risk for heart failure"
Core sciences for premedical and medical education[a]	• Anatomy • Biology • Biochemistry • Histology • Organic chemistry • Pathology • Physiology	• Economics • Epidemiology • Information sciences • Laboratory sciences such as biochemistry and genetics oriented toward biomarker discovery (e.g. genomics) • Psychology • Statistics
Doctor patient interaction	Bedside manner that emphasizes soliciting the patient's chief complaint and then guiding a workup and interventions to address it.	Desktop manner that emphasizes fostering the patient's appreciation of his or her risks, and then adopting and adhering to strategies for risk reduction.
Approach to diagnosis and treatment	Clinical-pathological correlation uses the results of the history, physical and studies to select the disease that best explains the patient's chief complaint. Clinical judgment to select the best treatments for the pathology and to relieve the patient's symptoms. *Example*: diagnosis of congestive heart failure based on historical and exam findings of orthopnea and edema and studies such as chest x-ray. Treatment with lasix and beta blocker guided by reduction in shortness of breath and edema.	Clinical-actuarial correlation uses the results of a patient's risk factor assessment to correlate with models that estimate whether the patient's risk is sufficient to warrant treatment. *Example*: WHO FRAX criteria to calculate 10 year risk of fracture using 12 risk-factors gathered from history, exam, and studies. (www.sheffield.ac.uk/FRAX) The results inform physicians whether to recommend bisphosphonate treatment and other fall and fracture risk reductions such as exercise. For other examples, see "Directory of

	Health Risk Assessment Tools" (www.healthline.com/tools/risk).

[a] arranged alphabetically

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