# THE PRAXIS CHARTING MANIFESTO

## A Fork in the Road

*"The practice of medicine is an art, not a trade;*
*a calling, not a business;*
*a calling in which your heart will be exercised equally with your head."*
*Sir William Osler*

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*Cutting the Gordian Knot: Why the current approach to charting medicine makes no sense in the age of computers, and how the Praxis Concept Processor resolves this problem by using AI that learns to chart from you.*

*Are you still charting as we did in the 20th Century? If you get the sense that you are wasting your life charting, then this paper is for you.*

*We thank our wonderful clients for sharing our dream, for guiding us in the right direction, and for assuring us that we had not lost our minds by questioning outdated beliefs.*

http://www.praxisemr.com

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# Executive Summary

A unique method of medical charting harnessing the power of the computer, and how this approach improves medical quality, resolves merit-based reporting, and saves providers over 80% of the time currently wasted documenting medicine.

Twenty years ago, Praxis EMR discovered an alternative way to chart medicine, one that no other Electronic Health Record had foreseen. Initially envisioned to save hours wasted charting, the Praxis Concept Processor has enabled a different approach to documentation, one that uses the computer as an extension of the human mind to decrease clinical error, improve medical quality, and reduce professional stress brought about by complexity. What is presented here is more than a method for extremely rapid charting. The Praxis Concept Processor has become an intellectual assistant in the very practice of medicine, leading physician-user satisfaction surveys, particularly in the area of usability, quality medicine and, interestingly, "enjoyment of charting".[i] And yes, Praxis saves providers more than 80% of the time currently thrown away in meaningless clinical documentation, making charting an intellectual pleasure and not a practice hindrance.

This may sound strange at first, but with Praxis you chart backwards. Moreover, as described in this paper, this innovative approach to clinical documentation enables a more personalized, scientific, and effective way of charting than the old-fashioned dead-paper record approach ever could. Praxis allows for a faster and more profound way to think with each subsequent case. The Praxis Concept Processor progressively learns from your past encounters and brings forth your own knowledge for exactly the right patient at exactly the right moment.

What follows goes against conventional wisdom because Praxis challenges strongly-held biases about how and why we doctors chart medicine. However, it is evident that the prevalent charting approach, learned at a time when computers had not yet been conceived, has become the source of significant clinical error, malpractice liability, and financial cost for both doctors and patients alike. We discuss why the currently accepted method of charting is a major fallacy. In fact, we believe that the old approach to clinical documentation will implode as this new method of charting changes the way computers assist providers in clinical practice. The old paper-record paradigm, and the resulting electronic healthcare record systems it has spawned, have has proven futile for the effective practice of medicine, becoming a major source of physician stress, dissatisfaction, and burnout.

Whether you decide to use Praxis or not, you owe it to yourself and to our wonderful profession of medicine to look at this new approach to charting with an open mind.

# The Old Paper Record Paradigm

As stated, the clinical problem goes way beyond Electronic Healthcare Records. It deals with the nature of medical charting, a method taught by our forebears for over two hundred years. We look at medicine as a stepchild of science and pay lip service to scientific reasoning, although when it all is said and done, we also understand that we are practicing a unique art form. Indeed, our concept of medicine grew in step with the scientific revolution. The founders of our modern profession struggled long and hard to adapt our medical thinking to the "scientific method," inculcating it to medical students the world over[ii]. Today, any idea that shakes some of these foundational beliefs, even if limited only to medical charting, may be viewed by many as heresy and not worthy of serious evaluation as a valid alternative to linear paper-like charting. And to be fair, the scientific method approach has proven itself more than useful during the last two hundred years. The scientific method has improved the practice of our profession far more during the recent industrial age than it had for the first ten thousand years since doctoring emerged as a human specialty; although recently, it is hitting a brick wall when it comes to disease prevention and cost management. The cause of this halt in progress will also be explained in this paper because this new charting approach also resolves both of these vital healthcare issues—disease prevention and cost management—with amazing ease, something the alternative prevalent model can never even begin to accomplish. In fact, the EHRs are making these issues worse. In short, medical charting has recently taken a strange path; one we have slowly gotten accustomed to following; one not foreseen by our predecessors or they would have rejected it from the start believing we had lost our minds.

## Re-Thinking the Ancient Charting Paradigm

In the context of the scientific method, the medical record or “progress note,” as it is also known, is viewed by the medical profession as a metaphor for the scientist’s laboratory notebook, the one most of us used during our early years as students in high school, college and medical school. This laboratory notebook has been employed by our scientific cousins for years to carefully note the results of experiments performed in the hard sciences to confirm or discard scientific hypotheses. We doctors used it briefly as undergraduates while learning about the different discoveries presented to us during our coursework. Later as medical students, we were introduced to the patient's progress note or chart. It was explained from the start that the medical record should describe the true clinical condition of the patient as perceived “objectively” by all healthcare professionals. We were taught that the clinical chart should record all the relevant observations about the patient, our clinical conclusions, and our diagnostic and treatment plan provided

at the point of care.

This approach follows directly from the scientific method by using inductive and deductive reasoning. The accepted dogma is well known to all of us: We listen carefully to what the patient is telling us. We write exactly what we perceive at the point of care, and then enter all incoming information into the progress note the way scientists record results of their experiments in their laboratory notebook. Once the patient has finished stating his or her symptoms, we perform a mental exercise known as the “differential diagnosis.” This exercise attempts to correlate symptoms and findings observed about the patient against each possible diagnosis that instantly emerge in our minds. **Note that exactly how these diagnoses emerge in our minds is not ever discussed; it is simply assumed as a given.** A period of back-and-forth patient questioning follows, where we attempt to narrow down our set of possible options by ruling in or out as many of these competing mental diagnoses as possible, correlating each potential diagnosis with the facts at hand. This is usually followed by a relevant physical examination that further discards each incompatible diagnosis, and finally a review of the available clinical studies that should end up leaving us, hopefully, with a single diagnosis to go after. This is what we call "making a diagnosis," and what the scientific method terms inductive reasoning[iii]. As soon as this single diagnosis is reached, the theory follows, the remainder of the case should unravel automatically and seamlessly. It is said that while making hospital rounds with a group of his students, Sir William Osler (Canadian physician and one of the four founding professors of Johns Hopkins Hospital) was asked by one of his awed young listeners: "Your differential diagnosis is amazing, Doctor Osler. Now that you figured all this out, how do you propose to treat our patient?" to which the master replied, "Oh, don't bother me with that, anyone can do it now!", and moved on to the next bed, where yet another hard case was waiting to be figured out by the great diagnostician. It follows, then, again according to the scientific method, that the therapeutic and diagnostic steps to follow, once a single diagnosis is reached, do so via straight-forward algorithms based on current scientific evidence and “best practices,” a syllogistic cookbook of sorts, one that that makes use of deductive reasoning. As an aside, the primordial importance of the pathologist in all this process has never been questioned. The pathologist is the final judge and arbiter of Scientific Truth, the Final Diagnostician, so to speak. The pathologist reviews the physical specimens taken from the patient or the cadaver, when the unfortunate patient does not make it, and by using anatomic, microscopic and histochemical studies, he or she concludes by proclaiming the unarguable single diagnosis of the case: the one and only truth. This involvement of the pathologist is important in what is to follow in this paper.

The previous discussion forms the dogma that we healthcare practitioners are supposed to know by heart and follow to the letter. And this entire thought process (description of the symptoms, findings, laboratory studies, the logical arguments made to reach the final diagnosis, and the proposed treatment in each case) must be recorded in the patient’s record clearly and completely, dated and signed by its author for every patient and for every encounter. **We have come to believe,**

**heaven knows why, that our charting process should be as linear as the description you have read, whether by typing on a computer, dictating into a microphone, or writing onto dead paper.** No wonder charting seems to take forever!

In this paper we will prove that what is really happening in our minds when we chart medicine is nowhere near what has just been described. In fact, because of our early indoctrination, what we are doing when we chart medicine may not be close to what we think we are doing. Now, if you are not a medical practitioner and have been reading this far, the following automobile example may prove useful:

*An Automobile Example*

*Imagine you are driving your car at about 45 miles an hour and reach a busy intersection on a drizzly summer afternoon. You have the sun filtering through the clouds and causing glare that hampers your vision of the traffic up ahead. You've got cars ahead of you and next to you and behind you as you are cruising at speed limit. Suddenly, you reach a yellow light as you are about to cross a busy intersection.*


*Now you've got to make a quick decision based upon the diagnosis of situation you are in: Should you step on the gas and attempt to whiz by the busy intersection or hit the breaks and come to a screeching halt?*

*To make this crucial diagnosis, you perform a number of tasks simultaneously: You look to see who's attempting to drive across the intersection to figure out who will pass first. Say you do see someone coming from the left and try to make eye contact with that driver, but it turns out that the crossing driver is wearing sunglasses, therefore you can't tell whether she sees you or not. You're also peeking at your rearview mirror to gauge how close the car behind you is approaching. You think about the state of your tires, as the pavement is wet today. Your eyes even drift to the corners to check for the presence of a police officer who could give you a ticket...*

*...and while you're doing all that, you're listening to the radio and thinking of something else...*

*Right?*

*Now imagine that you speed across the intersection and a police officer appears out of nowhere, stops you dead in your tracks, hands you a pen and paper and says: "Write down all the logical steps you took to make your decision to cross over the intersection as you did. Don't forget anything!"*

*You start writing: "Ok, first I looked across the street. I did see a car coming from the left and noted that the driver was using sunglasses so I was not sure she saw me, but I felt that her speed was such that a collision was unlikely if I sped up. I also noted the car behind me was coming rather fast, so if I were to have stopped suddenly, he may have crashed into the back of my vehicle. I also thought that with all the drizzling rain and the sorry state of my tires I would not be able to stop in time anyway. My possibilities then were...."*

*Now imagine you have to do this every day on every street corner for every police officer on your way home. Also imagine that your drivers license is at stake, that you could be sued for millions, and that you could not purchase car insurance without all this paperwork being done constantly.*

*You immediately see that writing all this down would take you far longer than what you actually did, which took you less than a second. Also, attempting to perform all this inhuman writing would be far more stressful than simply "listening to the radio and thinking of something else"!*

*Far fetched? Ask any healthcare provider!*

Starting about 50 years ago, the medical record, still on pen and paper from the 18th Century, began to gradually morph into a progressively more longwinded and complex set of litanies meant more for attorneys and bureaucrats than for personal use as a self-reminder or even for the benefit of colleagues. The charting explosion nightmare was initially caused by the increased malpractice litigation that began in the early 60s, but that was only the beginning.

The progress-note quickly transformed itself from the succinct 3 by 5 cards used by our forebears—a short handwritten entry representing the very essence of the clinical encounter—into an ever more confusing bureaucratic and legal set of litanies filled with clinical irrelevancies, disclaimers, and protective redundancies. Nowhere was this change more flagrant than in the United States as malpractice litigation began to run amok[iv]. Providers began to be second-guessed by attorneys and hired "medical experts" years after the clinical event ever took place, leading to a minute review of the medical record. This Monday-morning-quarterbacking of the chart has often taken place without a hint of the complexity and uncertainty of the actual event, without a clue as to its confounding cofactors, such as how clearly the history was provided by the patient, how busy the clinic was at the moment care was rendered, how hastily the chart had to be written to have time to care for this and other patients or how the total number of concurrent cases were impacting the clinician's time at the point of care. Indeed, the chart totally ignores how many other seriously ill patients the doctor was treating when the note was written, or perhaps hours before, if it is entered from memory when there is no time available to write the note at the point of care. None of that can be read in the record.

Moreover, the clinical experience itself, as every doctor knows, is often charged with uncertainty, complexity and emotion. None of that appears in the record either. As lawyers like to put it, "Res Ipsa Loquitor" (the thing speaks for itself). In medicine, this was translated as "if it is not documented, it is not done." Yes, more often than not, doctors began to write defensively for attorneys and for third-parties than for clinical use, and the medical chart became bulimic.

Worse yet, as the resulting morass with documentation settled into the "standard-of-care," it drew the attention of the third-party payers, particularly the government, who then began to use what was written on the chart to approve or deny payment for medical services and even to fine doctors for the very content of the chart. As insane as this may sound, a price was placed on what was written on the record rather than what was being done for the patient. So strangely enough, spending 5 minutes with a patient and 20 minutes charting could sometimes pay more than spending 20 minutes with the patient and 5 minutes hurrying through the medical record. Vital to understanding the history of this nightmare is that this craziness was in full swing even before the first computer ever set foot in a medical office. In other

words, it had nothing to do with the computer.

Although this insane phenomenon preceded the advent of the first computer into the clinic, it surely provided the perfect storm for what was to follow.

## The Terrible Truth about Templates

It was the push by public health to improve patient outcomes and lower the cost of healthcare that forced computers upon reluctant physicians. Yes, it is true that most doctors are not computer experts, or at least were not computer experts when this digital process began in earnest about fifteen years ago. However, this lack of expertise was not because we physicians were computer phobic or technologically averse, as many pundits in the computer and high-tech world have proclaimed, but precisely for the opposite reason. As seen in the early part of this discussion, we clinicians have been highly trained in the sciences from day one. We believe that our colleagues understood instinctively from the first moment they touched a template-based EHR, that this approach to charting medicine via the computer attempting to reproduce the old paper charting approach would never work, and they would instinctively reject it.

What the prevalent technologies have accomplished by porting this paper record paradigm into the computer was simply to magnify the problem many times and turn it into a nightmare. EHR developers, who were told by providers that this flawed paper writing approach was the gold standard, simply added electronic typewriters armed with software hotkeys and macros in a desperate attempt to speed up data entry obtaining just the opposite effect. Then these early word editor macros morphed into the more complicated so-called templates and pick lists that engendered even worse results. So, the EHR arms race was on.

Figure 1. *Shoot out at the OK Corral. EHRs went through this crazy charting-speed evaluation in the 1990's*

This flawed template approach became so ridiculous that fifteen years ago, Electronic Medical Record "shoot-out" contests were set up at many Health IT meetings around the country. In those contests different vendors would compete with one another by using their star physician-clients to determine which EHR was the fastest to accurately transcribe a prepared history dictated by a medical school professor into the different EHR applications competing for first prize. No one ever stopped to think at those meetings that patients had never once walked into a doctor's office carrying their ready-made clinical history to be inputted into the computer by the harried provider acting as a simple data-entry clerk. In fact, generating such a clinical history is the whole purpose for visiting the physician in the first place. Of course, the organizers running these contests were not physicians but IT consultants. The blind was leading the blind from the very beginning of this strange EHR race.

Soon things became worse as third-party payers and the government felt this ill-conceived approach was the correct one to use, and began to formulate rules about interoperability and template conformity, adding complex codes to the EHRs to make the interface dream possible. What is funny is that most seemed to blame the computer, as though the computer had created itself. No one seemed to question the underlying assumption made about the very nature of charting. Indeed, the paper record is still viewed today as the unquestionable Truth that all EHRs should follow.

And strangely enough, if viewed from the scientific paradigm described at the outset of this paper, templates--the collection of macros and pick lists created by software vendors in an attempt to shorthand data entry--do seem to make sense. If a template could be created to cover every possible illness, every clinical descriptor, and every patient treatment, and if the templates were built by the best minds in

healthcare using scientific reasoning based on “best practices," then this excellence could be electronically delivered to the practitioner at the point of care as a ready-made cookbook. The provider could simply follow the script contained therein and practice superb medicine. How easy is that? In fact, why have a doctor at all? Anyone could practice medicine if the software were good enough! Moreover, if the text could also receive and send hidden codes prepared by the experts, then third-party computers could easily audit the care rendered for any patient, tabulate diagnostic approaches, treatments, and figure out “what works out there” to further remotely learn how patients are cared for, and learn how to provide better care at a lower cost. Third parties and the government could learn from mistakes via the codes, figure out best solutions, and send back the appropriate guidelines to progressively improve the quality of healthcare rendered. These Clinical Decision Support Guidelines, CDS for short, would complete the circle to improve medicine and provide more cost-effective healthcare.

The American College of Pathologists did develop SNOMED[v], a codex of medicine that purports to describe every symptom, every diagnosis and every possible treatment. They licensed this huge dictionary of medical language to the governments of many nations, including ours, to be pushed onto doctors and EHR vendors by legislation. The idea was that "Snomedese," or “Codeese” and not English would describe the clinical record. SNOMED provided a platform for computers to understand what was going on at the point of care of any physician’s practice anywhere in the world. Keep in mind, as we mentioned earlier, that pathologists are not practicing physicians and have never experienced first-hand the event of treating a patient, but they are, as mentioned, the final arbiter on illness. The Regenstrief Institute followed suit with "LOINC," another such set of codes, this one meant to standardize reception of clinical data. And of course, we also have the ICD-10s, CPTs, RxNorms, CVX codes, and the list goes on. This alphabet soup of codes would all be funny if it were not so tragic for providers and their patients!

So, the idea pushed by the many different “stakeholders,” including the US government, is that doctors should communicate—not by using free text dealing with the ambiguities and grayness of the medical experience—but using coded language that represents “the reality” of the encounter. For any doctor who has toiled with the equally insane Level of Service system created by CMS in 1997, this approach is not new, but simply a more extreme symptom of an ever-greater illness of the blind leading the blind.

How seemingly logical, how very complex, and how very wrong!

Until very recently, very few have questioned the scientific premises underlying the above approach to EHR development and its implications for medical practice[vi].

As all physicians are beginning to find out, however, the template approach to EHRs helps very little in the actual practice of medicine and the healing of the sick, which is the very purpose of our profession, while causing a huge amount of wasted time and

unnecessary personal stress, to say nothing about the interference with the practice itself, and the actual expense of all this effort to deal with bureaucratic requirements. Doctors often find themselves fighting with their computers as they attempt to get things done for their patients. More and more time is spent in dealing with the computer, and less and less time in patient care. Some studies have found doctors spending up to 40% of their time in meaningless "computer work."[vii] Another recent study by Brian Arendt and Valerie Gilchrist, published in the Annals of Family Practice was entitled "Doctors are Tethered to the EHR"[viii]. Before this insanity even began doctors were used to taking their charts home, which was not good. Now they take their computers home, which is far worse. The paper by Richard Gidwani and Steven Lin describes how some physicians are relying on scribes in desperation[ix], but this is not a solution either. In this paper, we explain how absurd using scribes is to medicine, even if transcription were to be performed free of charge. A wonderful editorial in Medical Economics hits the nail on the head: *"It's time to get doctors out of EHR data entry"* [x]

As mentioned, much of medicine deals with gray areas, areas of uncertainty, of human interaction and of feelings. The factoids and absolutes that are demanded by the codes are poorly suited to handle clinical nuances, to say nothing about the huge waste of intellectual resources and time devoted to handling these meaningless computer tasks. In fact, most clinics have been forced to hire additional personnel and consultants—in addition to scribes—to deal with the bureaucratic requirements, further driving up the cost of healthcare, and many or our colleagues are becoming depressed, and even leaving the practice because of their EHRs[xi]. More importantly, none of this data entry helps the provider where it counts the most, at the moment of interaction with his or her patient.

Once again, if the purpose of practicing medicine is to heal the sick and deal with people rather than with paper or with computers, then the electronic force-feeding of this bureaucratic insanity into the practice of medicine appears to subvert the very essence of medical practice. It makes it far more expensive and time-consuming for those brave souls who are charged with rendering healthcare to the rest of us, all the while causing personal and emotional stress to both patients and healthcare professionals alike.
When looked at it in this manner, templates serve no purpose at all except to get in the way of our thinking process. It is presumptuous to dictate how any provider will approach a given patient and a given clinical encounter, and to imagine what their personal thoughts shall be at the point of care. It is even more presumptuous to imagine how one would describe a clinical history, what are the exact words and syntax that would be used, what would the exact order of the symptoms elicited be or what findings would feel relevant, or worse, to assert that there is such a thing as a *correct clinical history* within the template that the provider must abide by when charting.

Indeed, thinking is an individual experience, and as such, it is unique to each one of us. This is what is known as the "art" of medicine. This is what differentiates one

doctor's approach from that of another. **So, the interference caused by the template at the point of care easily confuses the thinking process of the provider, leading to a misdiagnosis or mistreatment, to say nothing about generating much personal stress and wasting an enormous amount of time playing the stupid and dangerous game of fighting the often-irrelevant verbiage emanating from within the computer screen.**

Although charting on the old paper record before the advent of the computer wasted inordinate time and caused unusual stress to providers—hours per day in some specialties—it was at least a true reflection of our thinking process in a way that a template could never even begin to approach. “Pick lists”, a part of this template insanity, substituted artificial constraints on the descriptions of clinical events, serving only to straightjacket, to confuse, and to block any effective thought process, worsening the very practice of medicine.

And we have not even discussed malpractice yet. As Curtis Harris MD, JD explains in his letter, later in this paper, the templates may be brought into evidence in a malpractice case, putting to question the good judgment and even the veracity of the doctor’s observations. Res Ipsa Loquitor indeed!

As we also explain later, templates are also disastrous for public health, for “garbage in equals garbage out.” If the resulting documentation is not an accurate description of what we are thinking or doing at the point of care, but rather the result of cutting corners and accuracy simply to fit template molds and deal with countless pick lists, then the resulting data is not that useful to third parties either.

## Assistant or Patient-Assisted History Taking is Not the Answer

Some clinicians rely on their medical assistants or nurses to perform the intake history. Others ask the patient to do so on the Patient Portal or in the Patient Kiosk, which is a Portal brought into the waiting room. This is also called "History" although, as Allan Wenner MD, the developer of Instant Medical History[xii] brilliantly pointed out, the output of this patient history should be thought of by the provider as no different than any other incoming external study or lab, and should not be confused with the self-generated history taking. None of these methods can avoid having to perform our own evaluations and take our own histories. The foreign text answered by the patient or taken by the assistant adds value to it, as does a laboratory finding, but no more than that.

As far as using scribes to chart, we miss the point that the problem is not between the mouth and the charting device, but between our instant brain and our clumsy and elliptical voice generation or manual typing. Yes, a smart assistant may figure it out on their own, or ask us for clarification, but just as easily, they could misinterpret

our statements, with important medical and medico-legal consequences.

## Throwing the Baby Out with the Bathwater

As stated, many physicians blame the computer. This blame is misplaced, and so is the blaming of the codes, even though we have just bashed them. There is a purpose to codes after all, as we discuss later in this paper. We will prove that the devil is not in the use of computers or even in the use of codes. The devil, as we mentioned at the outset, is found in the very approach to charting. The reality is that computers are no better and no worse than the way they have been programmed to work, and they were programmed to work like the old paper record did, which in turn generated the mess we are immersed in today. So, before we throw the baby out with the bathwater, let's look at a completely different approach to charting, one that works, one that is highly effective, one that makes sense.

## Computers To Help Physicians Think

The fascinating question before us is whether the computer can empower a different charting approach than the one we were taught, one based not just on entering clinical events onto dead paper, but on the expansion of our minds at the point of care, starting out with our intuition, so as to allow us to practice the wonderful art of medicine unimpeded. In short, the question is whether the computer can merge the old scientific method approach, originally promulgated by the Cartesian French Rationalist school and the British Empiricists of the 18 Century, with the equally old critique of the scientific method that was initially introduced by the great philosopher Immanuel Kant that we providers use in clinical practice every day, often without even realizing we are doing so. The Kantian view would assume that the patient is a “black box,” a mystery outside of human comprehension. [xiii]

As viewed from Immanuel Kant’s perspective (his old theory of the “Organon”), the medical record is merely an accurate description of what is happening within the mind of the provider while interacting with the patient. What the computer deals with is not the patient, but the writer of the note, the clinician. After two hundred years, the computer can finally join the scientist and the humanist back together again, these two apparently incommensurable worlds, and that is what medicine should be all about. [xiv]

If we look at the EHR problem as a charting issue and not a computer issue, we perceive a completely different solution with fresh eyes. Misusing computer templates to chart into a dead record is not the only possible approach to clinical documentation. On the contrary, the computer offers amazing possibilities out of the Gordian Knot that template-based EHRs have placed before us, one that makes it so

difficult for providers to practice medicine today. This powerful alternative approach developed by Praxis is known as the “Concept Processor.”

# The Praxis "Concept Processor"

So, given the long discussion just presented, how does the Praxis Concept Processor resolve the charting nightmare? How does the computer work with our mind and not against it?

Let's analyze our own thought processes. It may be a surprise to realize that we humans don't think with words. I am sure we all agree that we do not think one letter at a time, but what is perhaps more interesting is to realize that our minds don't process even one word at a time. First, we experience concepts that flash as a brainstorm of ideas into our consciousness, arriving initially without any words attached, at least not entirely consciously, and of course this happens even before any words are written on paper or entered on our computer screen. Yet, we appreciate our own thoughts instantly, although we are not aware of how they actually arrived into our consciousness. Thought comes before language or inner speech[xv]. It is only when we are ready to speak, write or type that our subconscious again takes over to translate our thoughts into intelligible language that forms phrases, sentences, and even entire paragraphs. This second stage of expression takes place semi-consciously and even semi-automatically. Most often the words we use are a repetition of identical or similar litanies we have used many times in the past, for different patients and for different encounters. After we grasp an idea, our words seem to emerge out of nowhere, and yes, with a few grammar and syntax errors thrown in for good measure. We may even include a Freudian slip, which often results in very amusing text:

*"A 60 year old judge was admitted with Acute Penal Failure...."*

*"...after looking through the joint, three loose ladies were removed...*

*"A 20-year-old male was brought in unconscious after being involved in a motorcycle versus truck accident....General Exam: "Well-developed, well-nourished male in no acute distress...* [xvi]*"*

Perhaps we don't appreciate that we are charting semi-consciously because of all the inculcation we received regarding how we should express objective reality, how we should limit our description to that of a machine-like recorder of sorts. In truth, we are recreating reality in our minds right before we speak, write, or type. This psychological process is indeed different from the one we described at the outset of this paper when we addressed the scientific method approach to charting.

Can this second part of our thinking process, the instant and automatic generation of words, phrases, and sentences be replicated by the computer the way we do it?

The answer is an unwavering “Yes!”, in fact, even better than we can do it. Our computer can chart faster, easier, and more effectively than we ever could do so manually, by typing, or even by dictating. In fact, our computer can generate all our writing instantly, faster than we can think of the words themselves, and, of course, no Freudian slips or legal repercussions! As soon as we're done being amazed about how quickly our very thoughts appear on our computer screen exactly how we wish to see them, all we need to do is to click "agree", and our entire charting is completed, and we are off to our next patient. Not only are we finished charting a complete progress note, but all our prescriptions, orders, procedure reports, instructions, even routing slips are also completed at the same time as our note, instantly. The Concept Processor allows us to document medicine at the speed of our minds, which is faster than that of our mouths, to say nothing about our frail fingers. The Praxis concept processing engine recreates our personal units of thoughts, learned from cases we handled in the past. **However, unlike the way our mind generates its thoughts, the computer does not work "elliptically", meaning it does not omit vital details that sometimes are so obvious to us that, in the stress of the moment, we may even forget to write them down; or worse, we may forget to think about them; we may forget to act on them; we may forget to ask the right question, check for the pertinent finding, order the vital laboratory study, or even order a life-saving medication, thus causing severe harm.** Elliptical thinking happens even though we know better; after all, we are only human (although some attorneys would disagree!).

## First Praxis Heresy

**The Praxis Concept Processor looks at charting, not as the task of documenting what transpired with the patient onto dead paper, but as a product of the mind of the provider at the point of care.**

And Praxis performs this distinct function with a speed and quality that dwarfs human imagination.

The concept processing approach is indeed very Kantian. The AI engine works simply as a projection of the provider’s mind, as an extension of the provider’s mind, as an assistant of the provider’s mind. The Concept Processor cannot do more than that, but helping the provider chart and handle clinical tasks instantly with superb accuracy while lowering human error is more than enough! After all, the patient does not write the clinical history; the provider does. The patient does not come up with a diagnosis; the provider does. The patient does not generate a diagnostic or treatment plan; the provider does. Charting is definitely not about the patient, but

about the provider's mind in relation to the patient, which is a subtle but totally different concept indeed.

To be able to explain the difference between the two approaches here is the second Praxis heresy.

## Second Praxis Heresy

**The clinical record is not a description of what happened during the encounter, of what the patient said, of what the physical examination found, or more importantly, of what the diagnoses and treatment of the patient were. The clinical record is simply a description of what the provider thought happened during the encounter, of what the provider thought the patient stated, of what the provider thought the physical examination disclosed, of what the provider thought the diagnosis was and, obviously, of what the provider thought the treatment should be.**

In other words, the clinical record is and has always been the expression of the thought process within the practitioner's mind at the point of care, and no more than that. Of course, there may be additional data to an encounter: vital signs, laboratory findings, outside studies, other providers' opinions, which Praxis handles elegantly as will be discussed, but in the ultimate analysis, the note is not about these issues either because none of those items are writing the clinical history at the point of care. The provider, who has access to all that information at the point of care, is the one doing all the charting.

So according to Kant, we humans can only be certain of what is happening inside our minds in reaction to what we believe we are observing and doing on the outside world. This a different story, but one that, thanks to the unique thinking machine that we now have at our disposal, may be handled with tremendous speed, ease, and above all, quality. Thus, the document should always be a faithful and honest representation of our thinking process, and no more than that.

This is particularly true of the clinical history also known as the Subjective Findings. As long as patients don't write their own clinical histories, the history also resides within our minds as providers, **and it does so even before the patient encounter ever takes place**. **In fact, it happens long before the encounter takes place**. This is why medical students need so much more time to write a clinical history--if what they eventually produce could be truly called a clinical history, for it is usually nowhere near as adequate or sufficient as the one taken by the experienced clinician. The same applies, of course, to the task of examining the patient and coming up with a diagnostic and treatment plan. Even though patients seen by the medical student and the expert clinician are one and the same, the student's mind is obviously nowhere near as prepared to elicit the crucial symptoms, uncover the useful clinical findings, evaluate the incoming laboratory and other data, obtain a

final diagnosis, and formulate a reasonable treatment and management plan as the expert clinician can. This is also why we clinicians cannot hire master writers or newspaper reporters to take our patients' histories. Those folks could spend days with our patients and come out empty handed. Indeed, the medical record reflects our thinking process as providers in reaction to the patient encounter, otherwise the clinical history could have been taken simply by a voice recorder and be done with it. In fact, if a passive voice recorder were used in lieu of a medical provider, the resulting history would usually not be adequate to reach anywhere close to an effective diagnosis or treatment plan.

This applies not only to the questions we ask our patient, but also to what we choose to examine, and even to what we believe we perceive during the physical exam. Contrary to what the British Empiricists and the Cartesian Rationalists claimed in the 18th Century, perceptions are never passive acts. Studies in psychology and particularly in the new field of cognitive neuroscience have clearly proven that perception is very much a subjective event as well.

# Saccading: We Perceive What We Believe We Perceive

Figure 2. *Saccade (/sɪ'kɑːd/ səKAHD, French for jerk) is a quick, simultaneous movement of both eyes between two or more phases of fixation in the same direction. For clarification, our eyes are constantly moving in small saccade motions, which are very fast jumps from one eye position to another whereas in smooth pursuit movements, eyes move smoothly instead of in jumps, but not during movement (represented by the lines). It has been demonstrated that the eye only "sees" those areas covered by the points linking the lines. These points are the small visual fields involving the very center of the eye (the fovea). Those areas not covered by the dots, such as the red mark on the left side of the face, are simply not seen.*[xvii]

Figure 3. *If we then ask the observer to focus on the left side of the face and have him watch the photograph once again, he then "sees" the red blemish for the first time. It was missed at first.*

Studies on visual perception, such as the one displayed above, easily prove that the act of viewing a photograph is anything but passive. Our eyes focus on a very small part of the visual field to apprehend visual information, less than 4%. Then our eyes rapidly and subconsciously jump ("saccade") from one visual sector to the next visual sector, constantly sending a very small amount of information on each sector to the occipital lobe of our brains, where we mentally reconstruct what we believe we are seeing, which is not what we are seeing. Most of our peripheral vision is completely blurry. In fact, we see what we subconsciously wish to see; everything else we simply don't see. (You may wish to view a wonderful video on Saccading by Andrew Johnson PhD, of Minnesota State University[xviii] or the selective attention test by from Daniel Simons and Christopher Chabris[xix])

Later in this paper, we come back to the vital importance of saccading in medical charting, when we refer to the difficulty that templates present because of this crucial and counter-intuitive effect.

Then, there is the relevance of historical or subjective information as it is being received from the patient. Careful questioning of the patient in the hands of an expert clinician quickly focuses on what may be going on. The diagnosis, then, is more of a Gestalt process happening within the mind of the provider when examining the patient, rather than deliberate inference to best explanation, the

inductive reasoning process, described at the outset of this paper, the one we all learned in medical school. What we learned in medical school could indeed be substituted by algorithms and the templates used today[xx], but not the art of medicine, at least not yet. As every clinician knows, it is not unusual for a doctor to reach a diagnosis and take a course of action within the first few seconds of the start of the interview. Why should it then take the same provider several minutes to chart what took her a few seconds to figure out?!

## Prodigious Human Memory

Just think about this: The patient comes into your office, gives you a full story of her complaint. You listen attentively, ask relevant questions and get back answers. Some of the answers you deem relevant, which causes you to ask even more probing questions and thus get more feedback. Then, you perform a relevant physical examination, relevant, once again, to what you are thinking. Then, you review whatever clinical data you may have available that moment, focusing once again on its relevancy to what you believe may be going on. Then, you reach a conclusion, which may or may not be a formal diagnosis, and from that conclusion you carry out a plan of action to help your patient. You may order specific medications, laboratories and other studies, request referrals, return visits, admit your patient to the hospital, again all based on what you are thinking at the time.

Finally, when the complex clinical exchange is finalized, you shake hands with your patient; she leaves the room; and afterwards, in the now empty examining room, or later at your desk, or even hours later at home, you finally sit down and dictate or write longhand the entire event that took place minutes or hours before, all from memory!

“What is so strange about this?” a provider may ask. Some doctors may actually be charting like this all the time. Well, what is strange is simply this: What we have just described above is impossible for the human mind to accomplish. The human mind can only recall three or four factoids—if that many—then quickly forgets all the others[xxi]. How in heaven’s name could a provider recall the entire complexity, the nuances, the technical minutia of a specific clinical exchange, even if it happened minutes before, and once again, not infrequently it may have taken place hours prior to its writing, when we are tired at home and drawing on our memory of not just one patient, but sometimes many different encounters, consecutively.

Something else must be transpiring here, something fascinating. In fact, we do not really recall the details of the encounter we experience at all, even though we may think we do.

What we do recall is what ***we believe*** transpired during the encounter, which is a totally different story. In the new field of cognitive neurosciences, this mental process is described as the “Bayesian Brain”[xxii], “predictive coding” style of charting,

or "chunking" of memory units held within our subconscious brain neurons. We have a prior belief of the likelihood of disorders even before we see our patient. As the interview proceeds, we update our hypothesis based on the reported symptoms. What we as clinicians can easily recall from memory is our “concept” of what transpired during the encounter, very much the Kantian concept described earlier. Then we reconstruct within our minds what we believe should have happened during the encounter based on our rich experience in dealing with this type of clinical event in the past[xxiii]. This thought process forms a preset mental framework of the case that was actually residing within our brain long before the patient ever sat in front of us. We are constantly predicting and hypothesizing causes and concepts based on our past experience. This “concept” of the case was present within our subconscious mind, learned from seeing countless similar cases in the past. Our subconscious concept is a product of years of training, reading, making similar diagnoses on many patients, and also of making mistakes. In short, what we remember is a mental construct of the event alongside a minuscule number of "exceptions" taken from the encounter itself. What we recall, what we act upon, and what we later chart on is a mix of a preset thought processes with preciously few added bits of variations derived from the actual experience with our patient. Almost every element in our writing was residing in our memory as a structured litany learned way before the encounter ever took place. During the encounter itself, our brain automatically crosschecked our initial concepts against what we were observing. If a given mental "chunk" or concept did not fit our observation, then we instantly and subconsciously flipped it for another mental concept—our mind stores thousands of them— and we finally kept the very last one in our consciousness. It was that very last concept, the one present when we finally shook hands with our patient, that we could now rattle off semi-automatically, even if hours later.

This chunk of information appears in our consciousness all at once, as a Gestalt. Again, this process does not mean that our concept did not change during the encounter. It was changing all the time as we examined our patient, but it simply means that during the encounter our mind was switching from one preset concept of litanies to another one, instantly and subconsciously, as the examination proceeded, only to keep the very last one in long-term memory. Yes, at the end of the encounter, we are left with our own final concept, perhaps colored by a handful of factoids obtained from the patient. And these factoids invariably fit into what we deemed relevant to justify our final assessment and our entire treatment plan.

And it is also this final concept found within our mind that instantly reconstructs the entire clinical history as described above. Like a puzzle of units of thoughts that come together at once within our conscious mind, our Gestalt regenerates the clinical reality, the one we actually chart on. Note the use of the word "relevant", yes, "relevant" to our personal thought process and to no more than that. As the paper by Bubic Cramon and Schubotz of the Department of Cognitive Neurology, Max Planck Institute for Human Cognitive and Brain Sciences, explains: “...the term ‘predictive brain’ depicts one of the most relevant concepts in cognitive neuroscience, which emphasizes the importance of “looking into the future’, namely

prediction, preparation, anticipation, prospection or expectations in various cognitive domains." [xxiv]Another wonderful Ted talk on the same subject is the one by Anil Seth on how "your brain hallucinates your conscious reality."[xxv]

So, perception appears not to be a passive event or a voice-recorder after all, as the British Empiricists had maintained: It appears to be a Kantian process emanating from within our mind in reaction to what we experienced during the patient encounter. **And it is this all-encompassing personal concept with its underlying semi-conscious litany, the one we actually recall and chart on, long after our patient has left the room.** That is why, as experienced physicians, we are able to dictate a complex clinical history in the middle of the night half-asleep, as any medical student observing this for the first time while on call will attest to in total amazement. Our medical student, of course, cannot pull that feat for the world. The dictated litany simply arrives instantly to our mouths directly from within our semi-conscious mind in reaction to our earlier interaction with the patient. The very the structure of the note is framed by years of practice and experience in handling very similar cases. The charting process is not a passive voice recorder after all.

## The Central Role of the "Assessment"

Let's slow down here, as the following idea is key to understanding the Concept Processor.

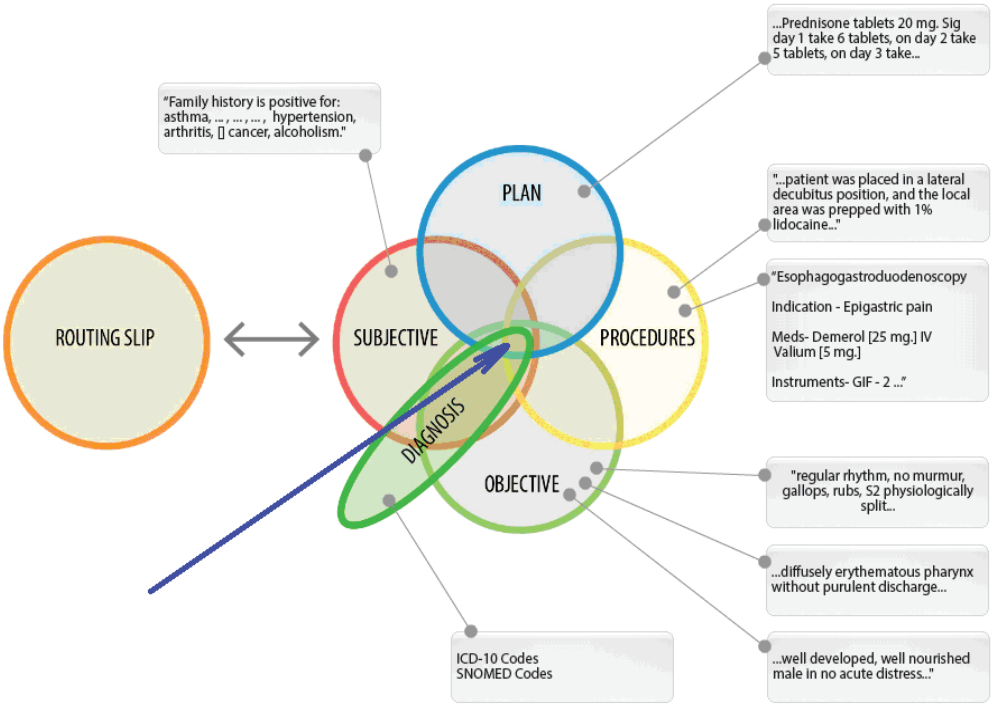



Figure 4. *These Venn Diagrams describe how our minds parse a clinical note semi-consciously. They display how a progress note is mentally broken down automatically, even before it is written down or entered into the computer. Keep in mind that we humans do not think of the actual words depicted on the right side of the figure. Praxis calls these sets of words, these litanies, "Units of Thought." We think of their underlying concepts, without even using words to represent them. The actual words emanate from our minds just as we are ready to utter them. Of course, each one of us uses different sets words, i.e., different syntax to express similar ideas. Note that these units of thought are all related to one another as depicted by the arrows; they link to each other through a neural network that recalls the relationships between them as learned from past use.* ***Note that these circles all intersect at a single point*** *(blue arrow).*

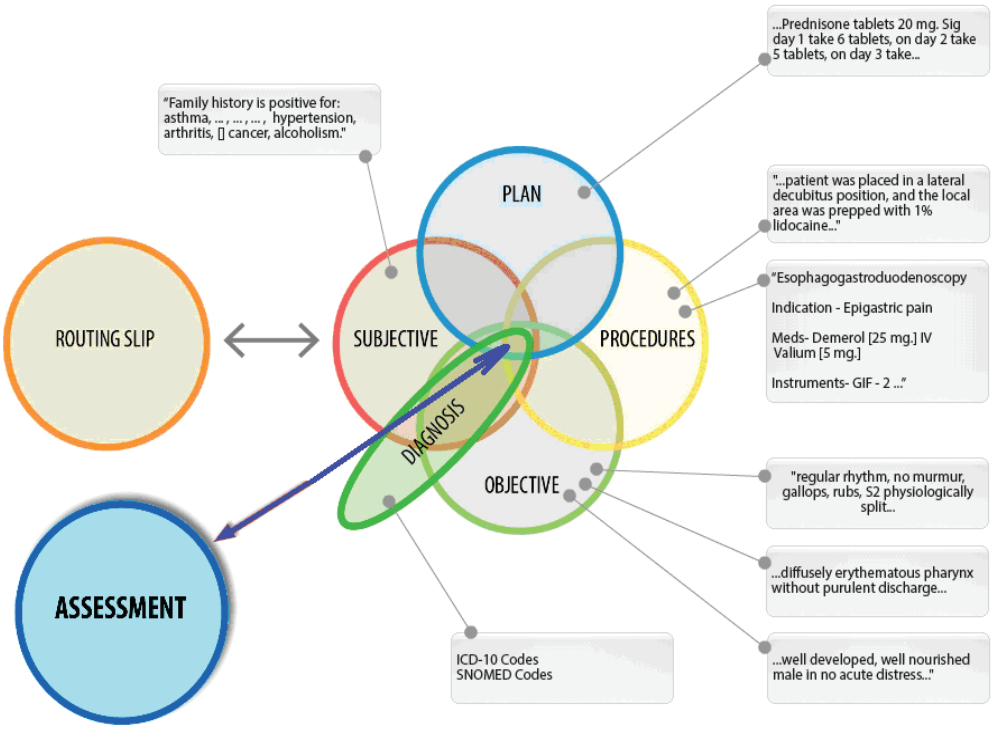



Figure 5. *The point where all our units of thought intersect is called by Praxis the "Assessment," which has a very specific definition. First, note that the Assessment Element is NOT a Diagnosis. The Diagnosis is simply another set of units of thought and no more than that. The Assessment, however, is a different story.*

(Note the use of the capitalized "Diagnosis" and "Assessment" refers to the specific elements or labels within the software application—the mental containers if you will—whereas the use of lower cases for "diagnosis" and "assessment" refers to the individual terms we use to depict each. The same capitalization convention will be used for other Praxis elements, such as the "Agents" to distinguish them from specific agents).

So, what is an Assessment according to Praxis? In Praxis, the term has a very unique meaning which is vital to understanding the Concept Processor.

The Praxis Assessment is defined as "your personal reason for describing, treating or thinking about a case in the way you do."

The Assessment has little to do with what is wrong with the patient, or what we learned in medical school. It is simply a mental concept, a bucket or container found inside our minds, a master concept for the way in which our minds parse the different elements that make up our clinical case, so we can then easily chart it. We do this mental linking instantly, intuitively and semi-consciously. The Assessment becomes the linkage between these mental connections, a holding area that points

our mind to other units of thought to be instantly recalled, mentally retrieved, and semi-automatically uttered, all in one breath.

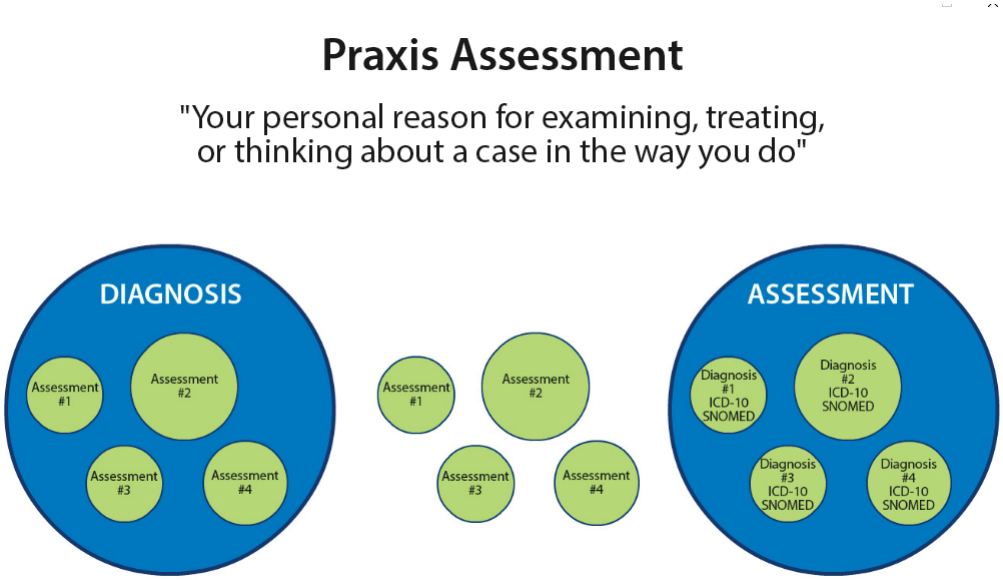



Figure 6. *Three types of Assessments are depicted by the Venn Diagrams above. Like all units of thought, an Assessment is a construct of the mind. It is subjective and personal. The purpose of the Praxis Assessment is simply to link our other units of thought so as to instantly generate a clinical note which in turn helps us think through our case (i.e., our own clinical note becomes a personal checklist of the items we wish to review with our patient today).*

First, note once again that in Praxis, the Assessment is not a Diagnosis; in fact, the Assessment may not include a diagnosis at all. It is simply a way to hold our clinical thoughts together and no more than that. However, this idea, as simple as it sounds, is a most powerful one.

On the left area of the previous figure, we see that a single diagnosis may be composed of countless assessments, as we don't treat a given condition the same way time after time. We treat it in countless different ways, depending not only on the clinical presentation of each, but also on different non-clinical conditions. As an example, a patient may be presenting with financial constraints, affecting social issues, or special insurance requirements. Each small circle, then, represents a deviation from the usual way we tend to treat a given medical condition. And the word "usual" is also a mental construct, and a very personal one. No two doctors think of "usual" the same way, and the Assessment reflects this kind of very personal approach to the art of medicine.

In the center area of the above figure, we see that assessments do not require diagnoses. Indeed, we may not even have a diagnosis at first, but we always know what to do, unless we are a medical student, that is, and in that case, we cannot

practice medicine, either. As an example, a simple case of cough is not that simple. Books have been written on “cough.” What is our diagnosis at first? No idea! So, our assessment of cough does not bring up a diagnosis, but it will bring up a thorough initial history of related symptoms and social history such as the smoking history, so that we may use it as a checklist to initially evaluate our patient. Then, when we figure out what may be going on, we bring our next assessment that completes the job by filling in our entire physical exam, diagnosis and treatment plan, and we are done! It will even generate the Routing Slip so we may get paid. All in one step!

We use the Assessment the way we think. We may start with what is obvious to us at first, perhaps a specific order, medication, an obvious physical finding, or even a chief complaint in the form of an Assessment as just described. This initial action will trigger the neural network within Concept Processor to display the related assessments we have used in the past, sorted by frequency distribution, with the most frequent use on top. We select the closest assessment to what we need and all its related thought units: the history, the relevant physical findings, the diagnosis if we have one, and the treatment will promptly appear on the page to guide us with the case and to chart it for us, all at the same time!

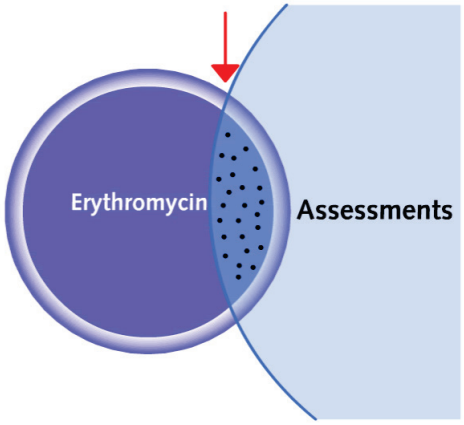



Figure 7. *Short List of assessments related to our use of Erythromycin in the past, sorted by frequency of use. Our medications, like all our other units of thought, are also listed by frequency distribution, with the most frequent drug we prescribe listed at the top. After we selected Erythromycin, we find Acute Pharyngitis from the list of related Assessments, but we are presented with only those Acute Pharyngitis cases for which we had prescribed Erythromycin in the past, and none of the others. So, starting from a specific unit of thought, such as a medication, a treatment, or an objective finding, the search works in the same manner. The Concept Processor’s AI neural network takes us to the relevant Assessment every time.*

The Assessment Element is simply a mental holding area that encapsulates all the other elements of our note, including the new government mandated diagnoses, which instantly appear to be selected when the appropriate assessment within the Assessment Element is selected. The Assessment only has to make sense to us and

to no one else.

So, an Assessment is not a template, although it may initially appear that way. Indeed, “charting by exception” leads to bad medicine, by attempting to fit patients into cookie cutter molds envisioned to handle any given diagnosis and requiring the doctor to edit entire notes with myriads of pick lists to deviate from someone’s idea of “normalcy”. Our patient may be facing financial constraints that require us to deviate from our usual diagnostic or therapeutic approach. We may be facing problems in obtaining permits for studies or medications. We may simply not have the time today to fully examine our patient and might be forced to limit our examination to a limited description set, and, being honest, we chart exactly what we do. We may not have all the facts at hand at first. In short, we must often deviate from following our usual approach for many different reasons, both clinical and non clinical. **However, we do not flip a coin when doing all this.** Each approach we take for describing or treating a case in a different way from what we normally do is represented in Praxis by a different assessment. **So, if we were presented with a different patient that presents with exactly the same set of clinical and non-clinical conditions, we would behave and chart in the same manner.** The only exception to this statement is the not impossible situation when knowledge about the handling of a given case has changed between the last time we saw a patient with this specific condition and today. Perhaps months or even years may have passed in between. No problem! We simply edit our previous text to conform to our newly gained medical knowledge, and the new changes remain improved for all our future cases.

## Instantly Generating the Medical Record

The Concept Processor is an artificial intelligence engine that finds the closest case you have ever seen in relation to the one you need to chart at the moment. It performs this task instantly, with great ease, and then it generates your entire note, with all your prescriptions, orders, procedures, and billing, at once and automatically.

Predicated on the previous discussion is the ability of the Praxis Concept Processor to easily find the closest possible assessment from among the many thousands we may have generated in the past, instantly and without error. At first, it would appear that the task of finding any one of these assessments—to say nothing about retrieving the closest assessment we have handled in the past, among a myriad of similar ones—to be daunting. Yet the Concept Processor gets around this problem elegantly and with ease.

“Common Assessments happen commonly.”

This truism is a variation of Pareto's rule, and in fact it’s what allows us to practice the complex business of medicine to begin with. It is the reason clinical specialties have come into existence. It is what we mean by the word "experience."

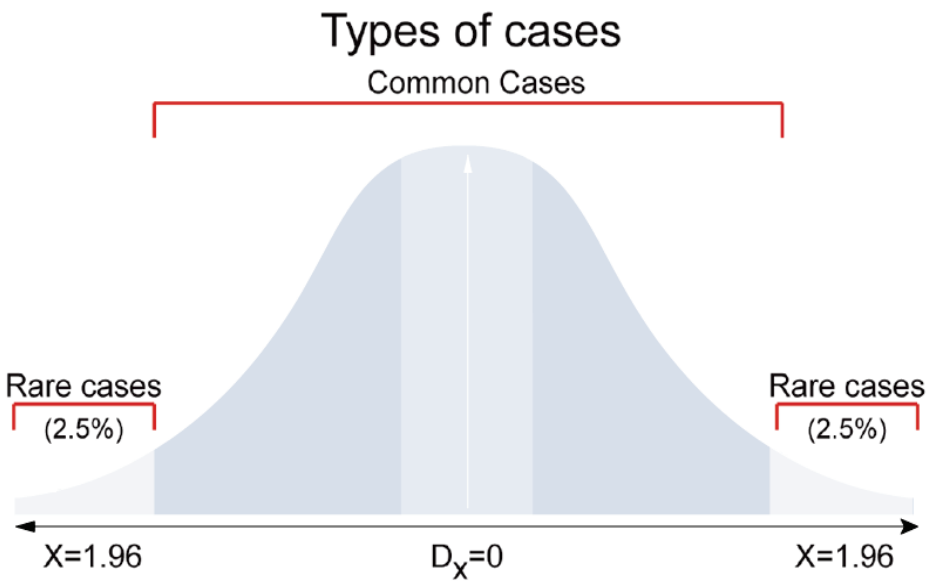



Figure 8. *Cases and units of thought do not present randomly to your practice. Some present far more frequently than you do others. Some you may see once in a lifetime, whereas others you may experience several times a day, several times a week, or several times a month. This happens both at the case level and at the individual SOAP Element level. For example, some prescriptions you may write far more frequently than do others, and the same holds true for laboratory orders, treatments, excuses, procedures, physical findings, historical descriptors, and, course, entire cases as represented by their own assessments.*

The Concept Processor takes advantage of the above frequency distribution of case presentation to make this type of charting not only possible, but straightforward. The neural network engine sorts the keywords created in the past by frequency distribution, with the most common item always listed on top. For example, the most common medication is listed at the top, followed by the next most frequent, and so on down the list. The same holds true for objective finding keywords, procedures, laboratory orders and all other SOAP elements, including, of course, all our assessments. A Google-like engine re-sorts the list with every keystroke we enter, but always by frequency distribution, thus allowing us to reach our desired unit of thought almost immediately.

So, we first find any obvious element of our note, such as a medication, a physical finding, or a procedure, and then the Concept Processor automatically re-sorts our assessment list, displaying only that small portion of the list that includes our use of that initial unit of thought, and it re-sorts this now shorter list of assessments by frequency distribution with the most common one always on top. So, with a few keystrokes, we find our closest assessment, and we are finished.

# The More We Use It, the Faster We Chart

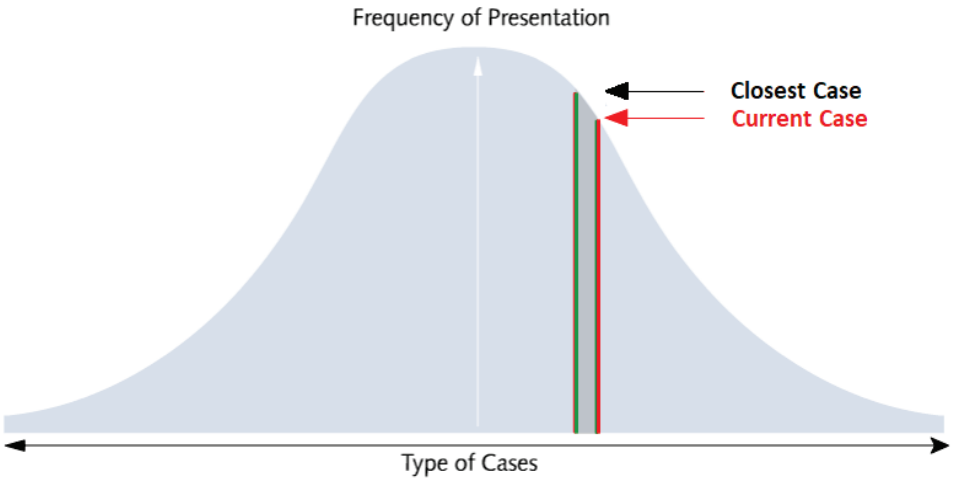



Figure 9. *Praxis will invariably and easily find the text of the closest assessment we've handled in the past in relation to one needed now. If our closest case is not identical to the current one, we change the inappropriate elements, either by flipping individual units of thought for others we might have used in the past, or simply by editing our current text to generate a new unit of thought. Both the old unit of thought and the new one will now exist to be re-used in the future. The more we do this, the less we have to do it.*

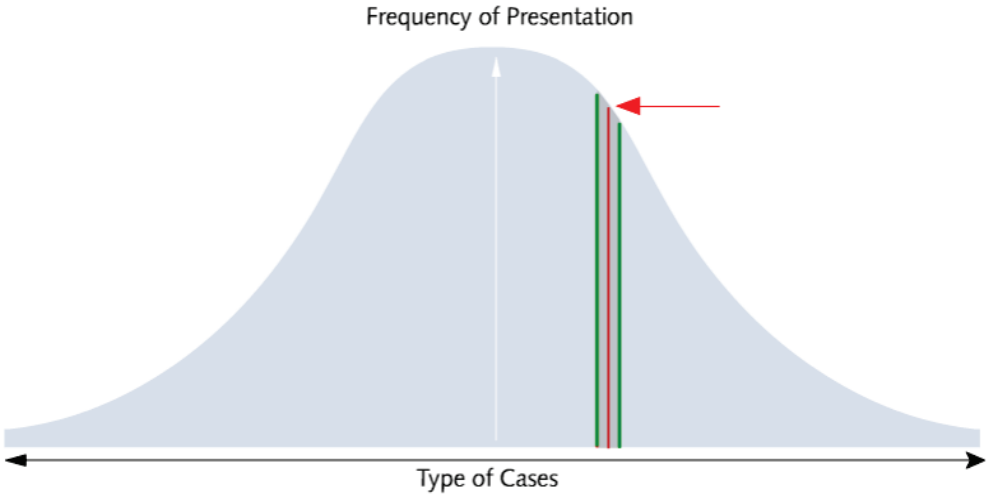



Figure 10. *Then in the future, if we were to see a case that falls between these two closest previous cases, the number of units of thought to be changed or edited take half the time and effort…*

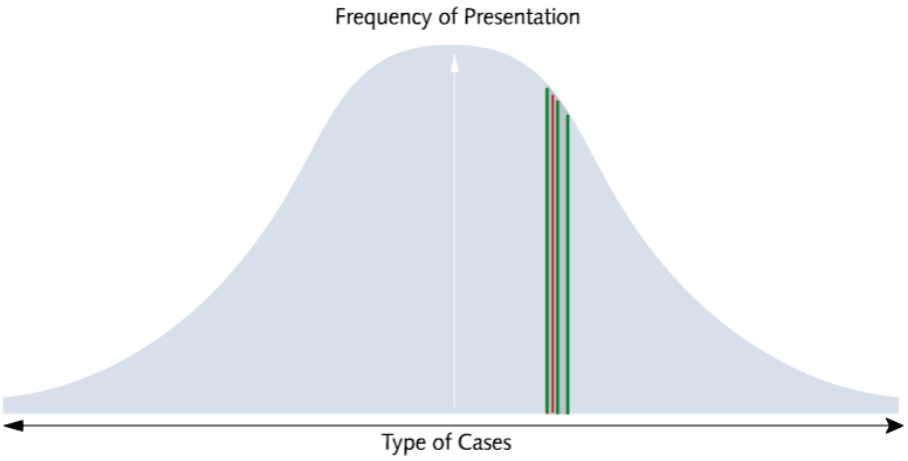



Figure 11. *… and then a quarter for the next such case, and then an eight… until soon…*

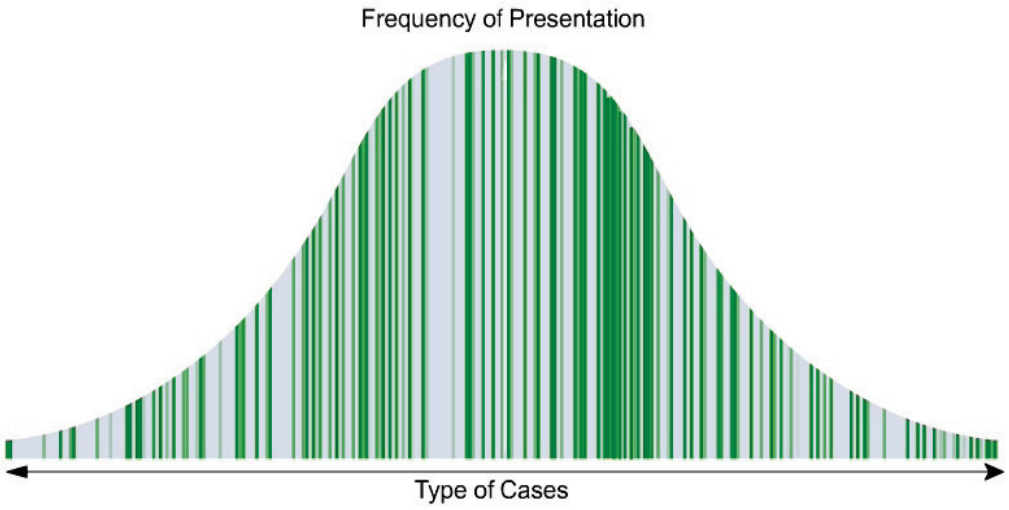



Figure 12. *...our system is charting the vast majority of cases at the speed of the mind.*

Eventually, our charting is almost instant. Our chart turns into a teleprompter, a reminder of our own thought process in relation to any case we encounter. A teleprompter for the mind is a good analogy. We need not lose eye contact with our patient since we know exactly what we are looking for on the page; we wrote it all, albeit for a different patient presenting with a similar or an identical condition. We are using the chart simply to make sure we are not forgetting anything. We are browsing what was written by us in the past and using our reading as a checklist. Our chart becomes a guide that helps us think and act at the point of care the way we naturally do, except faster, better, and more easily than relying upon our memory to do so. We do so with far fewer errors, as our chart never forgets anything it has been taught. Once again, we cannot argue with it, because it learned everything from us. Unless we disagree, we are done charting. And if we do happen to disagree, if our current case differs in any way from what we are reading, the engine learns the reason for the future, and the more we use it, the less we disagree. The Concept Processor becomes an extension of our minds.

In a way it is like driving a car. We can walk home or we can drive home, and in each case we are performing exactly the same task, except that if we drive home we get there far sooner, using much less muscle energy. Here is the same effect except we are referring to brain energy. We are always in control of our charting, except that it is more than that, because here it is our own chart that reminds us to do the things we wish to do; it becomes an alter ego of our mind.

So, when we first review our resurrected clinical history, there are only two possibilities: Either we fully agree with all the concepts we wrote for a similar presenting patient as applicable to our current patient, or we do not. If we do agree, then our charting is completely done. **Not only is our progress note exactly the**

**way we would have done it manually, perhaps with fewer errors, but all our prescriptions with correct strengths, dose forms, directions, amounts, and refills, have been instantly generated on our behalf and, if we approve, sent electronically to the patient's pharmacy, as will be done with all our orders, studies, instruction handouts, procedure reports, admissions to the hospital, orders to others, and even our Routing Slips that include all appropriate charges.** We're literally done not only with the charting, but with our entire case.

And, if we do not agree with any part of the note, there are only two possibilities for that as well: Either we find some mistake in our previous charting, or our closest text does not exactly apply to our current patient for whatever reason. In either of these cases, we simply edit the note as appropriate, which may not even require that we type or dictate anything. We may simply flip one or more units of thought for those we have previously used for other cases, such as changing one type of medication or lab for another, or we may simply activate the text of a different relevant symptom by clicking on it, or, as a last option, we can simply edit the text itself by typing or using voice recognition. In either case, it is far easier to change a couple of things here and there than to perform the entire charting task anew for every single encounter and for every single patient. Then, we save the new note and very briefly indicate why we made the change by changing our assessment keyword, and we have just generated a new assessment for future use. Now we have two close assessments. So, the more we use the program, the closer each case gets to the current one, and the less we have to edit.

The Concept Processor learns all changes made so the number of changes that will be needed progressively decreases as the distance between the new case and the closest previous assessment gets shorter. The time needed to perform our charting continually decreases as does our effort. Soon, the changes needing to be made are minuscule.

Of course, each one of us approaches a given case slightly and sometimes quite differently from the way our colleagues may do it. This is true even when practicing in the same specialty, in the same clinic, and seeing the same kinds of patients. That is the very essence and beauty of medicine; that is what makes medicine an art form. However, for every one of us there is consistency of thought. As an example, others may not agree with us or follow our approach on a given patient, but it is difficult to disagree with oneself, and if that happens, we simply improve our text for the future. In short, our clinical histories are always getting better.

Thus, an Assessment may be thought of as a master concept for any clinical situation we face in daily practice. It represents our own gestalt, our personal approach to illness and to patients. The Assessment is somewhat similar to what our forebears used to call a diagnosis many years ago, before all the coding insanity began to take place, when we could write whatever we wished on the record without worries, but it is also more than that: It is a projection of our thought process. It is what holds our thoughts together. It is everything we will do for our patient today and what we plan

to do for our patient in the future, everything we feel is relevant to chart and do from a clinical standpoint.

The simple fact that we are charting instantly, and saving hours of meaningless bureaucratic work each day, refocuses our mental energies for more useful tasks, such as taking better care of our patients and having more time to relax, which in itself improves quality of care. Most humans hand-write twice as fast as we type. Most of us speak three times faster than we hand-write. Surprisingly, most can read about twice as fast as we can speak or hear.[xxvi] Finally, most read our own writing much faster than we could read someone else's (perhaps more than three times faster!). Thus, we will be charting at 2x3x2x3 or about 36 times faster than we could ever type. Talk about saving time!

As amazing as it is, the extraordinary speed with which we can chart with Praxis is only a small part of the benefits that this unique technology brings forth.

## How the Concept Processor Improves Quality

One might initially think that if one charts so incredibly fast, almost certainly grave mistakes will be made in haste. Perhaps this would lead the provider to be sloppy, cut corners, forget important questions to ask and issues to review; in short, that one would practice less-than-excellent medicine.

The opposite is the case!

### Automatic Habit Changer

Praxis becomes an automatic habit changer. After all, our habits are our best friends but also our worst enemies. Say we learn of a new way to diagnose and/or treat a given condition while we are sitting at a medical convention. Let us further argue that we have always handled this particular condition in a different way: the way we were originally trained. Then let's say that many months later, in the middle of the night, we encounter a patient who presents with exactly the condition we learned about at the convention months before, and now we struggle to remember what we learned. Yes, we could attempt to change our long-standing habit, but we may not recall some of the crucial details or caveats that had we learned about when using this new approach. In short, we might not feel comfortable with making a change at that very moment. We may feel safer to use the old-fashioned method.

Now let's rewind back to the very moment when we were sitting at the convention learning the approach presented for the first time. Right there and then, we simply open our Praxis without a specific patient in mind. We instantly find and retrieve our previous approach via its assessment, make any changes that we have just learned while the material is fresh in our minds, save these changes in Praxis, and then, months later, if an actual patient with this condition makes her appearance at three

o'clock in the morning, we do not have to stress wondering about what new approach we had learned months before. The new protocol, completely vested by us when we had ample time to think about it, is displayed right in front of our eyes, ready to be instantly used with this new patient, including all the diagnostic and treatment options, all the medications, and, if we wish, even the inclusion of any journal references related to what we had learned. The reader of the clinical note is left to wonder how we could remember all those details down to the journal article reference at 3 o'clock in the morning. All we need is, as always, to simply agree with ourselves, and we are done.

This method of charting backwards to help us think, rather than forcing us to later chart on a treatment we must think up out of nowhere, liberates considerable mental energy we currently spend in recalling all the minutiae we have already thought of and handled countless times in the past. It is all a matter of agreeing with ourselves, and nothing is easier than self-agreement. In fact, that is exactly what our computers are meant to do on our behalf.

## Third Praxis Heresy

**It is faster, better, and easier to do what you wrote than to write what you did.**

Yes, with Praxis we are charting backwards, and this makes total sense not only because it saves us an enormous amount of the time otherwise wasted in meaningless documentation, but, more importantly, because it dramatically improves medical quality. The latter claim appears counterintuitive. How can we improve not only our medical documentation, but more importantly, the quality of medicine we practice by instant charting? How can we claim that, instead of rushing through a case, as it may at first appear, charting at extremely high speeds actually improves our thinking process?

## Reduction of Random Errors

To understand how this approach reduces clinical errors by charting instantly, let's take another look at the Bell-Shaped Curve we presented earlier:

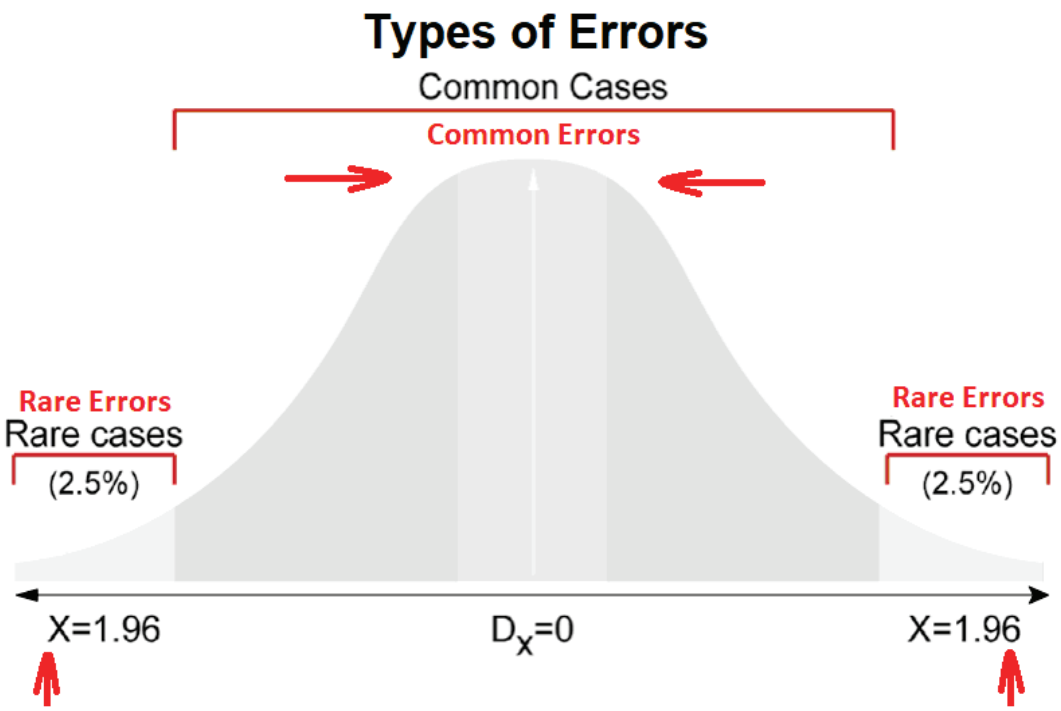



Figure 13. *Rare cases are rare, so rare mistakes are rare. Moreover, when you see a rare case, you are not likely to make a mistake. That is when you wake up! You may ask your colleagues in consultation, admit your patient to the hospital, or at least ask your patient to return the next day to give you time to read up on this issue. No, the vast majority of encountered clinical errors are of the everyday garden variety type, the inexcusable errors, the errors which are not caused by ignorance or conceptual difficulties but from simple human fallibility. These are precisely the kinds errors which the Concept Processor saves us from making.*

If a case was performed correctly in the past, we may use our own note the way a pilot uses a checklist, to ensure that nothing is forgotten or overlooked[xxvii]. So, if the case was performed correctly in the past, it cannot be done incorrectly now. We are following our own directions, found right on the chart. And if perhaps an error, of omission or commission, is uncovered by us today and corrected with our current patient, this error cannot ever return in the future. So, the more we use the software, the less random errors we make. Our own note helps us recall the steps we must take, the questions we must ask, the findings we should be looking for, and the treatments we must order.

For the Praxis Concept Processor, the clinical history really works as a live teleprompter, an extension of our minds. It displays our very personal checklist of symptoms and findings we believe must be addressed during our encounter. The exact words we wish to use will appear on the page right in front of us, in the exact order we wish to see our symptoms displayed, exactly where our eyes are saccading at that very moment, where our eyes expect to see them. Our own text prompts us

to ask the right questions in the order that we normally think. And if, perchance, we think of a new symptom to ask or a new finding to elicit in relation to this very case, we simply add it exactly where we wish to see it and we never forget to think of it in the future. So, the more we use the program, the better the clinical history we elicit. As clinicians, we become both the teacher and the student of our own clinical history. In a way, our chart comes alive, helping us think more clearly through each case we handle. The Concept Processor provides us with that sense of security that ensures we are not forgetting anything relevant no matter how tired or busy we may be at the time.

The old paper record approach, on the other hand, attempts to mimic a sound-recorder, although we humans could never hope to be such a machine, and, as mentioned earlier, even if we succeeded in being sound recorder our approach would have defeated the very purpose for which we are doing all this, which is to obtain a useful clinical history to help our patient. The clinical history is nothing but a very active mental process, something a sound recorder could never hope to replicate. So, the old way of charting is a really a myth, as neither sound recorders, professional court reporters, nor expensive scribes, could ever perform a clinical history without an experienced clinician knowing what questions to ask and how to ask these questions in a way that elicits relevant findings, given the situation at hand.

Some doctors confuse the act of making a diagnosis, discussed at the outset of this paper, with the act of charting the clinical note. This confusion, we maintain, is the result of our training and blind faith in the theory of inductive reasoning. Yes, it is true that some doctors like to "jot down" what the patient may be saying during the encounter to help figure things out initially. In fact, this type “brain-storming” charting is the best argument for writing long-hand—not typing—while we are interacting with our patient. Ali Abdeal, a medical student at Cambridge University, shows in Youtube how handwriting within a tablet PC allows him to use this method as a trigger for understanding new ideas while listening to the lecture. Handwriting, Mr. Abdal argues correctly, leads to a deeper understanding of concepts, just as it leaves a record for future reference[xxviii]. Of course, this may also be accomplished using Praxis with a software like OneNote® or Notability® in any tablet computer, but just as often these same doctors keep those loose notes elsewhere and then throw them out as useless garbage after the fact, although this ‘brainstorming” may also be easily attached to a Praxis note.

The reality is that making a diagnosis today is still as mysterious a mental process as it has always been, often happening within seconds, and most commonly within the first couple of minutes, of a clinical exchange. On the other hand, charting the case the old-fashioned way has always been an ex-post-facto task, after our diagnosis has been made or, in the absence of a diagnosis, after we have figured out what we will do about the issues before us, and often hours after we have left the room.

Charting is not about making a diagnosis, anyway, because the diagnosis always happens first in the mind, before it reaches paper, or in this case before it reaches

the computer screen, although admittedly jotting ideas down may help us think more effectively. Yes, there is the rare patient that truly stumps us, but with all the free time we have saved with our other patients, we may easily afford to spend a few more minutes with this more difficult case to try to figure out what may be going on. And we can always flip an assessment for another one on the fly if we ever catch ourselves pointing the wrong way. Moreover, as explained earlier, we may use a Virtual Assessment without a Diagnosis to elicit a great history regarding the complaints we are evaluating before we bring in our final assessment to finish the note.

Even rare cases are not a problem. The chances are high that the units of thought making up such a rare case are not rare in themselves. This may simply be a matter of flipping one or more individual units of thought for others we already have in our knowledge base to be finished. It may simply involve adding a study, changing a medication, or sending the patient to a specialist, all SOAP items we may have already created for use with many other patients in the past. How different is a fever instruction for the Familial Hemorrhagic Fever from one to treat the common cold? And if we need to type or dictate, we still take off from the closest possible charted case and change it a bit, to make our new case. So even if a case is very rare, it is much easier to generate from other elements that we have in memory, than doing the whole thing anew. If this is how we do it in our minds, why not let the computer do that for us, much faster and easier than we could ever dream of, and of course, with far fewer human errors?

## Charting as a Checklist

The use of checklists in medicine has been described by the work of Doctor Atul Gawande, Professor of the Department of Health Policy and Management at Harvard School of Public Health and Professor of Surgery at Harvard Medical School. Doctor Gawande elegantly explained how most clinical errors are not systematic or caused by ignorance, but are random. Random errors are the consequence of human fallibility when performing complex tasks, something that, as Doctor Gawande points out, may be easily resolved by following pre-made checklists. Doctor Gawande demonstrated how using them for everyday tasks in the operating room, an unusual and difficult locale, results in a dramatic decrease in intrasurgical mortality[xxix]. We mentioned, how, by using Praxis when attending a medical convention, reading a medical journal, or speaking with a colleague, we may immediately amend our knowledge base without even having a specific patient in mind, and when the appropriate patient appears with the condition—perhaps months or years later—our changes will automatically appear right in our note to help us change our habit instantly, just as a checklist would have. Because we vested on the changes displayed on the note perhaps months before, changing our habit when the appropriate case presents to us becomes automatic. Praxis becomes an instant habit changer, and, once again, habits are our best friends but also our worst enemies. As the Praxis third heresy states: It is easier to do what you wrote than to write what you did! We are simply following our own advice; which the easiest to get.

The Concept Processor becomes a powerful and sophisticated checklist generator, except that the author of the checklist is always the one using it. For this reason, it is entirely possible that we may have failed to elicit a relevant symptom or finding for a previous patient that presented with a similar condition. Once we realize this error, or, perhaps, once we learn about the importance of a symptom, finding, or clinical study, or perhaps, when a "pearl" of wisdom simply jumps up at us out of the blue, the correction or improvement (which mean the same thing) never goes away. Our own text works like a checklist that keeps reminding us, forever, no matter how tired we may be, what time of the day or night we are working, how many hours we have been up, or even how many other patients we may be seeing at the same time. The new symptom, finding, study, or treatment entered today will be displayed exactly where we wish to see it and in our own words. We never forget, because we never have to remember. This form of charting in the era of the computer, makes sense. The alternative method of charting using macros, pick lists, and hardcoded expressions created by someone else, does not make any sense at all. In the last analysis, charting is not about typing or dictating, it is about thinking and practicing medicine our own way. Later in this paper we will discuss the fascinating issue of the propagation of ignorance, which is also elegantly resolved using the concept processing technology.

## Why the Teleprompter Idea Makes Sense

Please go back to our discussion on saccading. We see that the eye is not a passive sensor picking up everything located in front of it, but an active and involuntary searcher, subconsciously jumping over the written page hundreds of times per minute, as it captures tidbits of information and sends it to the occipital lobe of our brains for integration. From there the information goes to other parts of the brain to make sense of the meaning what we are presumably seeing. This saccading also applies very much to reading.

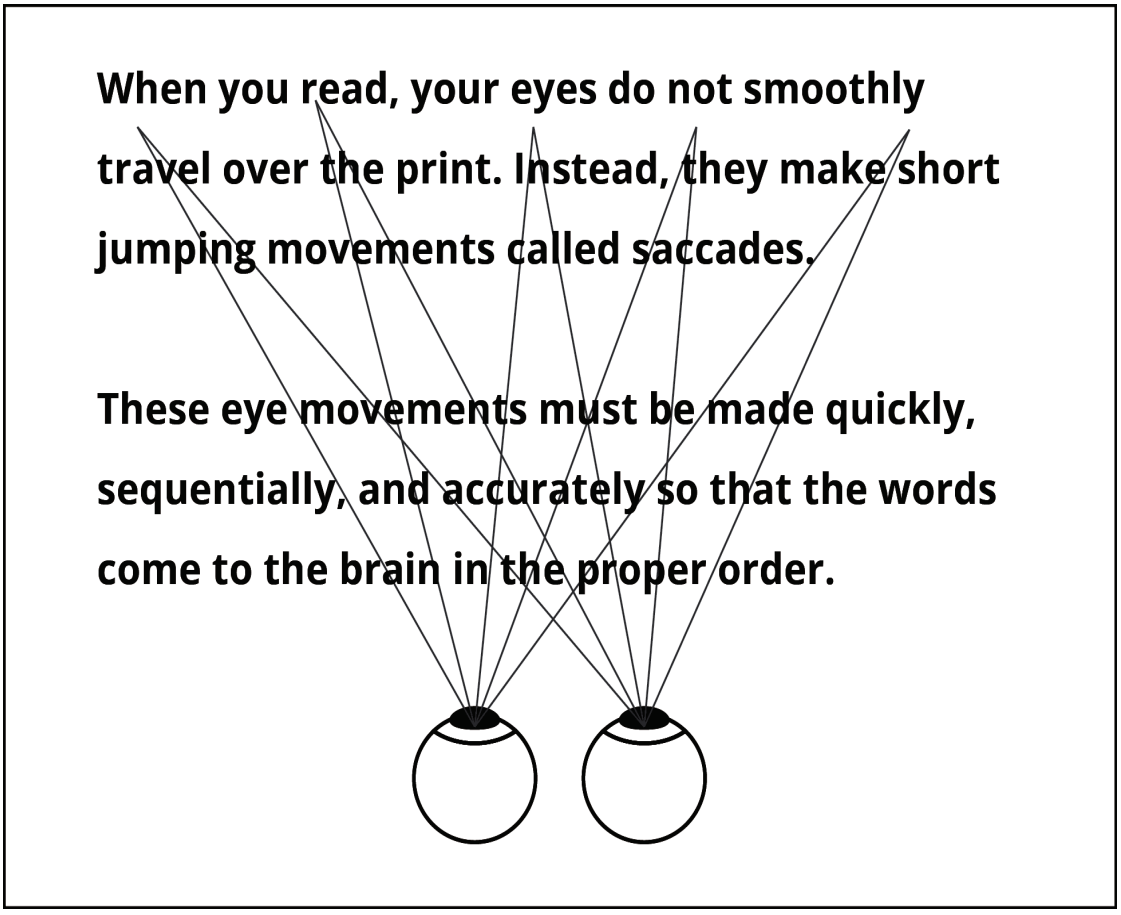



Figure 14. *Saccading as applied to reading. This is just one reason why reading your own writing is so much faster and easier than reading anyone else's.*

We never really read from left to right. Our eyes are predicting where exactly the information we need will be found on the page. Our eyes automatically jump to that very spot ("saccade"), and the very center of our eyes lock on it for a fraction of a second to pull and make sense of the information found therein. It is therefore obvious that our brains decode the text far more easily when we are the very authors of that text. When using templates, the brain is forced to translate the different words, phrases, and syntax order in order to make sense of their meaning. Doing so, the reader may be easily overwhelmed with the data being perceived, missing crucial entries. It is not unusual for providers to miss even more obvious findings that are displayed right in front of the eyes. With foreign text, our eyes simply do not know exactly where to focus, to saccade, in order to obtain the tidbits of information being observed. After awhile, this routine exercise may feel like finding a needle in a hay stack. While working on a templated page, the clinician may easily miss vital information, particularly when one is tired or sleepy. The exercise of reading foreign text is always stressful, even if one is unaware of the feeling of mental discomfort. It is an un-physiologic activity that certainly affects one's train of thought and may cause clinical error. None of this is true if we write all the text

ourselves. So, what is a concept for one doctor, is a meaningless template for another.

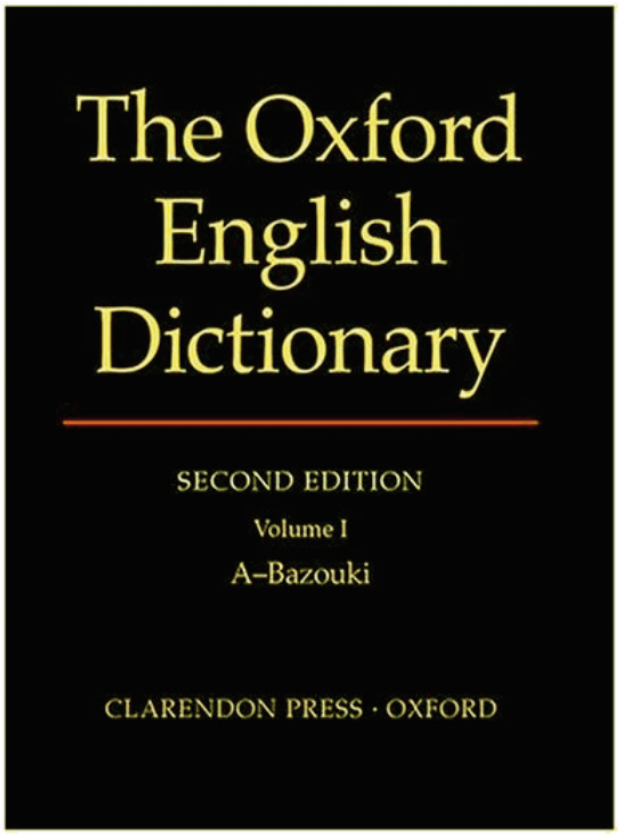
Clearly, when we write using our own words, our own syntax, and most importantly, our own train of thought, our brain has a far easier time finding the location of the relevant text later. Our brain, then, does not have to "translate" our words and ideas as it does when they are generated by someone else using a syntax and order of thought that makes sense to them. So, the idea of a teleprompter is well applied here. Think about a politician giving a speech and locking eye-contact with us. The text on the teleprompter acts merely as an *Aide-mémoire,* helping us to not skip anything we deem important and relevant to bring up with our current patient. Meanwhile, we are focusing on what is really important, our patient. We transmit empathy and listen not only to the incoming words, but to the gestures and unspoken messages that our patient is sending us. We are not worried about forgetting to ask things because we know that we will get to them in due time, so we can focus on what our patient is saying. Think about the patient as well. The fact is that, from time to time, we might take a quick browse at the monitor, which is not the same as having to struggle with the data on the screen to make sense of what we are viewing to the exclusion of our patient. Clients tell us that patients actually appreciate our consulting the monitor from time to time. To a patient, it means you are being thorough, that you don't cut corners with them. This is not the same as being glued to the computer.

## The Learning Curve

A fallacious argument in favor of templates has to do with the perceived advantage of having all the history pre-written by someone else. Indeed, at first, would appear that the amount of personal knowledge and syntax required for the software to work effectively on our behalf is insurmountable. We are often asked: "How long will it take us to have Praxis live in our clinic?"

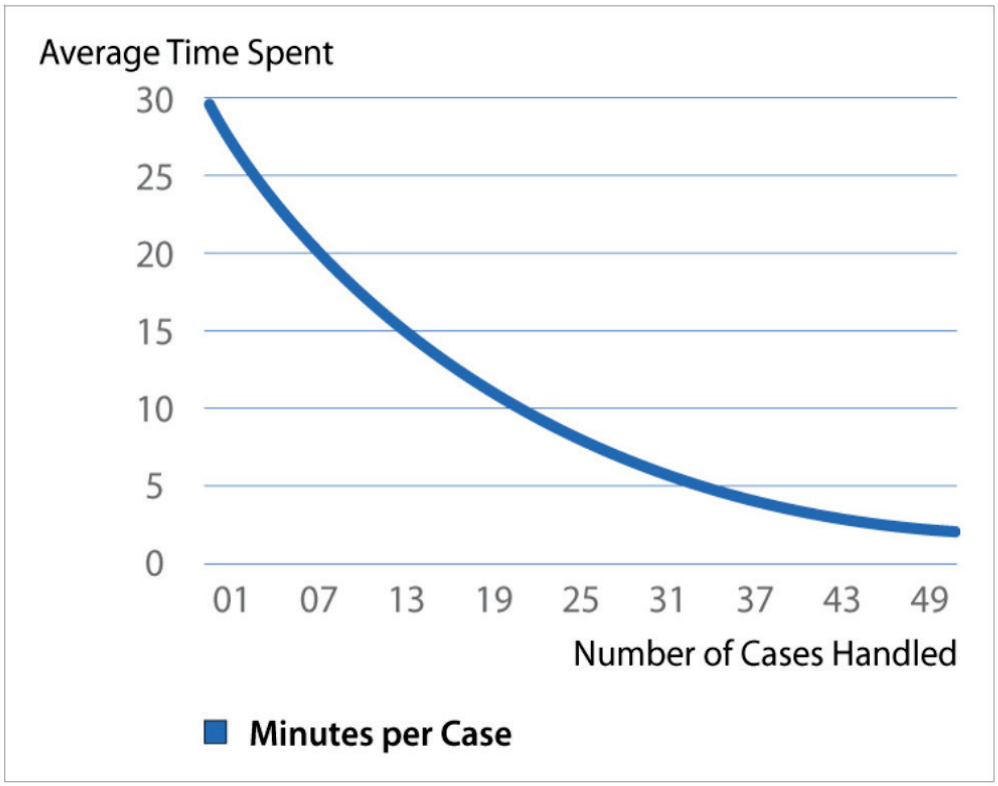
This is an important question, and one whose answer the developers of this program could not even fathom at first. Our initial and fortunately incorrect idea was that, even if the software required us to spend months to teach it our medical knowledge, but then saved us just an hour a day for the rest of our professional lives—and today it is close to two to three hours per day—those time savings would amount to about 13 years devoted to nothing but meaningless bureaucratic charting. So, investing a few months at first would be time well spent.

Imagine our surprise when we discovered that the answer to the question was that it took only a few days to make Praxis work effectively. Why this apparent transfer of knowledge takes so little time, is obvious.




The Oxford English Dictionary includes over 600,000 words in its vocabulary base, but College educated adults use but a fraction of those words: about 1,500 of them on average. Of course, no two of us use the same set of words to express ourselves.

However, what is even more interesting is what has already been explained: We humans do not really use words to think. We use personal concepts that flash in our minds instantly and without words attached as units of thought, that our subconscious then translates by encapsulating complete sets of words, phrases, sentences, and even entire paragraphs while we dictate or write semi-automatically. And these units of thought are re-used by us for many different clinical cases and conditions. So, the real question here must be: **How many units of thought do we need to be able to handle the vast majority of our clinical cases?** And the answer is: Remarkably few, far less than we would ever think possible!




Praxis Learning Curve Assuming 5% Improvement Per Case

The way to initially train the Concept Processor is straightforward. We start the program without any real patients to treat. We first blank our mind, disconnect from the world, as this is a creative act, and then imagine a patient coming in to see us who presents with a most common case. We begin charting this imaginary case as though it were real, using free text. This first exercise will indeed take us a significant amount of time to complete. It will probably be one of the slowest cases we will ever have to chart. This is true not only because there is nothing initially present in our medical knowledge, it is an empty slate—a tabula rasa—but also because, at first, we do not even understand how to use the EMR. Indeed, the first case will clearly not save any time.

However, to our amazement, we will find that the second case we imagine, even if the diagnosis were different from the first one, will take us significant less time to generate. This is so because the Concept Processor has stored all the previous units of thought, such as a normal chest and heart examination, a negative review of systems, perhaps a commonly used medication we might have used, including, of course, its full dosage and directions.

The third case we try will probably be charted even faster. We quickly learn that the

learning curve speeds up geometrically as we add more imaginary cases to the mix. There are progressively more units of thought in storage to rely on. Of course, if we cannot type, we may initially substitute typing for one the excellent speech recognition programs available today. We say “initially” because soon we do not need to type much at all. Because the Concept Processor is based on free text, no different than Microsoft Word or Notepad, it fits perfectly with speech recognition software.

We will find that the learning curve is extremely fast. Soon, we are charting most of our cases in seconds. It is only then that we begin using it with real patients. From then on out, we progress on this editing mode for every patient and every case until we are charting amazingly fast. At that point the charting speed reaches an upper limit. Even though we will be browsing—not really reading—our own writing, this process is obviously not instant. However, we will continue to improve our clinical history by using the most similar one to remind us how we think through each patient and each type of case we handle and add to, clarify, or correct the past. In other words, the quality of the history we take continues to improve way beyond what we could do on paper—the template charting mode is not even in the running here.

Clients report using the software within a month of part-time training, and they also report that this is a fascinating experience, as for many clients this is the first time in their professional lives that they begin to understand how their clinical minds work.

As just mentioned, “reading”, is a way of saying, as we are thoroughly familiar with our own writing, and our eyes really “saccade” or browse exactly on the very spot where we expect to see the information we are searching for. Still, our brain does not work instantly. Quality is a different issue:  We are always thinking of new questions to ask, new findings to check for, new orders we create, new variations we edit, etc. This is a never-ending improvement in our clinical work by using our own chart to help us think ever more effectively.

# EMR Comparisons

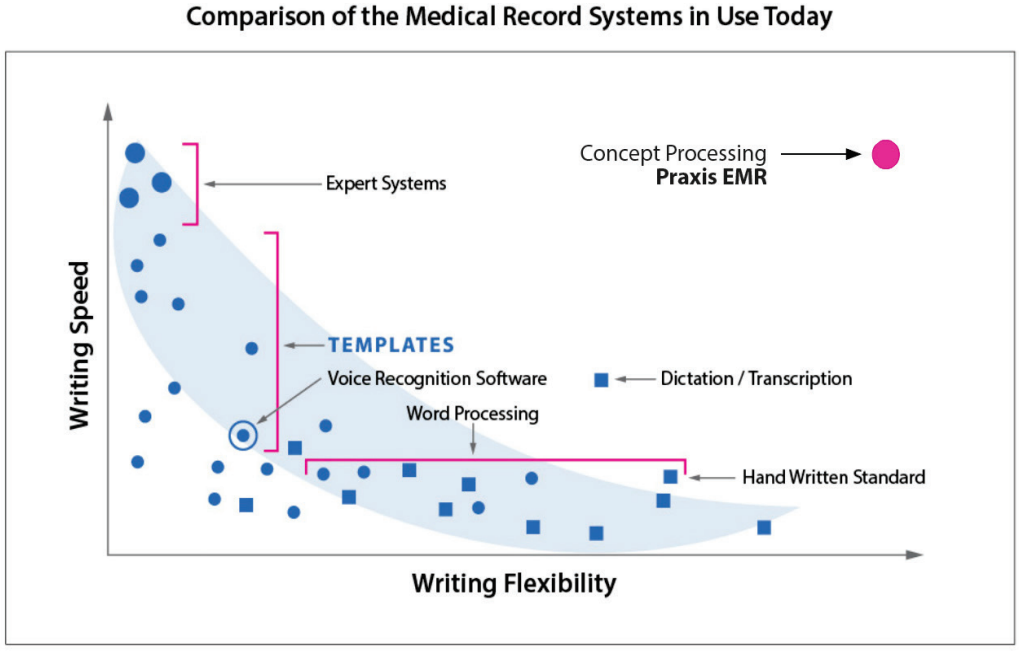



Figure 15. *This curve points out the perverse inverse curve between speed of writing and writing flexibility that exists for all other (template-based) EHRs. Note that although Praxis gets as fast as a totally automatic template system, one which offers almost no flexibility, the speed of charting does reach an upper limit. However, the writing flexibility (horizontal arrow on the top right corner pointing to the red circle) reaches no limits at all.*

# Touchy-Feely Text

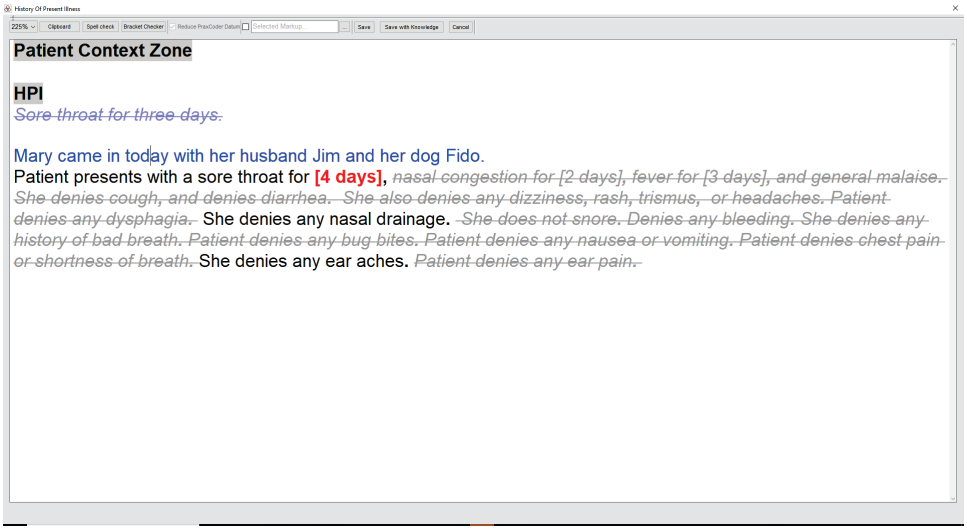
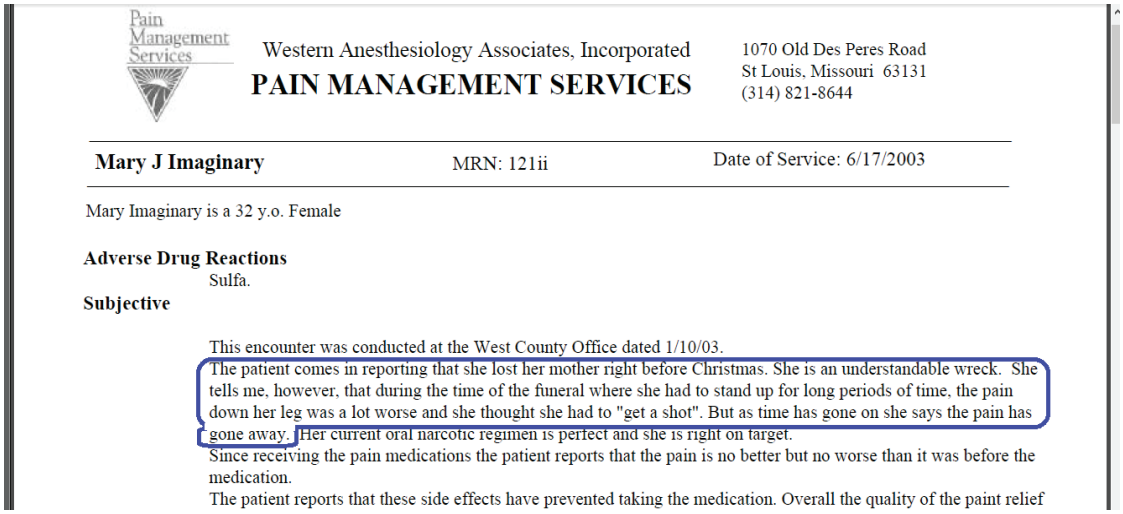



Figure 16. *"Mary came in with her husband Jim and her dog Fido" is called "touchy-feely text in Praxis. With just a click of the mouse it changes to blue color, meaning it will be selectively excluded for use with other patients. Note the rest of the text includes relevant symptoms germane for a case of Acute Pharyngitis, that were generated before with other patients. The symptoms shown in black initially appear de-highlighted. By simply clicking on phrases, sentences, or even paragraphs, we activate the appropriate ones for inclusion in today's encounter. The texts in black and gray may look like a clinical history, but are truly checklists or questionnaires of sorts, which help us think through the relevant symptoms for this condition. In addition, any text we now add to the mix, if we deem it clinically relevant, will be also available to use with other patients in the future.*

Here we touch on a type of writing that for a lack of a better term we call "touchy-feely text" and displayed on the previous figure in blue. This type of text is usually not clinical, and for some providers it may appear irrelevant, but for others it addresses the humanness of the medical interaction, and allows us to break the ice with our patient next time we see her by bringing up "Fido." The Concept Processor handles this type of patient-related text differently than it does the clinical text also displayed in black and gray, for it recognizes that this non-clinical or semi-clinical text would never be used for other patients, and often it might not even be relevant to treating our patient today either. In some fields of medicine such as psychiatry, primary care and medico-legal work such as Industrial Medicine cases this type of text is more relevant. So, the Concept Processor automatically excludes touchy-feely text from our knowledge base for use with other patients. After all, it is unlikely we will meet another patient named Mary with a husband named Jim and a dog named Fido.



Pain Management Services

Western Anesthesiology Associates, Incorporated
**PAIN MANAGEMENT SERVICES**

1070 Old Des Peres Road
St Louis, Missouri 63131
(314) 821-8644

**Mary J Imaginary** MRN: 121ii Date of Service: 6/17/2003

Mary Imaginary is a 32 y.o. Female

**Adverse Drug Reactions**
Sulfa.

**Subjective**

This encounter was conducted at the West County Office dated 1/10/03.
The patient comes in reporting that she lost her mother right before Christmas. She is an understandable wreck. She tells me, however, that during the time of the funeral where she had to stand up for long periods of time, the pain down her leg was a lot worse and she thought she had to "get a shot". But as time has gone on she says the pain has gone away. Her current oral narcotic regimen is perfect and she is right on target.
Since receiving the pain medications the patient reports that the pain is no better but no worse than it was before the medication.
The patient reports that these side effects have prevented taking the medication. Overall the quality of the paint relief

Figure 17. *"Touchy feely" type text is entered manually or by using voice recognition software. It has been specifically excluded by Praxis from appearing with other patients presenting in the future with this condition. Note that text below the displayed highlight is highly clinical and was resurrected similar previous cases. When reading this document—from top down as customary—it would appear that the entire text, in this case a full page long, had been dictated or typed by its author, clearly not the case. This entire case was generated in seconds! (Our thanks to Thomas Johans, MD, Director of Pain Management Services, St Louis).*

## Patients with Multiple Assessments

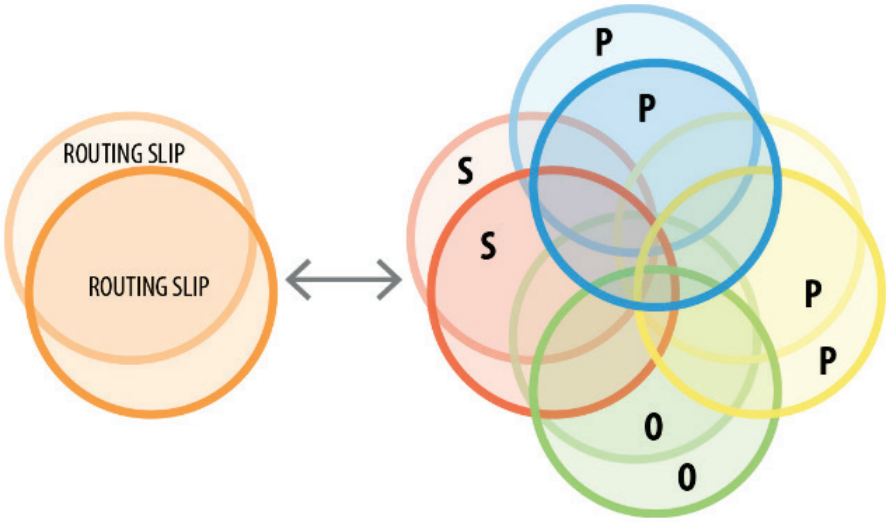



Figure 18. *You are not seeing double. Two different assessments will be combined, logically, in a millisecond by the computer to result in a simple SOAP Note following straightforward business rules. One may merge as many different assessments as needed, instantly, to generate the note.*

The discussion on charting, up to now, assumed a patient who presented to our practice with a single acute episodic assessment, which in most specialties is hardly the case.

What about the case of a patient who presents with two or more assessments? As we all know, this is very common event in clinical practice. Patients often present with a large list of diagnoses. Praxis handles multiple assessments even easier than it does a single assessment. Why this would be the case takes some explanation.

First, merging text derived from more than one assessment is a trivial task for computers to perform. Indeed, computers are built to do just this. It is as simple as merging different elements of the SOAP note depicted by the previous figure's Venn Diagrams, following logical algorithm or “business rules,” as computer engineers also call them. If a patient were to present with abdominal tenderness and an ingrown toenail, the completed text would display both the abdominal tenderness and the ingrown toenail ("Something against nothing is something"). Two identical medications derived from two different merged assessments should result in only one copy displayed, but with the higher dosage of the two. A normal body region description merged with an abnormal body region description should display the abnormal, and so on. Logical rules like these ones are simple for the computer to interpret and use; computers have no problem with them. The result of the merge is instantaneous, errorless, and precise.

Of greater interest, however, is that for most specialties, and particularly for those in primary care, patient visits are most often recurrent as opposed to new. Some physicians report that up to 95% of their patients are recurrent with chronic conditions. These patients may present with a significant list of diverse diagnoses, known as the "problem list," or, more colloquially, as the “shopping cart.” It turns out that for these types of cases, the Concept Processor works even better than it does for a patient who presents with a single episodic diagnosis.

Why is this the case?

## Praxis Chronic Assessments Never Change

The case of the patient who presents with multiple conditions is handled by the Concept Processor differently than it does the patient with a single acute assessment or even a couple of acute assessments. It turns out that a patient presenting with more than three acute assessments will probably be dead! In other words, our typical patient may present with no acute assessments, one acute assessment, perhaps as many as two acute assessments and then a shopping list of many additional chronic assessments that are the same from visit to visit. These are unchanging clinical conditions that recur time after time.

The first realization is that this type of case presentation is more of a management challenge than a diagnostic one. We often know exactly what our patient is suffering from. The question before us, during the encounter, is what to ask our patient today, what to check for today, and what to do for our patient today. Here, the computer can perform a better job than we humans ever could. After all, the computer never forgets anything that it is taught.

Clearly, no real patient presents with a Praxis Chronic Assessment. The Praxis Chronic Assessment is, like its acute Assessment counterpart, a mental construct, not a clinical one. Our real-world patient may present with different symptoms, findings, and treatments all the time, and this is of course reflected in the clinical note. Rather, and without even being aware of it, we automatically parse in our minds the patient’s clinical presentation into a set of chronic assessments that never change, plus perhaps one or two "surprises," or unexpected presentations, which we may find during the patient encounter. These may be unexpected symptoms, findings, or perhaps, complications or exacerbations of the underlying chronic clinical problems. An example of the latter might be Hypokalemia, which could be thought of as an acute assessment (an exacerbation) superimposed on the assessment of, say, Chronic Renal Failure. Another example could be Diabetes Mellitus out of Control on Chronic Diabetes, Hypertension out of Control on Chronic Hypertension, or Asthmatic Exacerbation on Chronic Asthma. Each one of these unexpected acute presentations form independent units of thought—individual acute assessments—which bring along the full diagnostic and therapeutic approach covering those specific situations, and learned from us in the past. We mentally separate these acute assessments from their underlying chronic problems. Thus, what is left when we remove today’s unexpected “surprises,” may include the several

additional chronic conditions that our patient may be suffering from. What remains are all chronic assessments which never change in three dimensions—where the third dimension is "time"—and which the Concept Processor handles as single step—one click of the mouse! The resulting text merges any active acute assessment with all the previously entered chronic assessments we already knew about, and displays it on the page. Like a checklist, the merged text prompts us to evaluate our patient during the current visit, reminding us exactly about what to expect, handle, and document today.

Other EHRs may clone a note from the last visit, a horrible approach fraught with danger, and rightfully frowned upon by third-party payers. Instead, the Concept Processor first dissects the progress note into its units of thought, reconstructing the follow-up note for today's encounter intelligently, automatically mixing our knowledge base for each assessment with the patient's previous clinical history, chronic findings, and expected diagnostic and therapeutic orders for today's visit. The resulting note reminds us of everything we need to ask, check for, and do today. If there were no surprises during the patient encounter—which would be merged in as separate acute assessments—we are finished with our charting almost instantly, no matter how many chronic problems the patient may present with. More importantly, our note reminds us exactly what we need to do during today's visit. And if we encounter surprises, of course, it is just a matter of adding the appropriate acute assessment to handle it, as we do for any case presenting a single episodic condition.

Within this type of note, the patient's history displays in a most interesting and unusual format. The Evolution or Transitional Medical History is a resulting mix of the history taken during the past encounter plus our own knowledge base for each of the Chronic Assessments the patient may present with. It performs this mix instantly by combining our knowledge base text with any specific patient-related information taken from previous encounters and clearly displaying any random parts likely to change during today's visit.

What is fascinating is that the text displayed is not just a clinical history. These are really "questions" written in disguise: This text is a specific checklist of symptoms that covers the relevant issues that its own author believes should be asked whenever a patient returns with these specific chronic problems. Thus, the clinical history is always different depending on what the patient responds to each of our questions. They have in common the syntax—our syntax—describing each individual symptom. And if we are ever surprised by an answer given or by an additional comment elicited, which may include something we would not expect to see as part of the underlying chronic assessment, then we simply add a new acute assessment to the mix and continue our questioning along those lines. These optional assessment additions happen whenever a patient presents with complications or exacerbations of an underlying chronic condition.

This is pretty much also how our minds work. No vital questions can be forgotten

because they all jump up at us from the page, but if a given symptom has ever been omitted by mistake in the past and added today, it will never be forgotten in the future for this patient, and for any other patient presenting with the same clinical condition. As we all know, patients usually volunteer their symptoms at the beginning of the interview with us in response to open-ended questions. These symptoms (sometimes described as the "ticket of admission") may trigger acute assessments, but even when they do not, even when the patient claims to be feeling absolutely wonderful today, this questionnaire should cover all of our concerns in regards to the patient's existing medical problems. And the acute assessment may be added at any time during the interview, even at the end when the patient gets up, says "Oh, by the way, I forgot to add…"

## Charting in Three Dimensions – Health Maintenance

The most exciting feature of the Chronic Assessments is probably the unique way it handles the Plan elements. As mentioned, Praxis defines a Chronic Assessment as an Assessment that **never** changes in three dimensions, where the third dimension is time. Let's look at this point in more detail: When we say a Chronic Assessment never changes, we do not imply that one treats the patient exactly the same way visit after visit. It simply means that the handling of an expected plan element, whether it be a chronic prescription, a specific study (i.e., a blood chemistry panel), or a referral for care, recurs in a patient with chronic conditions with the same predictable periodicity. For example, for a chronic assessment of Diabetes we may repeat our Metformin prescription and a Fasting Blood Glucose at every encounter. Yet, we may order a Chemistry Panel every six months, and an ophthalmology referral once a year. With Chronic Assessments, the actual order remains hidden from the current note until the exact time comes to once again display itself on the record, de-highlighted, to remind us to carry out our own instruction, and not just for this patient, but for any patient presenting to our practice with the same chronic conditions. This means we are reminded by our own chart when to repeat our treatments, referrals, or diagnostic orders, given the patients' underlying conditions. This is Health Maintenance on the fly!

And as we mentioned, if during the encounter we are "surprised" by a symptom, a finding, or a study result, we simply add a new acute assessment that handles our response to the surprise in question, adding all the orders that we feel are needed at that very moment.

In short, the Chronic Assessment remembers to remember, a most powerful tool for the busy provider facing patients who may present with a large list of chronic conditions.

## Honesty and the Concept Processor

Some may argue that if a doctor does not chart after-the-fact, then somehow the resulting write-up is not credible. This argument seems to say that the very act of writing long-hand or typing is a guarantee of honesty. Of course, the fact that many doctors chart their notes many hours after the fact is never taken into account by this argument. And never mind that a dishonest physician may cheat the system by charting about facts that have never taken place, simply using pen and paper. Indeed, one does not need a computer to cheat. The order in which one acts should not add or subtract from one's honesty or good intentions. In fact, using the chart as a checklist simply means that one is more thorough and never forgets to do what is needed: exactly what one wishes to ask, examine, and perform at that very moment. This, of course, is not true of pen and paper, when the tired physician charts in the evening about something that he feels sure that happened during the encounter but in fact never did. We referred to this not uncommon problem when explained the Bayesian Brain on page 26. Memory does not work like a video camera, storing images in protected files; rather we edit our memories according to our emotions and thoughts every time they are evoked, even right after the encounter takes place[xxx].

Because of instant charting, the provider can complete the document during the time with the patient, while the patient is still there to be questioned or examined, and at the same time the provider may double check that everything that was ordered on the Plan section is there to be provided. Of course, the writing should always be accurate, that is, it should honestly reflect the relevant issues perceived at the point of care. To this effect the Concept Processor prompts the provider to review all relevant issues involved within any given case. As explained, the Concept Processor is a checklist that doubles as a chart.

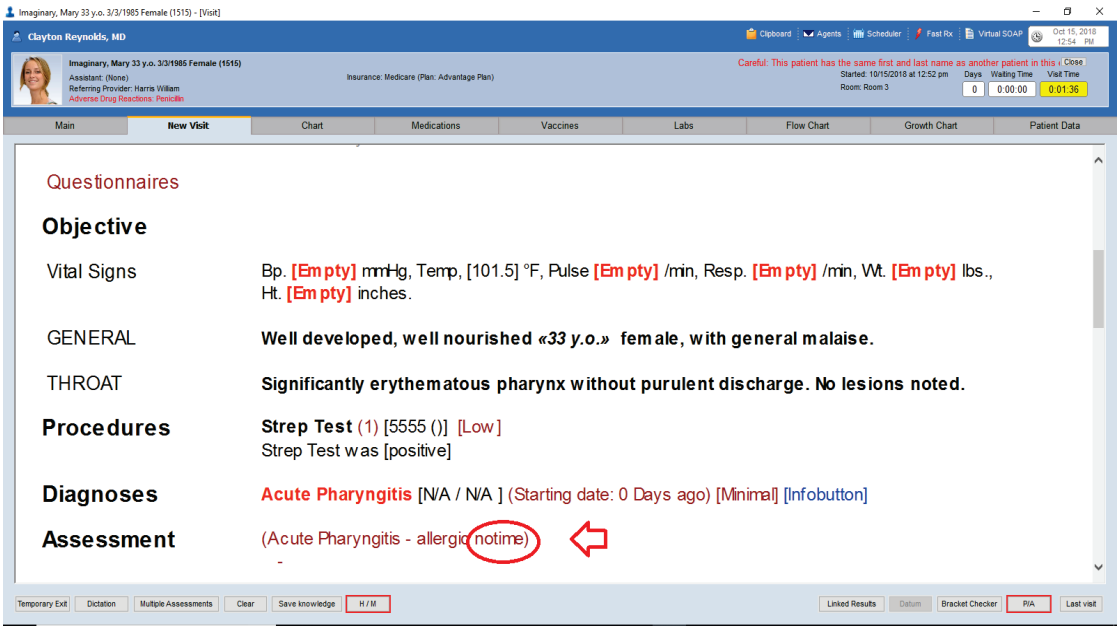



Figure 19. *As an honest physician, we may create this "Notime" assessment indicating we had no time to examine the ears, the nose and the chest. If not comfortable using Notime , write "NT" or any other mnemonic. What we write in the assessment is up to us as the assessment is invisible anyway. In the "no time" assessment, we may also change the patient instructions to have the patient call us in 24 hours to reassure us that everything is fine. This is not a templated diagnosis of Pharyngitis, but our own personal reason for everything we do, or don't do, for whatever reason that makes sense to us.*

The Concept Processor helps us to be even more honest, since we can feel secure that we followed our own checklist or changed it on the spot at that very moment, during the encounter, and while the patient was still with us.

Of the many testimonials we have received over the years, this one sticks out. It was written by Doctor Curtis Harris, who is an Endocrinologist and also an attorney, Professor of Medical Law at Oklahoma University, with a Masters in Computer Science, and of course, a Praxis user. Doctor Harris put it as follows:

*"PRAXIS has much greater utility and flexibility... than a template-driven program. In addition, PRAXIS has another very valuable feature that you may not have considered: that is, enhanced legal protection for the busy practitioner.*

*Good documentation is critical to properly defend a physician against a malpractice claim. However, it is not only important to record what was done, but also to show the logical progression of thought that led to a diagnosis or course of action.*

*PRAXIS requires the physician to record his thinking process, and to refine the logic with each new patient. By focusing on the difference between patients, the record necessarily reflects why one given diagnosis or therapy was chosen over another.*

*This in turn allows the defense attorney to use the record to assert the uniqueness of the patient, and why this therapy was chosen for this patient. Since a physician is not held to be a guarantor of a cure of a good result, but instead must choose an acceptable treatment based on the information available to the physician at the time the choice was made, clear documentation of what was known is usually an adequate defense.*

*There is another related problem that is latent in every template-driven program that is not present in PRAXIS. The templates in other systems are subject to discovery and to use against the defending physician. Imagine how pleased a plaintiff's attorney would be to find that a physician's entire practice could be reduced to a series of simple statements.*

*Suddenly, the art of medicine is diminished, and the defending physician appears to be a mere technician in the way he practices, forcing all his patients into a single mold. However, since PRAXIS is based on the examination of previous patients, these records are not subject to discovery since they are protected by physician-patient confidentiality.*

*While the process by which a physician using PRAXIS to enter data is discoverable, that process is little different than what is now done without PRAXIS. While several other systems provide for such things as accurate and legible recording of notes and prescriptions, it is the flexibility and theory behind PRAXIS that will, in the long run, provide the best legal protection for the practicing physician."*

*Curtis E. Harris, M.S., M.D., J.D., Oklahoma City, Oklahoma*

Honesty is imperative to the practice of medicine, but one cannot ensure honesty by forcing doctors to spend many hours painstakingly writing their notes longhand the way our forebears once did. Cheating has nothing to do with charting.

# Beyond Reading and Writing: Doing Things Intelligently

Perhaps the greatest condemnation that discredits a lifeless paper record is, in fact, that it is dead. The old paper record served for only one purpose, and that was to read from it and no more than that. Other than for its value as a reading piece, the paper is worthless. So Electronic Medical Records that ported this dead paper paradigm unchanged into the computer have missed a wonderful opportunity to be of vital help to the provider at the point of care.

A major advantage of the Concept Processor is that the text generated on the page does far more than simply display itself. Underneath what appears as free text, the AI engine is waiting to automatically carry out the individual orders indicated by the items found within its own writing. As previously explained, the text contained within the clinical history is divided into units of thought. A unit of thought may be considered an "object" in computer parlance, meaning a self-contained piece of data mixed with hidden programming code that works as a unit to actually perform the task displayed. Prescriptions, study orders, instructions for staff, and many other actions indicated within our progress note, can actually carry themselves out as soon as the visit is saved. This means that we need not undertake each task separately from the note, and we never forget to do so. The progress note comes alive and performs for us what it states it will do. All we need to do is to agree with ourselves before we save our note, and then it all gets done.

Let’s look, as an example, at the task of generating prescriptions. Praxis is often asked by doctors who see the program for the first time: "What about the prescription writer?" to which we simply ask back: "What prescription writer? Why should there be one?"

Most other EHRs follow the old paper charting paradigm: The provider writes the entire note, then the provider selects each individual prescription, each study order, each laboratory order, each handout instruction, each order to the staff, each excuse note, and then must even select the routing slip for the visit. Or, perhaps in a different order, the provider writes a prescription for a patient that requests it, and then, if the provider can remember, the note must be charted later. But why have to do all this? Are we saying that what we wrote on the progress note was not exactly what we wished to prescribe at that very moment? Or perhaps what we e-prescribed today should not be exactly what should have been charted? And if they are one and the same, why have to do it twice?

Indeed, as soon as our note is completed, the pharmacy gets their prescriptions exactly how they were entered on the encounter note, the clinical labs get their orders, the procedure notes get printed or faxed in the doctor’s stationery to the

third party that requests it, the instructions and excuse notes are provided to the patient, the admitting orders are filled out on the hospital's own admitting form, and, yes, the routing slip is also automatically and perfectly generated for the visit. All in one step!

Consider a return visit. The first time the patient is scheduled for a follow-up visit to treat a given assessment, we may enter something like this: “Schedule the patient in 6 months for a 30-minute follow up.” We then click right inside the text we have just written, and a wizard window appears where we indicate what this text means, by filling out the appropriate return fields. As soon as we save the progress note, Praxis opens the schedule on the first available time slot, six months from today, and if the patient agrees, we click on the open time slot and the entry is made for the exact time and range appropriately labeled as a follow up. However, the next time we see a different patient with the same condition, we will not only see the same follow-up directions we wrote before for the other patient, but if we simply agree by doing...nothing, that patient will also get scheduled automatically in six months for thirty minutes. In other words, the text we wrote the previous time knows exactly what to do the next time as well.

The same can be said for laboratory orders that are automatically sent to the clinical labs, admitting orders that are sent to the hospital, special forms that are sent to third parties, specific orders directed to the staff and the other health professionals. Nothing needs to be done after the note is instantly completed except nod our approval. The progress note runs the whole show, and since the Assessment runs the progress note, we do not have to do anything. As soon as the note is saved, everything get’s done as indicated by our own charting.

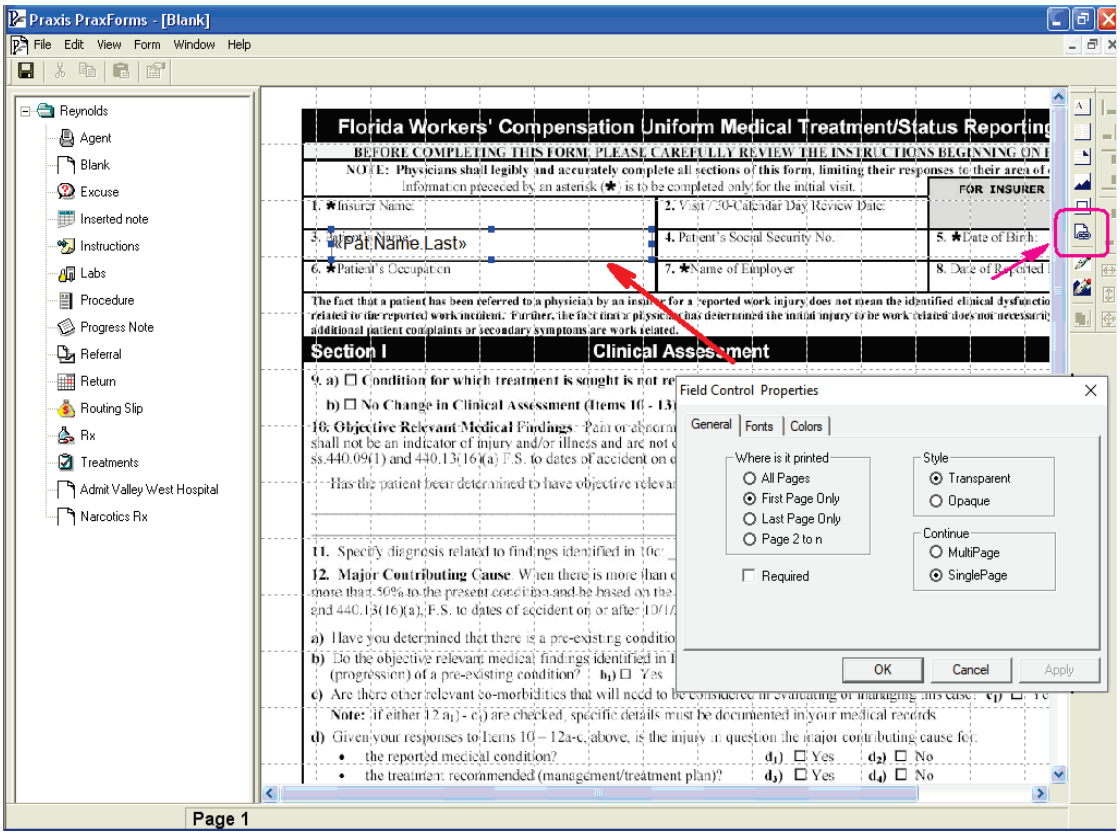



Figure 20. *The Florida Workers Compensation form was scanned into Praxis and each field displayed will be mapped to a different Praxis output field (one such field, the name, is depicted above). From then onwards, the assessment knows it must: 1. bring up this form for assessments that require it, 2. populate it with the data from the current encounter note, and 3. print or fax the form. The recipient will think you had nothing better to do than get an old-fashioned typewriter, fill out their form, and then send it. You do it once, and Praxis does it for any patients and for any encounters that require it, filling out each form appropriately. Nothing to do!*

Of course, the same may be said for billing the case. We are not going to bill identical cases with identical insurances in different ways. As soon as our chart is completed, the routing slip has been generated and sent to the billing software or billing service of our choice via an electronic interface. By the time the patient walks into the front desk, seconds later, the case has been properly billed.

This ability to execute automatic tasks on behalf of the provider by linking the note's displayed text to its very performance is a concept processing feature that no paper record or template could even begin to replicate. After all, why return in six months and not three months, or a year? We have a reason for everything we do for our patient. This reason is learned by the Concept Processor from previous similar cases

and replicated automatically for the current patient presenting with the same condition. This eliminates effort, error, and stress.

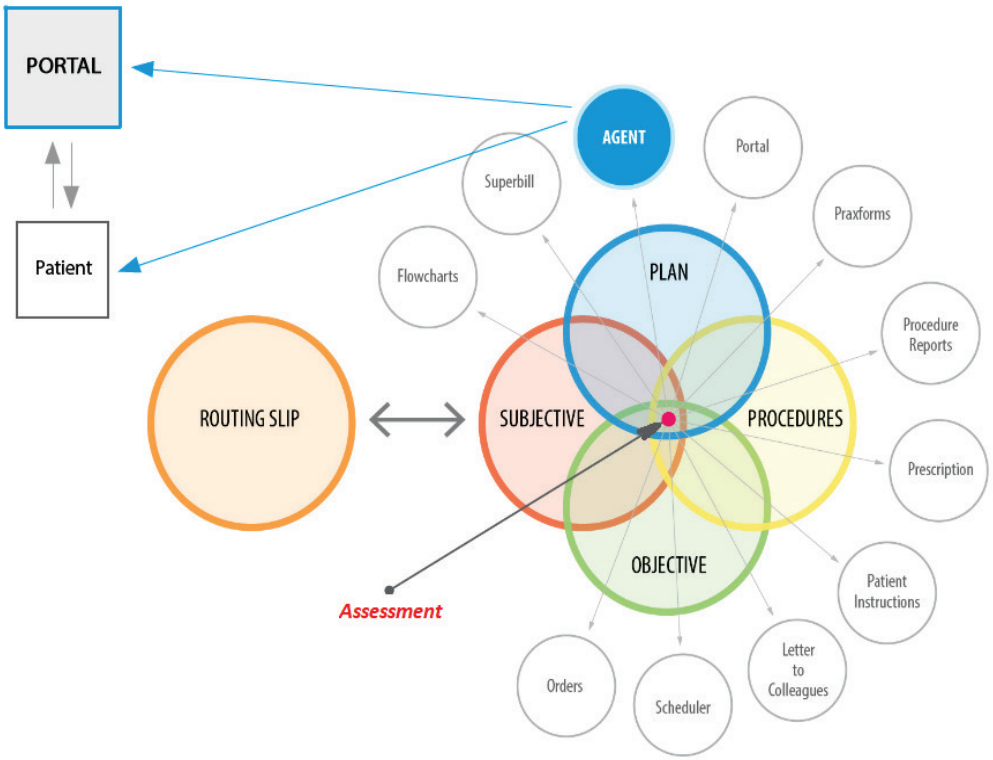
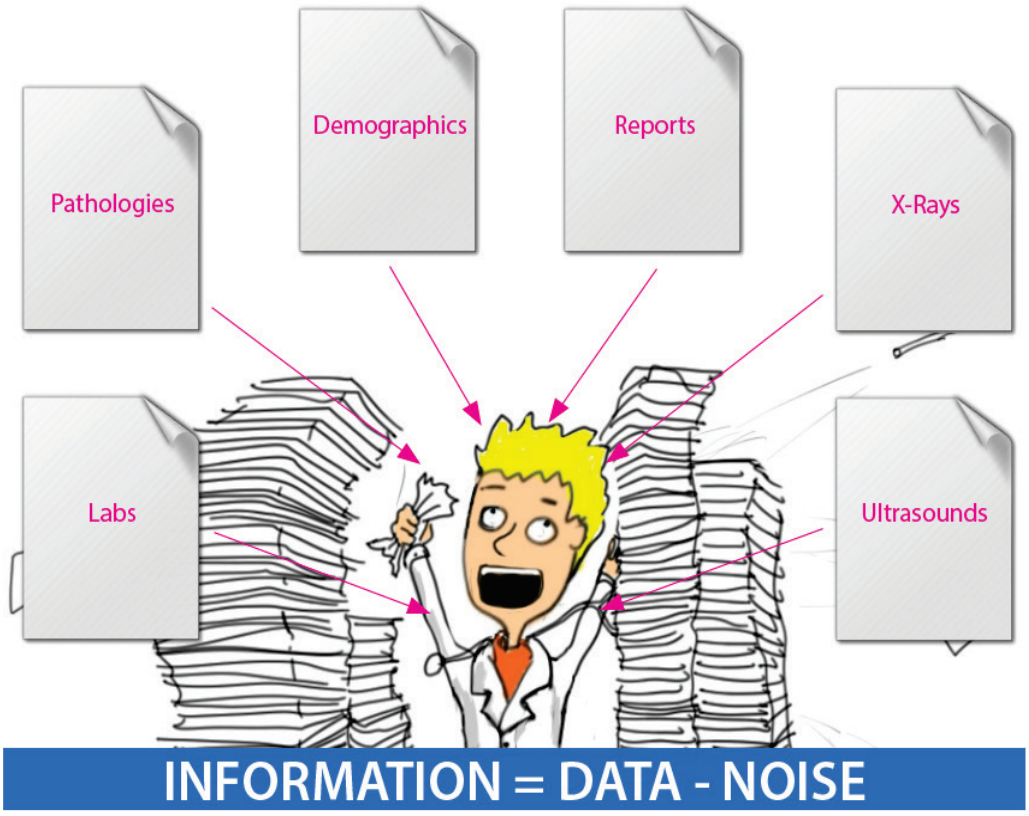



Figure 21. *These Venn Diagrams depict not only the Concept Processor's charting process via units of thought (colored circles), but the action items related to the same Assessment (white circles), such as the Scheduler we've just seen, or the Agents, to be discussed next. The Assessment runs the whole show on your behalf, automatically.*

## Reducing Noise and Information Overload




We have seen that the Concept Processor can actually perform the tasks it displays instantly and automatically. This ability of the computer to act on text goes beyond carrying out our orders. It can also help us make sense of the huge amount of data which is bombarding us daily. For example, why do we need to leave our current note, open the laboratory section located on a different panel or window, struggle to find the specific lab results we are searching for, and then, once we find them, have to remember them, return to our charting, and write it all down without making any mistakes? Don't we have a computer to do all that for us?

The term information overload is very unfortunate because it hides the real problem, which is precisely not "overload," but its opposite: "under-load". The problem lies not with the information received, but with the data received, which then needs to be mentally converted into meaningful information by our brains, causing stress, error, and even illness (the "Alert-Fatigue Syndrome"[xxxi]). The correct term should have been "data overload," which is a totally different concept.

This formula explains the difference between the two concepts:

*Information = Data - Noise*

*Or*

*Noise = Data - Information*

Data can be defined as everything we see displayed on the computer screen that we perceive either by eye-saccading, as described earlier, or by having to click on numerous computer screen windows. As discussed, our eyes can capture and make sense of a very small portion of the data that we perceive at any one time. Our eyes constantly and unconsciously jump from region to region of the screen at high speed, as our brains attempt to make sense of reality, to find the "pearls" that we are looking for in an ocean of overwhelming data onslaught.

Information, on the other hand, is defined as only that small part of the incoming data that we need to make a clinical decision, and everything else our eyes are seeing is simply noise or garbage. This noise causes enormous mental stress that we should not be exposed to at all. Yet, we are exposed to it because the experts that developed the EHR cannot possibly know in advance how we personally think, as each one of us thinks differently. This type of computer noise causes slowdowns, clinical errors, and emotional stress. This noise-to-information ratio of incoming data is simply harmful to our thinking process. It gets in the way of the practice of medicine. It causes patient harm.

Several types of noise may be described:

- Data that we perceive at the moment we are thinking of something else, but that our eyes are picking up nevertheless. This is irrelevant data our brain must ignore.
- Data that we are searching for by involuntary saccading or by clicking on different windows in the computer screen after we could not find it where our eyes were initially focusing. This forces our eyes to continue to saccade, wandering around the confusing screen, and searching other screens by scrolling or clicking until we find what we are looking for, if, in fact we ever do. Although we may be unaware of the eyes' involuntary saccading motion and all the clicking, we are very much aware of the fatigue and the stress all this mental work provokes. We are attempting to find a pearl in an ocean of irrelevancy. The information may be eventually found far away from our initial search site, and this wastes time and causes errors. It is quite easy to lose our train of thought during a long and complex search. We lose patient eye-contact. Our distress is perceived by our patient, and that is not good.
- Data that is not found at the time we need to see it, but that may appear either before or after. We must then place it in our short-term memory until the moment we arrive where we need to record it with the rest of our note.
- Data that is not presented in the format we wish to see it, or equally badly, data that is presented in several alternative formats, hoping that our eyes will select the right one. As an example, if you live in America, you probably wish to see temperature listed in degrees Fahrenheit, whereas if you live in Europe you wish to see it in Celsius, but no one wants to see it both ways, and doing so only adds insult to injury.

  All these mental gymnastics cause stress and place a heavy burden on an already fatigued clinician. Software developers may think they know how you think, but they do not. The reality is that only you know how you think, and sometimes you do not even know how you think until you are exposed to the issue at hand and attempt to separate the chaff from the wheat. Why should you have to do any of that? Underlying the entire noise problem is that what is information for one user, is useless noise for another, as no two of us think alike, no two of us saccade the same way, no two of us use the same syntax, or even the same set of words. In short, no of us look at data in the same manner. The number of errors created when trying to look up disparate results found elsewhere than where we wish to see them is staggering.

  What if the Concept Processor could instantly perform this search process for us by taking the incoming data and then displaying what we are looking for, placing it exactly where we wish to see it, exactly at the time we wish to see it, and exactly in

the format we wish to see it displayed?

How can it do this? Simple, by learning from our own past use! We don't mind doing the above exercise just once in our lives. What we do mind, and very much so, is having to repeat this insane process for every patient and for every encounter.

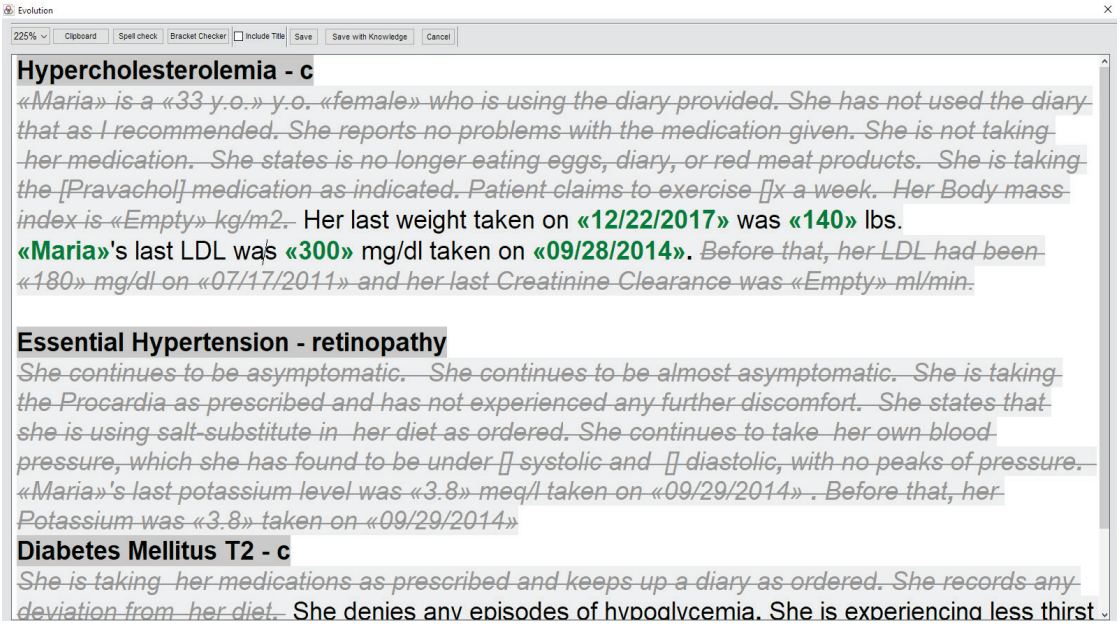



Figure 22. *Datum: Embedded discrete data "objects" within free text operate on data stored in the database and present the results to the user exactly when he or she wishes to see it, in the exact spot his or her eyes are saccading (focusing on), and exactly in the format desired, by learning to do so from this very user. Displayed are also the Body Mass Index and the Creatinine Clearance, both of which are calculated results from multiple internal data values. As usual, clicking on grayed-out text activates it for this encounter. We never forget to think of it.*

In essence, the Concept Processor works backwards: Instead of constricting our writing to multiple-choice markups that, in turn, generate discrete database fields and records, the Concept Processor finds the needed data within the database, then logically operates on the values received so as to display the results exactly where our eyes are looking for them, and in the precise format we wish to see them. The results display embedded within our own free text as though we had typed them ourselves, with no errors. In the figure above, why should we need to look up the latest LDL value in two different laboratory windows whenever our patient presents with this case of Hypercholesterolemia? Why not just have our note instantly display the results we need, exactly where our eyes are expecting to see them? Isn't that the task that computers should be doing on our behalf? The embedding of discrete data within free text written by the same provider who is re-using it allows us to view the information needed at the very moment when we are focusing on the expected spot

on the page. The incoming data becomes an adjunct to the written text on the page and not a substitute for it. The clinical history appears in free text learned from the very provider who created it originally, and the related discrete data—be it a laboratory value, the name of the referring provider, or the Body Mass Index result for that patient—appears embedded with this free text at the precise location we wish to see it, almost magically.

## Turning Discrete Data into Information

We saw how the Concept Processor resolves the abhorrent issue of clinical data overload, misnamed as information overload, but that is just the tip of the iceberg.

Here we are dealing with an area that computer experts are very familiar with, but that we in healthcare may have difficulties in understanding at first. This area deals with the power held within discrete data. Unlike free text, which "does not compute," discrete data can trigger computer program algorithms to act automatically on our behalf. It can "operate" on data. This is not just limited to performing mathematical calculations such displaying the Body Mass Index from the weight and height of the patient as shown in the previous figure. Discrete data is used to activate messages and warnings in our own words, convert our own free text into codes, such as G-Codes and SNOMEDs for third-party computers to decipher, automatically populate flowcharts with information taken from our own note, query any kind of clinical information, and trigger any sort of practice advisory at the point of care. These last two benefits are used in Praxis to reap great benefits from the new MACRA legislation, as explained later in this paper.

What is fascinating, however, is that we see exactly what we wish to see with a high information-to-noise ratio. Yet, because the units of thought on the chart are objects as explained earlier, underneath our written text, things will be happening on our behalf and that of our clinic. Praxis automatically generates any and all discrete data our clinic needs, and even links it via data dictionaries to the abstruse codes and values required by third parties, including the government, yet keep our own text clear, concise, and real for us.

Why have to work with discrete data and codes? Unlike humans, third-party computers do not understand English, so the government and other third parties legislated these codes, which in theory should reflect the reality of the clinical exchange. Indeed, attempting to query for information inside free text is close to impossible today,[xxxii] but querying for discrete data embedded in free text becomes straightforward. This is what computers are meant to do and they do it quite well, just as long as their use does not drive us humans crazy in the process!  Of course, without the Concept Processor, which understands what information we wish to see where, the generation of these discrete data values would be impossible, as no provider has the time or patience to select every code for every patient and for every encounter.


Figure 23. *Datum linked to a smoker field created by the user and then linked to the CMS "official" databases. The value "does not smoke," also created by the user, is actually re-named from the abstruse "Never smoker," which originally came from CMS, and then linked to the appropriate SNOMED code. So, when the assistant or the provider selects " Mary does not smoke" found within their own written text, the government gets its information ("Never smoker") with the appropriate code they need. In addition, the action on these choices may trigger specific practice advisories, a vital feature that will be reviewed later in this paper. Please keep in mind that we see the text written exactly as we wish to see it, in the exact place and time we wish to see it and in our own words. No "saccading" to find information is ever required, and this means fewer clinical errors and stress.*

There is no limit on the number or types fields that may be created, since this never needs to be done more than once, the first time on the first patient who needs it. The actual use of these discrete data fields becomes automatic from that point onwards. Each field appears magically within the relevant text, exactly the way we wish to see it. The values also display when and where our eyes are expecting to see them and translated to our own words. We are reminding ourselves about the information we need to fill out, using our own words and thoughts. And if we ever miss a discrete data value for a given case—like everything else in Praxis—we add it now, once, and have it forever. Our chart helps us deal with the rest of the world in our own way!

## Agents as Ambassadors of the Mind

Of all the automatic features that a Concept Processor undertakes on our behalf, none is more exciting than the Praxis Agents. Agents couple with the Concept Processor to deliver messages remotely, so as to handle the countless tasks and minutiae intrinsic to a medical practice.

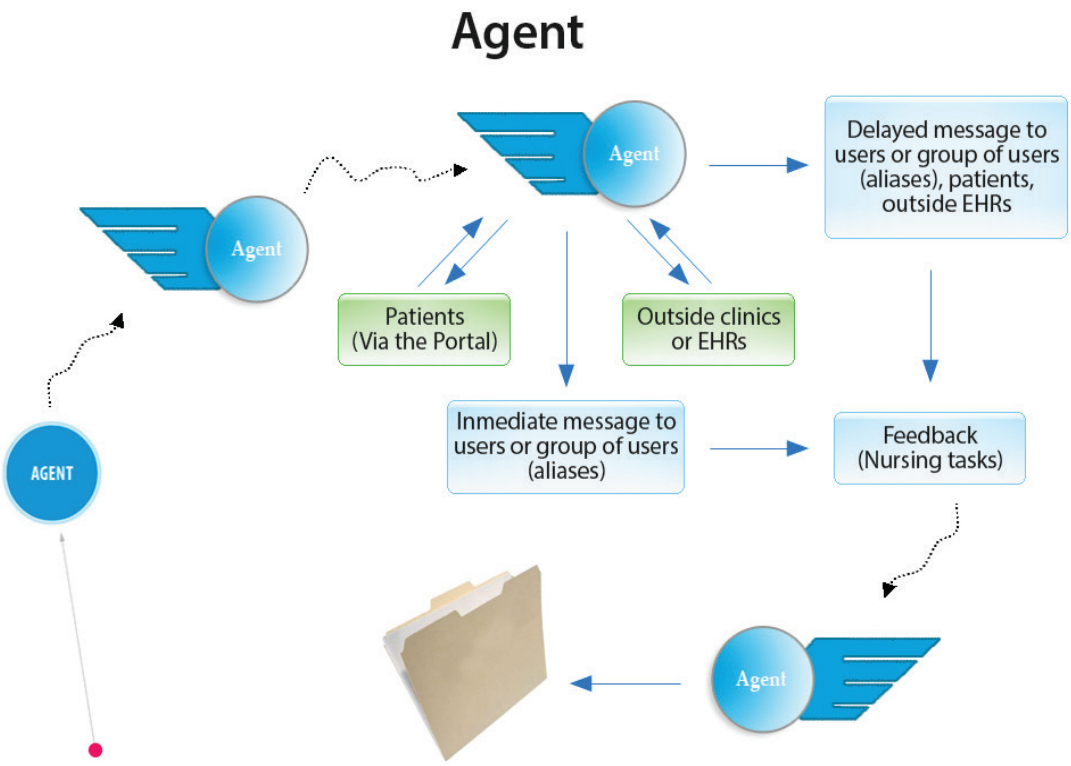



Figure 24. *Agents "do" things on behalf of the provider. They are intelligent messages generated automatically by the assessment of the case. Each agent is taught once, and it knows what to do forever. Agents become ambassadors of the mind, experts in transferring clinical information on behalf of the provider and the staff to other providers, staff members, directly to patients, and even to clinics that may use other EHRs.*

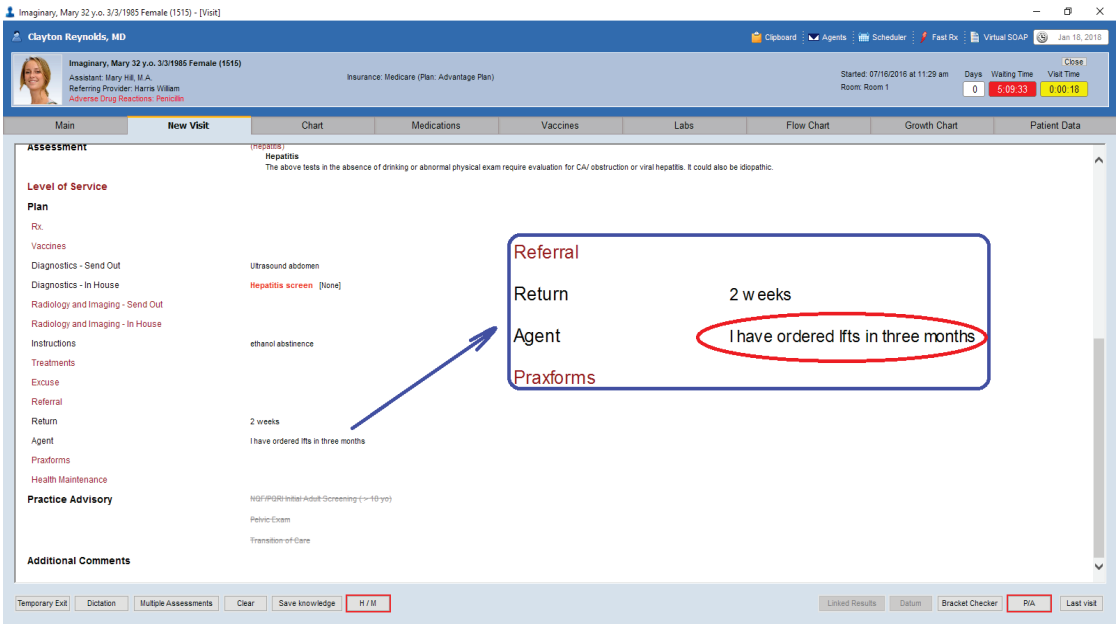



Figure 25. *A Praxis Agent displayed on the chart: This depiction may appear to you as simple text, but the agent within actually performs the task depicted. : This agent will go to sleep for precisely three months from the moment this note is generated, and then wake up to find the appropriate intended recipient, make sure it is read by that user, and then file itself on the patient's record documenting its performance. The actual recipient's name will display on the final note for purposes of accountability. The exciting part is that it is not the provider who sends this message, but the Assessment does so on behalf of this provider. All the provider has to do is to agree with the order displayed and the task will get done. The progress note may include several of these agents, which will leave the chart to perform the different tasks indicated by their respective texts. They are all sent automatically by the Concept Processor as soon as the note is saved.*

Agents can be thought of as "ambassadors of the mind". These are intelligent communication objects, messages, generated all at once by the Assessment as with all the other SOAP elements. They are "intelligent" in the sense that they are set up by the provider once, when first used for a similar case. Each agent within the note knows precisely what to do, where it should awaken and deliver its message, and the user who must read it. Because clinic personnel may be changing all the time, the agent finds the intended recipient, not just by name, but by user roles created by the clinic: Dietitians, billers, phone operators, "my assistants" (for a particular physician within a larger clinic), cardiologists, etc. If there were more than one user found per user-role, the first reader of the message makes it disappear from the inbox of the other intended recipients, to avoid task duplication. The recipient's name then appears on the note for purposes of accountability. Once again, all the provider has to do is...nothing. All the tasks listed by the agents get carried out automatically.

Agents may also be set to trigger under certain conditions, such as when the patient returns to the clinic to remind the provider and staff of what may need be done

during that encounter. Indeed, Agents may be used as self-reminders.

Of course, without the Concept Processor it would be impossible to set up or even select these objects for every patient and for every encounter. This is why the beauty of Agents lies in the power of the Concept Processor to automatically find them and trigger them automatically. All the appropriate messages will be taken care of. And, if we do not agree with any given order appearing on our note, we may easily delete or change it. The reason for our doing so will be learned automatically by the new Assessment, so the next time our note will appear corrected. So, the more we chart, the more assessments we have, the less we have to change our orders and our messages, and the faster things get done. More importantly, we never forget to order the task, or, once ordered, to get it done. Our agents "remember to remember." It is the Concept Processor that makes agents powerful.

By the way, we do not really care to know whether our message or order was read by the intended recipient, be that our assistants, specialists in our clinic, our patients, or even referring physicians via secure email. We do care to know, and very much so, when our intended recipient did not read the message within a reasonable period time that we have pre-set. In that case, the agent comes back to us to warn us. So, no agents back mean no worries!

## Finding the Right Document Instantly

Agents perform many other additional tasks, such as finding the right document, including scientific papers, patient handouts, videos, patient questionnaires, and then port it to our chart for review or to the appropriate party when the case demands it. All this is based on the same idea: We find it once for a given case, and the Concept Processor finds them forever.

## Nursing Task Agents

The Nursing Task Agent is a type of Agent that, in addition to being read by the target recipient, also requires action on their part. The Nursing Task may carry a statement such as:

“Mammogram report received and reviewed by the provider”

This agent may be pre-set to “wake up” three weeks from the encounter date, by which time the Mammogram report should have been received by the clinic. At that precise time, our agent appears in the inbox of the appropriate assistants for resolution. As soon as the assistant opens it, a prominent “DONE” radio button is displayed, indicating that this requested task should, not just be read, but actually performed. If the recipient clicks on this button, the statement above is copied to the patient record, and any appropriate codes (CPT/G-Codes/SNOMED Codes, etc) are immediately released to provide the clinic with MIPS credit for this outcome management task. This powerful feature will be discussed later under MACRA. Note that we do not really care whether the task is performed, but we do care it if is not

performed. If a task could not be carried out, this agent returns to the sender. Again, no feedback means no worries!

## Getting Paid for Chronic Care Management

One might ask, what happens if the Mammogram report does not return to the record within the indicated time period? Of course, our assistant would probably call the patient to ascertain the reason for not getting the study, perhaps obtain a promise from our patient to so, and then postpone the activation of Nursing Tasks for another period of time. A note may also be entered to describe what transpired. But what about the time and effort spent by our assistant in doing all this? What about the time spent calling the patient or tracking the report if the Mammogram was performed by a different radiology group? Who pays for all that time and effort?

Actually, the government will, provided that the time spent working can be measured accurately. Agents measure the time spent on them. Timers also track other actions within the EMR, such as reviewing medical records, reading incoming labs, and of course, viewing agents carrying documentation faxed, mailed, or electronically sent by patients, hospitals, or other clinics[xxxiii]. So, the total time spent by all users on these tasks can be measured for each patient, and the appropriate payment codes sent to the billing software for reimbursement. This is not a minor point. Clinics have reported an additional income of 12,000 dollars per provider per year on these non-face-time tasks. This is what computers are excellent at doing, and clinics should expect to get paid for the additional work in delivering excellent patient care.

*(Please note that this feature is currently in development and should be out shortly. Our thanks to Stephen Hsieh, MD, Director of High Rock Internal Medicine, in North Carolina, who is currently using it successfully)*

## Automatic Communication with Patients

As mentioned, agents extend communication to patients via the patient portal. Agents may include pre-written letters, instructions, questionnaires, and even consents to be signed. They deliver themselves automatically to the patient when the right time comes. At the appointed hour, the agent "wakes up," converts itself into an email message directed to the actual patient or her authorized representative. The resulting email does not carry the message directly—doing so could be considered a HIPAA violation. Instead, the non-descript email alerts the patient to click on an attached hyperlink, which then instantly opens the Patient Portal. As soon as the patient enters her or his unique password, the Praxis knows that the note was read. We say “Praxis knows” the note was read because we do not really care whether the message was read. We care if the note is not read by our patient within a reasonable period of time. In that case, the agent returns to alert us. Once again, as with every other type of progress note plan element, it is our assessment that automatically releases these agents for the right patient by learning from our past use. So, we

never forget to send the appropriate questionnaire or consent for the right condition to the right patient at the appropriate time.

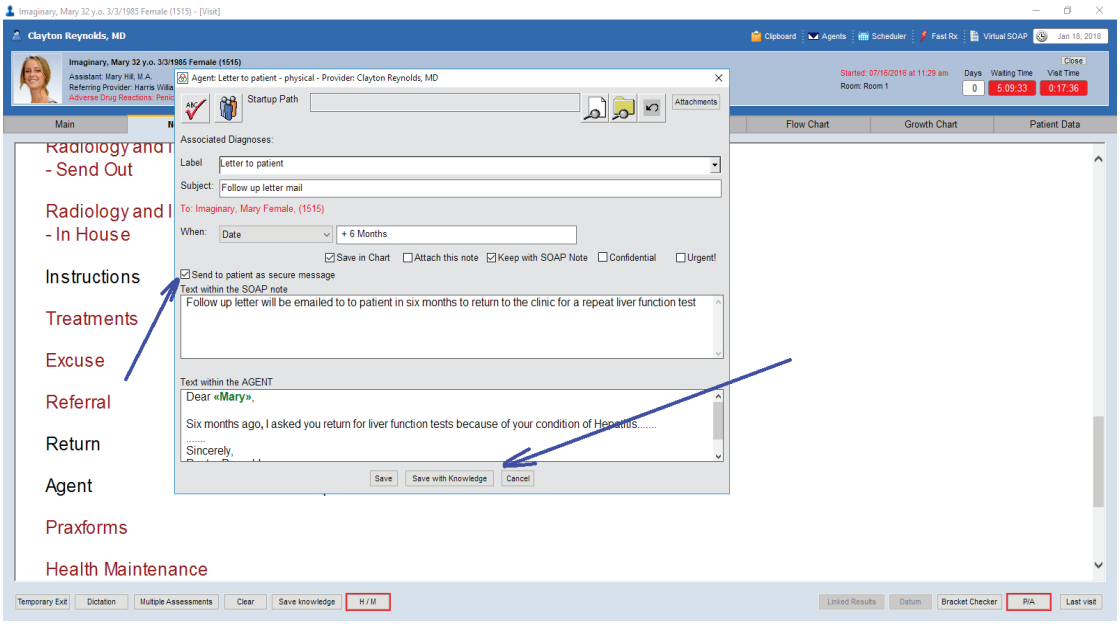



Figure 26. *Agent sent automatically to the patient six months from the date of the visit. All the provider does is agree and the task gets done at the appropriate time. The Concept Processor becomes an almost omniscient assistant.*

## Information Transfer to the Other Healthcare Systems

Currently, Praxis has expanded the role of the Agent to cover sending notes to the referring provider via secure email. When selected, the agent has no idea who the referring provider might be, although it knows that 1. A note to the referring provider is required and 2. What the contents and attachments of the note should be. It is the patient record that includes the information of the specific referring provider. This information could have been entered by the provider or the assistant today or in the past. So, as soon as the Concept Processor returns the specific agent, the datum elements look up the name of that patient's referring physician, and instantly substitutes the appropriate name and secure email information right within the agent's note. The referring provider will receive the personalized note as displayed in the figure below, plus the progress note and the C-CDA[xxxiv] discrete data set so that the recipient's EMR can use is to populate their medical record automatically.

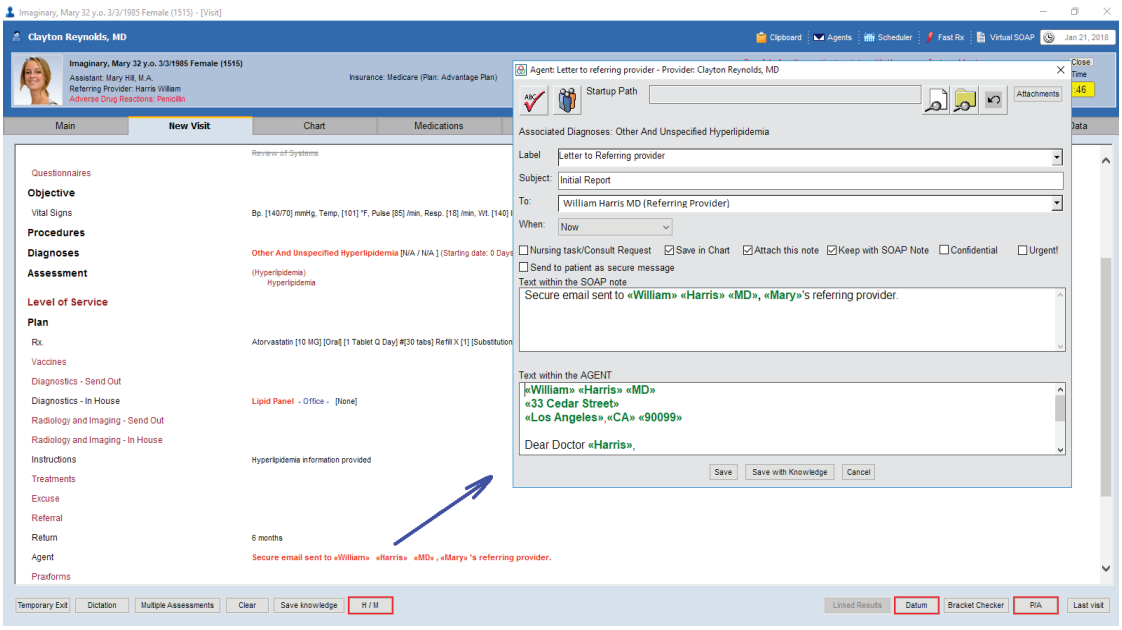



Figure 27. *Agent to referring provider turns into a secure email upon saving the note. One does not need to recall to whom the note needs to be sent, and of course, one need not write up the actual note. All the provider does, as usual, is to agree with the note and the referral, and the note is sent as soon as the chart is closed. In the near future, this feature will be expanded to all specialty referrals, not just that of the referring provider.*

In the near future, Praxis will expand on this feature to include any consulting provider or specific third party. Say an agent is set up to be send to a "cardiologist." If the specific name of that specialist has been linked to this patient's record, then the specific information will be displayed as in the previous figure. The letter and its attachments, including the progress note and the C-CDA, will be sent to that consultant via secure email. If, on the other hand, the patient does not yet have such a specialist listed, then the short list of cardiologists used by the clinic will instantly appear within the agent to allow the provider to select the right one. This action will automatically populate the letter as before, and all the fields so it can be sent automatically.

The beauty of this feature, once again, is that the assessment is both what reminds us which referral is needed, and the kind of information that we must send to our consulting provider. Then, it performs the task automatically on our behalf, sending all the required documentation to the appropriate recipient as soon as we save the note.

And, as before, we do not really care to know whether our staff, our patients, or our consultants ever see the messages we sent. We do care to know, and very much so, whenever our intended recipients **do not read our messages in a timely manner**. So, no alerts mean no concerns. We finish our note, and forget about all about it!

# Making MACRA Marvelous

*Medicare Access and CHIP Reauthorization Act of 2015 (MACRA)*
*(Also applies to MIPS, PCMH, FQHC, "Meaningful Use", and any other similar present or future labels!)*

And now we come to what is probably the most exciting part of the Concept Processor: Its unique ability to handle clinical quality measures, attestations, and practice guidelines demanded by third parties, including the government, and do so with extraordinary performance scores and amazing ease. Medicine is changing its payment system. The approach discussed next is one we believe will revolutionize medicine because it allows practitioners to comply with any kind of clinical guideline derived from third parties, or from the clinic itself, with little or no effort and with extremely high scores. In turn, this should increase revenues for providers according to the new MACRA regulations. And of course, a very high-performance score should in theory improve medical care, which is a goal we all share.

## MACRA Versus Usability

First of all, let us state up front that the ideas behind the MACRA legislation are not only well intended, but also reasonable, even lofty. It is not just that the cost of healthcare has gone through the roof, with atrocious and often meaningless financial checks and balances performed by business-oriented third parties with little if any understanding of the complexities presented to the clinician at the point of care[xxxv]. More importantly, a cost-effective approach to healthcare may not be obvious to the provider without having to personally perform tedious research which he or she is not prepared to undertake while seeing patients under great time constraints. An example is the crucial need to avoid repetitive or overlapping studies, almost impossible to carry out today without an effective retrieval system displaying the disparate information located in diverse settings of care, some of them far removed from the clinic. Accomplishing this, however, is not just a matter of having an effective Internet service and complex clinical exchange protocols of interoperability—which is what the government and the other third parties are focusing on—but fundamentally this retrieval must be accomplished in a way that works with the mind of the provider and not against it. Otherwise, we simply become overwhelmed with the barrage of clinical data, irrelevant warnings, and disruptive messages that interfere with our thought process. Our hands are tied when trying to render the best of care while facing such a data onslaught, incorrectly labeled as information overload. This is a struggle that leads to depression that has forced many colleagues to quit our wonderful healthcare profession[xxxvi].

So, we must first separate the underlying idea behind the MACRA legislation, which is virtuous, from the current inappropriate approach used to resolve it by other EHRs. The template approach to MACRA becomes horrific for those brave souls attempting to provide excellent healthcare under such stressful conditions.

With MACRA, the government strives to reach three major goals:

1. Expedite the transfer of practice guidelines derived from “best practices”.

2. Obtain from providers crucial information regarding actual compliance with these guidelines while measuring patient outcomes from their implementation so as to gauge and establish their true value.

3. Facilitate the transfer of clinical information among all healthcare providers while monitoring quality of care and avoiding duplication of services.

Although, intellectually, providers understand perfectly well the meaning of the clinical guidelines, as imparted by the government and third parties, this is not how we were geared to practice medicine, and no, this is not just a question of training, this is a question of philosophy. The pathology approach described at the outset of this paper is not prepared to handle the field of disease prevention and health management. In fact, we providers remain blind to health, which we simply define as the absence of disease. So, if our patient does not bring up specific complaints or presents with abnormal findings at the point of care, indicating an active disease process, we doctors have not much to say about their health. As a simple example, we may look at the whole field of nutrition, where we see countless books written by so-called experts, which disagree on the very basics of what constitutes appropriate nutritional guidelines, with mutually exclusive theories expounded all over the place. The same may be said for the importance and type of physical activity people should follow, the use of relaxation—indeed, what it means and how to accomplish optimal relaxation—and many other health habits that would presumably decrease the frequency and severity of illness, but that we have never measured unambiguously. Then, we enter the area of chronic care, where handling relatively easy medical issues prevents serious and costly medical complications down the line, and the issue of patient outcomes, where different possible treatments, which imply different upfront costs, may result in different long-term outcomes, with dramatically different eventual costs.

Because the study of health—as opposed to disease—is simply not amenable to tissue biopsies or after-the-fact necropsies, the classical pathology approach which is so useful to diagnose and treat illness, simply does not help our clinical colleagues help healthy patients to continue to be healthy, or to actually improve their health by minimizing potential for future disease. Even when treating disease, the pathology method cannot discern among cost-effective solutions that depend as much on social factors and patient financial conditions, as they do on physiology and pathology.

So, a different direction is needed: an approach based not on pathologic specimens sent out for studies, but on statistical analyses of large patient populations, and this is exactly what computers are meant to do and do best. That is, this is exactly what computers are meant to do best **if programmed correctly**, but with the other EHRs based on templates and the old paper-record paradigm, this is simply not the case. As we explain next, garbage in equals garbage out.

## The “Meaningless Use Dashboards”

One apparent solution made available by many EHRs and healthcare registries has been the so-called “Meaningful Use Dashboards.” This is an after-the-fact grading display that presumably measures how well a provider has performed against the backdrop of MACRA attestations measured during an arbitrary "reporting period."

Even if we assume that the data collected is accurate—a big if given the above discussion—at issue is that this type of display does not really help the provider at the most important moment, at the very point of care. By the time the dashboard is perused by the harried clinician, the patient is long gone, and once again, this is assuming the provider had entered the precise information accurately and completely to begin with—far from reality given the time pressures and complexities of a modern medical practice. So, all that the Meaningful Use Dashboards really accomplish is to increase professional anxiety, doing nothing to help the clinician practice better medicine at the point of care, which should be the goal of any Clinical Decision Support System (CDS). At the other extreme, placing clinical guidelines as “in-your-face” general warnings is not a solution either, because such noisy messaging interference distracts at the very moment we need to be focused: at the moment we are attempting to diagnose and treat our patient. Indeed, this sudden disruption with often irrelevant warnings may easily lead to clinical error. Providers are human beings, not machines, which these alternative solutions seem to gloss over.

Thus, at the core of the problem is how clinical information arrives at the point of care, and how easily it can change our habits as providers once we intellectually agree that a given clinical recommendation is better than the one we have been accustomed to using up to that moment. It is precisely in this area that the Concept Processor comes to our rescue.

We have already discussed how the Concept Processor resolves the random errors in clinical practice, which, as Doctor Atul Gawande explains, are the most common and serious errors in medicine, the obvious and inexcusable errors. We have also seen how the Concept Processor becomes an instant habit changer, automatically incorporating the latest approach to diagnose and treat a given condition once we have vested it while learning about it (page 39). However, the big question still remains: What about the errors caused by ignorance, also known as systematic

errors? How does the Concept Processor help us with these?

## Systematic Errors and the Concept Processor

Indeed, the fascinating issue of systematic error, or errors cause by ignorance, remains to be discussed in this paper. This issue is only completely understood when we realize that the freedom to chart and practice medicine in free text merges perfectly well with the need to learn about best practices, so as to reduce clinical errors and improve quality at the point of care. The latter is what MACRA is all about. The approach taken via the Concept Processor is elegant and unique.

### Errors of Ignorance: Should Doctors Practice However They Wish?

As we have seen, the Concept Processor is simply shorthand for the provider's mind, instantly generating the entire note, which also sends all the medications, diagnostic orders and treatments based on the provider's thinking process at the moment of the clinical exchange with the patient. The Concept Processor simply bridges the tedious and error-fraught conversion from thought to deed.

But what if the doctor is incorrect in his or her knowledge? The issue of propagating ignorance was brought up to us by those who first learned of the concept processing technology. This matter was raised, curiously enough, not by providers, but by the many non-providers that abound in the Healthcare IT industry. The critique itself could be phrased as follows:

"Wait a minute! Are you saying that doctors can practice medicine any way they want to, instead of practicing the best medicine in the one 'correct' way?" In other words, it would appear that the Concept Processor would propagate systematic error. If a doctor handled a case incorrectly in the past because of ignorance, then every time this same case reappears, it prompts the provider to make the same mistake time after time. Yet, the whole purpose of instituting computers in the practice of medicine was to assist providers into practicing good medicine by directing the correct approach every time.

Another way of phrasing the same critique would be: How does one ensure that doctors know how to handle a given case appropriately, particularly if medical knowledge is ever changing? How can third parties impart knowledge at the point of care if providers work in free text not amenable to computer interpretation and control?

# The 3 Rs

The crucial issue of freedom of thought and action versus practicing correct medicine was one we did not even fathom how to resolve back when we started this project 25 years ago, but fortunately we had those many years to think about this fascinating dilemma and brilliant physician clients who guided us along a path that would eventually point towards a unique and amazing solution. It was Doctor Clayton Reynolds, an early Praxis client, and an expert in Quality of Medicine and Utilization Review, who figured it out, perhaps because of his early use of the Concept Processor. Doctor Reynolds' counterintuitive solution resolves the Gordian Knot of quality medicine simply and elegantly. Board Certified in Endocrinology, Doctor Reynolds' passion during the eighties led him to work on medical practice reviews. He actually volunteered to head the utilization review committees at all of the three hospitals of the Antelope Valley, California, a position his colleagues did their best to avoid, as it involved the painstaking review of all of the hospital clinical records and discharge summaries with the intended purpose of finding mistakes in clinical care,  and then educating his colleagues. Doctor Reynolds found this work the source of great learning. Later, he was appointed Disease Management Oversight Team member of the Los Angeles County Department of Health Services, where he was tasked with supervising the evaluation of outpatient quality medicine in their Antelope Valley County clinics. As explained in his paper, Doctor Reynolds was monitoring the clinical staff on the issue of hypertension management, when he found a unique approach to improving quality. He called it "The three Rs of Medical Quality: Reminder, Record and Review" [xxxvii], and later helped incorporate it into the Praxis Concept Processor.

Doctor Reynolds explains his method in very clear and simple terms:

> The Reminder ("R"), the Recording ("R") of the note, and the Review ("R") are all three one and the same!

We will review this fascinating approach to quality medicine, and explain how his method fits what MACRA, PCMH and other third parties demand with the freedom of thought and action providers require to practice the art of medicine unimpeded, which result in a superior practice of medicine.

# Prospective Queries and Practice Guidelines

## Fourth Praxis Heresy

**"There is no such thing as a retrospective query in Electronic Medical Records!"**

What? A computer cannot query medical information retrospectively? This statement

may indeed seem like a heresy. In fact, the entire idea that the Healthcare IT industry and the government had in mind behind the whole push to implement Electronic Health Records on weary physicians was precisely that if doctors could write in "structured language" or discrete data rather than free text (i.e. in codes rather than English), then anyone could go into the patient records and do all sorts of retrospective statistical studies by querying the "factoids" produced by thousands of clinicians reflecting the conditions of millions of patients. As the paper by Doctor Trisha Greenhalgh[xxxviii] points out, it is fallacious to develop theories based on questionable premises. To prove that performing retrospective queries using electronic medical records is logically impossible is actually quite simple.

For a true retrospective study to be carried out, two premises must be true, and if either one of them is false, then such a query cannot be performed. We believe both of them are false and we can easily prove it.

## First Premise: The Programmer Must Be God

The developer of the EHR that created the diverse fields and records must be God. She must be omniscient, knowing more medicine than both the practitioner and the researcher performing the query combined. The programmer must know beforehand all the questions that will ever be requested by the researcher in the future, and thus create all the appropriate fields to handle them, or the resulting electronic searches will not be possible.

## Second Premise: The EHR Users Must Be God As Well

Even if all the fields in the universe were to be to be available beforehand at the point of care, every one of those fields, thousands of them, must be filled out for every patient and/or for every encounter, or the resulting retrospective query could not be carried with anything close to a reasonable result. In other words, the Sensitivity in Bayesian terms of performing true retrospective queries may be close to zero.[xxxix] It seems that the EHR users must be God as well (yes, we agree that healthcare providers are godly, but perhaps we should not go that far!).

Example: Suppose a researcher one day wishes to know how many patients of a given clinic have green eyes. Why would a researcher wish to have this information is not the question here. Let's just imagine this is the case. Let us also argue that the programmer, being God, has actually created the field for the color of the eyes, knowing beforehand that the researcher would wish to know this information some day[xl]. Would then the researcher obtain anything resembling accurate data? Of course not! It is highly unlikely that the busy clinic staff would have thought of checking for the color of eyes on every patient coming in without any previous prompting from anyone.

And if either of these premises are false—and we believe they both are—the whole edifice of retrospective queries crumbles down like a house of cards.

## The First Alternative Solution

***A retrospective query is a prospective query in disguise.***

Now, this is a totally different idea!

With the other EHRs, if we wish to do a query in the future, we would first ask our friendly programmer to create the field if not already present, and then we would request that everyone in our clinic fill out the values on every patient and/or encounter as required. Then, **afterwards**, after the clinic staff stops grumbling and remembers to fill the required fields on every patient or encounter as required, another big "if", we could do our query pseudo-retrospectively, which could accurately measure only for the period of time after this specific field was implemented and filled out.

## The Second Alternative Solution

***A prospective query is a practice guideline in reverse.***

This is the Three Rs' insight into the solution. It comes from the discovery that the clinical note is a projection of the provider's mind. The query, on the other hand, is a projection of the researcher's mind, because it is the researcher—whoever that happens to be—who initiates the query, requests the report, or sets up a quality attestation, all of which mean the same thing. Because the information being queried may not have been inputted prior to it being searched, it will simply not be found by searching the dead record a posteriori. However, if the search is performed after the appropriate user is advised to fill out the information requested at the point of care, then a reliable report may be generated for the period in question. And the Praxis Practice Advisory Agents can perform just such task to perfection and with great ease.

## Practice Advisories: Communicate at the Point of Care

We have already looked at how the powerful Praxis Agents work. As described earlier, Agents are intelligent messaging objects which know exactly when and where to appear to impart their information or issue their orders. They are easily programmed simply by daily use so that with subsequent similar cases, the sender need not think about issuing the minutia of orders and checks time after time. Agents may be linked to the Assessment of the case so that it is the chart itself that reminds its provider regarding what that same provider wishes to do for that specific condition and what messages they wish to convey when and to whom. Agents may also be linked as free Agents of the clinic, so they may be used by any staff member to automatically send simple or complex specific messages to the right parties at the right time by a click of the mouse. Agents also document accountability, by noting in the same message when and where the orders were carried out and by whom. Indeed, Agents can warn the sender if the messages were not read by the

appropriate recipient after a reasonable time, or whether they could not be carried out for whatever reason. Of course, Agents also file themselves intelligently in the patient record, under the right category, so that one may review what was done for the patient and when. Finally, Agents may also be triggered by events, such as the next appointment visit, or the next time the patient sees the nutritionist in the clinic. This last ability of Agents generates the most powerful practice advisory engine in medicine, which we review now.

A Practice Advisory is a form of Agent or intelligent message which, instead of linking its content to a specific patient, it links it to a specific set of preset conditions that may exist in a given patient and that would trigger whenever an appropriate user meets the patient who meets the criteria. For example, the appearance of this agent may happen when the encounter or record includes or excludes a set of discrete data values, such as the age, a given diagnostic code, a given medication, a given laboratory value, even data fields created with ease by the clinic (i.e., "Pain Quality greater than 6 out of 10"). A given period of time may also be set from the last time the same advisory triggered for the same patient. For example, advisories may be set to trigger once year, for every visit, or just once in a lifetime. These advisories are so easy to set up that they may be created by just about anyone without any kind of programming knowledge.

The second fascinating aspect of these advisories is how they display on the record following the Three R's approach. The second R, the recording, is most interesting. For example, an agent may send the following text, which would trigger whenever a provider opens the chart of any patient who is a smoker:

*"Patient was told not to smoke and was offered medication to quit."*

Note that the above advisory does not present itself as a recommendation. It is a de-highlighted fait-accompli. Simply clicking on it will chart it on the record, implying, of course, that the task was done. Note that doing this task ("Jim, don't smoke! It's bad for you!") is faster and easier than having to type the line. More importantly, we cannot forget to do it. Then, our performance of this advisory, the fact that we "activated" the object by clicking on it, makes it automatically queryable. And the result on performance attestation? You guessed it, 100%!

So, the recipient of the advisory simply clicks on the appropriate text and the response can then be queried by the researcher afterwards. Advisories should probably also carry a note indicating reasons for the request, so as to ensure compliance.

In short, a practice guideline, a clinical record, and a query are one and the same. The advisory and query are messages, although they travel in opposite directions. The advisory is created before the event is to be queried (i.e., prospectively) and must reach the appropriate end user as consumer of the information at the very moment when that user would be ready to act on it. And both, the practice guideline

/ query, carry back the resulting action by the target user. Therefore, every practice guideline implies its own built-in performance query, even if it does not appear as such.

For example, the message that appears right on the record states:

*"I informed the patient of the risk of tobacco and offered medication to quit..."*

Afterwards, the researcher may check on results by querying the activation of this data retrospectively ("Percentage of patients aged 18 years or older who were told not to smoke and were offered medication.")

And because of the Concept Processor, when a provider accepts an incoming practice advisory as reasonable, it may be added to his or her list of assessments, thus changing habits automatically. In the future, the request or treatment will be presented instantly and noiselessly by Praxis and prevent the prompt from a Practice Advisory. Using Datum, the provider may include the required SNOMED or G-Codes for attestation as well. They are generated in the background automatically whenever the free text is activated. So, the codes do not affect the practitioner's normal thinking process or writing approach, yet they link to the patient's encounter, so that it may be retrieved by the researchers performing queries in the future. Because the recommendation appears exactly in the format desired and at exactly the appropriate time and location on the chart where the user's eyes are saccading at that very moment, there is no information overload when following practice advisories**.**

With that, Doctor Reynolds' Three R's greatly simplified the field of MACRA. We are often asked by potential users how Praxis sends the information to the government, but that is not the crucial question at all. The crucial question should have been: "How can I score close to 100% performance with minimal effort on my part?" or, perhaps, "How do we get the right data in?" and not "How do we get the data out?"

So, a Practice Advisory is an intelligent Agent that will trigger at the point of care when certain conditions are met. Not only is the guideline written as a fait accompli, as an indicative sentence where the advice is implied, but once the text is activated by the appropriate user, it not only charts itself as "done" but will announce its performance to the world by automatically triggering the appropriate codes required by the third-party agencies.

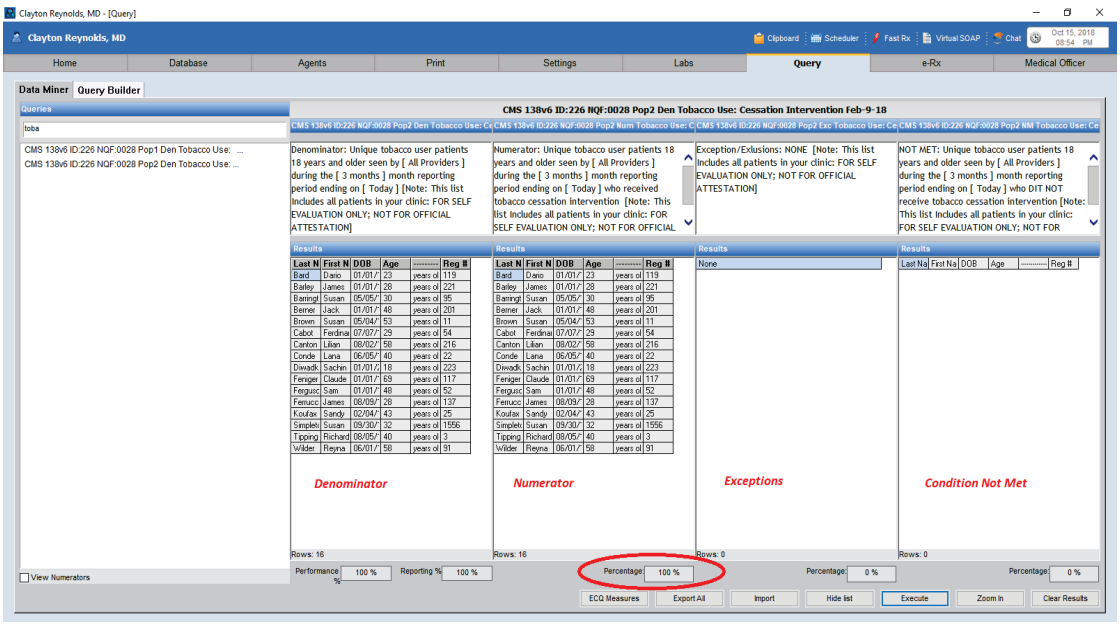



Figure 28. *This is the boring result displaying 100% performance of an attestation report related to the previous Smoking Guideline. Can the provider be accused of cheating? Fortunately, we are not in high school!*

## Practice Advisories that trigger other Practice Advisories – Practice Guideline Algorithms

Because the action of a Practice Advisory results in discrete data values, these taken at the point of care may also be preset to trigger other practice advisories in a treelike fashion, generating practice guideline algorithms with great ease. Thus, clicking on a given de-highlighted practice advisory line item will not only activate it, but may also make related practice advisories magically appear on the page all at once.

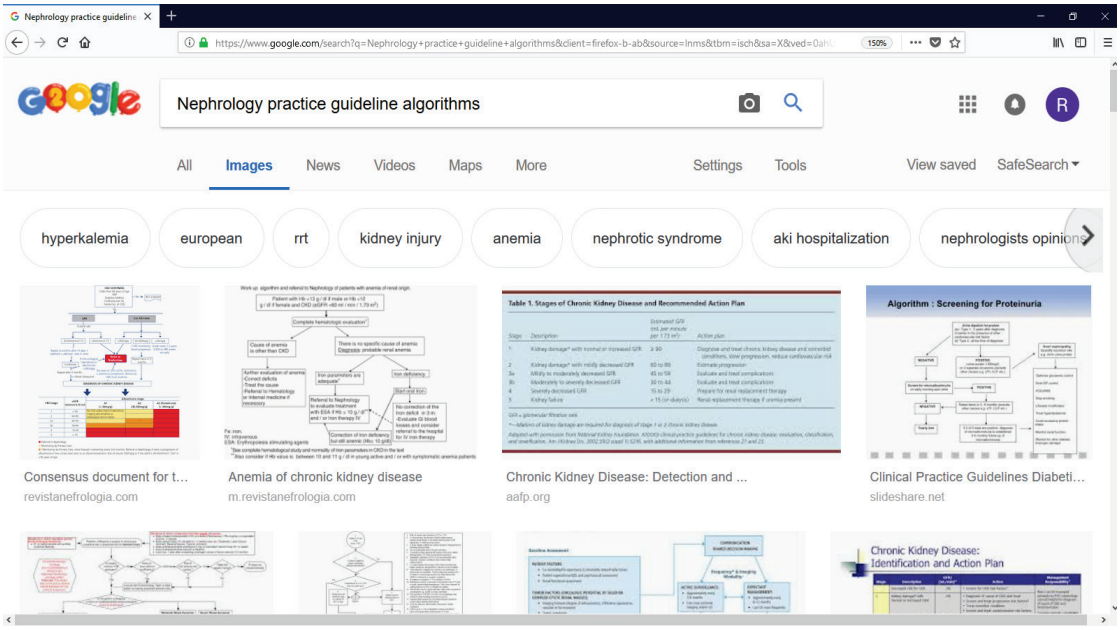



Figure 29. *Selecting in Google any clinical specialty, such as Nephrology, and then clicking on "Images", displays hundreds if not thousands of different practice guideline algorithms, which may be created in Praxis faster and easier than what it took their respective authors to draw them here.*

The power of practice advisories doubling as performance statements that can then be easily queried, that can be created by anyone without programming knowledge and used even easier, cannot be underestimated.

## Practice Advisories as Multiple Choice

As shown in the eye color example, advisories may be pre-set so as to make other advisory choices disappear when one of them is selected:

*"The color of the eyes is blue, brown, black, yellow, green, other. (We are undertaking a study comparing eye color with Hepatitis."*

This approach not only makes multiple choice alternatives such as for the color of the eyes example given earlier, but also for the MIPS "Exceptions" and "Exclusions" category options, which may now be created with great ease[xli]. Of course, this makes the forks for the practice guideline algorithms displayed above very easy to create.

## Are the Crazy Codes Really Needed?

Note that this approach does not require the use of any official codes in order to become both effective and queryable. However, since codes are used by the rest of the healthcare ecosystem— indeed, they are the law of the land—the Practice Advisory options may include these codes so that third-party computers may understand our writing, as computers do not understand English. The use of codes may also simplify the creation of some practice advisories because it is easier to

select a CMS "Value Set" [xlii] than to have to list of every acceptable medication, diagnosis and treatment option code one at-a-time.

As a result, CMS Quality Payment Program (QPP) Guidelines[xliii] are extremely easy to set up and implement by anyone with a bit of medical knowledge. Moreover, the hypothetical researcher mentioned earlier may later use the results from these queries to improve the practice advisories and develop ever more sophisticated ones with great ease.

Because the queries using the 3 Rs method are rhetorical in nature, we are dealing with the old Hawthorne Effect in all its wonder[xliv], resulting in close to 100% performance without much effort. Some may think this is a form of cheating the system by doing what one wrote, but fortunately we are not in high school. This method may be thought of as an "open book test" of the easiest kind, one that will increase the quality of care just as it does its payments to providers.

## The Fourth R – "Resolution"

[In development]

As mentioned, the provider sees the line item and acts on it. But what does "act" mean? Well, it means that, when seeing in the note: "Patient was told not to smoke," the provider simply tells the patient not to smoke. It is much easier to do what one wrote than to write what one did. However, many "actions" are not that simple. A prescription, for example, is an action that requires the provider to find the appropriate drug, select it and then activate it on the progress note so that Praxis sends it to the pharmacy. This is an action that normally the Assessment handles automatically on behalf of the provider, but what if the Practice Advisory line item coming from the outside states "Patient was told not to smoke **and was offered medication**"? How does Praxis know to prescribe the medication and which medication to prescribe? Yes, one could simply link it to an appropriate assessment so as not to be bothered by doing this for any future patients, but there is another exciting possibility currently in development.

The solution is simple. As was explained earlier, the progress note units-of-thought are really "objects" in the computer sense of the term, meaning that the Assessment element, via a neural network, generates all the other SOAP element objects, such as the related prescriptions, procedures, orders, diagnostic testing or even other agents automatically. What if Practice Advisory line items could do the same?

We will call this ability of Practice Advisory Line Items to act as assessments, "Resolution," or the Fourth R (using Reynolds' terminology). With the Resolution feature, the first time exposed to the guideline in question, the provider will be able to link a given recommendation to any Plan or Assessment element, so once the recommendation is linked, it not only charts its recommendation and generates the

appropriate codes for purposes of attestation as described before—but would activate the specific plan elements and even assessments that in turn fulfill the request automatically. The Practice Advisory will carry out its related orders just as soon as we click on the recommendation's line-item, activating it and signaling our approval.

And as we mentioned earlier, one of the Plan elements that may be activated by the Line-Item recommendation is the SOAP-Related Agent, including the Nursing Task Agent. As explained, the Nursing Task Agent, in turn, empowers the clinic to handle patient outcomes elegantly. If a Practice Advisory's line item that displays, "…patient was ordered a mammogram today…" is activated by the provider, not only will the order for the Mammogram appear instantly on the record—thus automatically ordering itself—but also the appropriate Nursing Task Agent that was described earlier, requesting that the medical assistant document the presence of the resulting report four weeks later by clicking "Done" on the Agent's radio button. There is nothing for the provider to do, except agree with the recommendation and let the patient know about the ordered mammogram. Not surprisingly, in the new MACRA payment system, outcomes studies like the mammogram exam, which depend on following the patient after the order is given, result in higher reimbursements (higher "deciles," using MIPS terminology).

# Let's Stop Industrial-Age Thinking

What they taught us in medical school is wrong. Dead paper charting has failed healthcare over the last half century and has become far worse with the advent of the computer. The incorrect paper charting paradigm was deeply exacerbated by circumventing the power of the computer to be of help to providers during the patient encounter. Just two hours wasted in charting per day equals ten years lost to bureaucracy[xlv]. These are ten years when providers are removed from the very practice of medicine, from being with family, and from personal pursuits. Doctors were not meant to fight incorrectly-developed computer software. We need to take a hard look at these failed assumptions that led to the rise of template-based EHRs. Today it is clear that these have not provided a coherent solution to the EHR dilemma.

As explained in this paper, much of the confusion with EHRs is caused by applying industrial age Cartesian thinking to a modern-day scenario that does not require mechanistic restrictions forcing providers to think and work inside a clinical box. Instead, a new class of EHR technology, the Praxis Concept Processor EMR, allows for a more powerful, more flexible, and a more user-friendly approach to clinical documentation, one that dramatically improves the practice of healthcare based, not only on the disease process, but on its absence and prevention. The codes required by third parties, not at all needed to perform extraordinary queries on this EMR, but required by third parties, may still be automatically generated using the Concept Processor without interrupting the minds of the providers who are treating patients. In fact, vital lines of communication between providers and public health researchers—the idea of the Clinical Public Health Specialist that we explain next—may be amplified to far-reaching dialogs, surpassing the current straightjacket clinical practice guidelines, using free text in English (or the language of choice) rather than "codeese." This approach does not waste the time and effort of either side, as do the arbitrary guidelines and codes which limit and restrict free-flowing communication. With the Concept Processor, the complexity of handling and querying free text disappears, and the richness and diversity of medical thinking is liberated for the betterment of patients and providers alike.

## Improving Providers' Revenue: The Roulette Table

It is simple! If one owns a roulette table and needs operating funds, one need not use an insurance company to provide them. One may simply approach the bank for a loan. At most, the bank will send a technician to calibrate the table, because if the table works as intended, the risk to the house and to the bank is close to zero. Medicine, today, stands at the opposite extreme precisely because of this lack of knowledge of the clinical odds. That is, in our view, is the principal reason that medicine is so expensive. The increase in costs has taken place even though providers' revenues continue to decrease, squeezed by expenses caused by bureaucrats hired paradoxically to reduce the cost of care. These folks—whether working for third parties or hired by the clinic to fend off against the resulting bureaucratic requirements—do exactly the opposite. The management fee is part of the overall financial cost. A whole army of watchdog institutions and financial organizations stands in the way of healthcare, micromanaging medical care and sucking up precious healthcare dollars that should be going into the pockets of the men and women who provide the only true value added: the providers, the clinical assistants, and the other members of the clinical team. Everyone else: third-party payers, business consultants, or even administrative assistants paid by the clinics themselves to fend off bureaucratic demands, actually increase the entropy of the system, add up to a huge and unnecessary financial burden, and remove funds not then available for healthcare providers and patients. Patients are unable to judge quality of care by themselves for the same reason: lack of knowledge of odds versus cost. Patients are hostage to complex payment schemes, which purportedly micromanage the medical practice, but in reality do the exact opposite: They slow down patient care, make it more difficult to receive it, and more expensive for all.

Thus, learning the exact odds and risks of healthcare will benefit patients and providers alike by lowering overall cost and improving quality. This knowledge will also improve provider revenue, since providers and their staff are the very ones who deliver value added in this equation. In addition, as we explain next, we believe that a new type of public health experts will emerge and play a major role in this new era because of their invaluable expertise in this risk-versus-benefit equation.

# The Emergence of the "Clinical Public Health Specialist"

## Templates Are Disastrous for Public Health

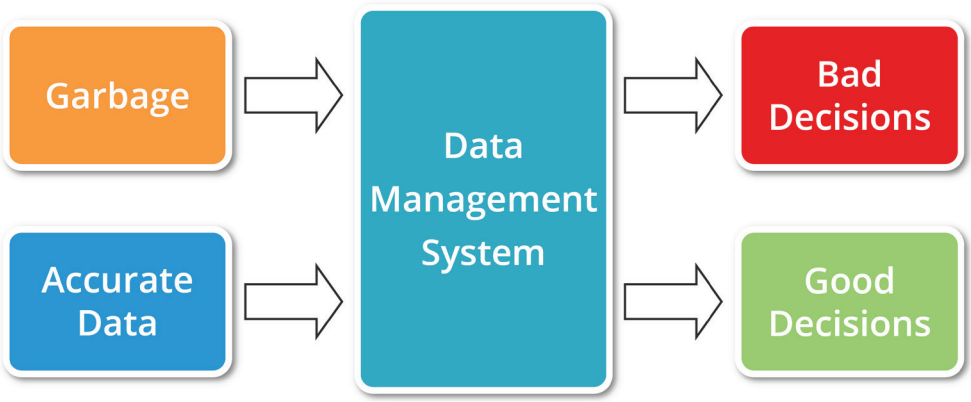



Figure 30. *Garbage in equals garbage out*

The template solution used by the other EHRs to comply with guidelines is a disaster not only for the practice of medicine but also for public health, including the well-intended MACRA regulations. Once again, the idea behind MACRA is not the problem; instead, it was the way the idea has been implemented via templates and codes which has wrought the havoc we currently find ourselves in.

Upon establishing the government guidelines, several assumptions were made:

How accurate is the data emanating from the current template-based EHRs using thousands of pick lists that invite users to rush through? Answer: Probably nowhere near as good as the government and other third parties believe by any leap of the imagination. Doctors, who are already under pressure to care for patients efficiently, do not have the time to select from pick-list options, which often may not accurately address what is truly happening at the point of care. From a practical standpoint many pick lists are left unanswered, or worse, they are not answered accurately.

How much effort and stress does it require to use a paper-like template-based EHR at the point of care to comply with all these regulations? How much time is wasted in doing so at the point of care? Answer: Significant time and effort. Some studies have shown up to 40% of the provider's time is wasted on the computer. This is simply unacceptable!

How effective is template-generated data for policy making? We believe not effective. Measurable results are limited to bits of discrete data, and medical quality is not found in discrete data, for the same reason that doctors treat patients and not laboratory results.

How can providers practice excellent medicine while being constantly interrupted by their computers, second-guessed, and micromanaged at the point of care? Not too well. The alert-fatigue syndrome experienced by many providers is a cause of severe dissatisfaction causing some physicians to abandon the medical profession altogether.

How can provider revenues be increased and not reduced by all these external manipulations and supervisions that are so time consuming at the point of care, and difficult to fulfill in a cost-effective manner? Not easily. In addition to wasting provider and staff time, many clinics must endure significant overhead expense in dealing with all this bureaucracy.

As mentioned earlier in this paper, for the first two hundred years, modern medicine focused on pathology as the heart of scientific medical thinking. The pathologic approach in medicine is, by nature, microcosmic, involving the break-up of a single human body into small pieces and sending these specimens to the pathology laboratory for interpretation[xlvi]. On the other hand, public health works at a different, macrocosmic level that involves entire populations, using statistics—big data—without really focusing on what may be happening within the cells of each human being. We all know about the Framingham Study[xlvii], where millions of dollars have been spent to follow a group of citizens by retrospectively reviewing paper-generated medical records over a longitudinal study involving decades. All this done to try to learn something about behavior and nutrition as risk factors for heart disease. Indeed, without the use of effective computer programs, these studies have proven extraordinarily expensive, and the results, as impressive as they may at first appear, are not that spectacular given the huge amount of money and effort spent. Our paper points out how the computer can support the health research process by performing highly sensitive and complex prospective studies on health care quality, outcomes, and cost management strategies dynamically and with great ease, while allowing providers with complete freedom to practice medicine any way they see fit, without wasting their precious time.

## The Clinical Public Health Specialist as a New Partner in Medicine

The Praxis Concept Processor makes an end-run on all the problems just mentioned.

We believe that with the use of the Concept Processor a rich set of new public health knowledge will emerge from these studies. This is knowledge that could be managed by a new breed of clinical consultant, a public health expert we could call a “Clinical Public Health Specialist." Like its pathologist and radiologist counterparts, the clinical public health specialist would not deal with patients directly but work with providers via the EMR, querying data dynamically, while imparting relevant just-in-time information at the point of care. By “dynamically,” we mean queries performed on the Praxis EMR of many different clinics as a follow-up to previous queries, so as to quickly focus on the heart of each clinical issue. The clinical public health specialist would obtain specific and accurate data that is “pulled” from Praxis, interacting online noiselessly with thousands of providers treating millions of patients, without disturbing—indeed while assisting—the practice of medicine. All these could be done today with great ease. On the provider side, the clinical public health specialist would be welcomed, as this expert would be perceived in the same light as the pathologist or the radiologist is seen today: as a consultant on both illness and also health. Indeed, the clinical public health specialist would be a source of patient-specific knowledge on health. Specific and highly relevant input obtained from this professional at the point of care would assist the provider when evaluating, not just the symptoms the patient may be presenting with, but also the patient as a whole, given metrics of demographic, financial, and, of course, clinical data obtained from statistics polling similar patient profiles across many different clinics. The information provided at the point of care would include risk-benefit assessments for different diagnostic and therapeutic options given the clinical presentation, including costs, outcomes, and social data. Armed with this intelligent information arriving just in time, the provider would be able to discuss with the patient and family different therapeutic approaches possible, with their inherent and specific risk/benefit results, given not only the disease process at hand, but also the patient’s social and financial condition.

Therefore, the burden of risk and cost/benefit decisions would be shared with the patient based on specific and relevant hard-statistical data based on countless other patients presenting with the same clinical condition. The enriched information provided would reduce the cost of care by eliminating many of the current business intermediaries that are “managing” providers and increasing healthcare cost, but also prevent complications, exacerbations, and even potential future disease.

“Without disturbing” is the key here. The exchange of information must be straightforward not just for the clinical public health specialist, but also for the practicing physician in the trenches, who would maintain these open lines of communication with the available expertise effortlessly and without noise as "noise" was described in this paper. This virtuous and dynamic feedback loop between public health and providers would not only result in a better grasp of the different cost-effective options available to the clinician to treat the disease—including cost/benefit outcomes for each option evaluated—but in vital information regarding the meaning of what it is to be healthy so as to avoid illness from appearing in the first place.

Our physician colleagues would surely welcome this help, as it circumvents insane clinical pre-authorizations, which would be automatically vested. We believe that if the odds are well known, the risk is minimized, and whenever the risk is minimized, then the need for insurance expenses also decreases, if not completely eliminated. And since insurance expenses erode into the final healthcare bill and reduce provider revenue while increasing overall healthcare costs, the cost of healthcare would significantly decrease as well.

Finally, the clinical public health specialist could also provide the healthy population, not visiting medical facilities, with invaluable tailor-made advice based on information of population types obtain from the feedback generated by Praxis. This would include advice on nutrition, exercise and general life habits, as well as potential risks inherent to the genetic and social history of the healthy person.

Because of the dynamic way this information is generated, this level of precision in data analysis would be unsurpassed. Its purpose would be to help not only healthy people avoid illness, but also to stratify potential risks factors associated with chronic illness, all based on specific human profiles, including social and genetic information that is not currently available. This public health knowledge would lead to a dramatic impact on the quality of life and the cost of healthcare, as it would significantly lower disease risk throughout society. Of course, the term “Clinical Public Health Specialist" is simply a suggestion. We foresee that larger healthcare organizations could hire public health professionals to accomplish these tasks for their own patient populations. Indeed, some clinical groups already have a similar professional on board today, though unfortunately, they are not armed with the tools discussed here, and, therefore, they lack vital information required to make intelligent decisions.

This is something that Praxis can accomplish today, but no other EHR can because of the inherent problems found in templates and discussed in this paper. The other systems are, unfortunately, based on the dead-paper record paradigm, which cannot render help at the point of care. Clearly, none of the benefits which can potentially revolutionize healthcare today can be carried out by rigid template-based EHRs.

# The Myth of Usability-Testing in EHRs

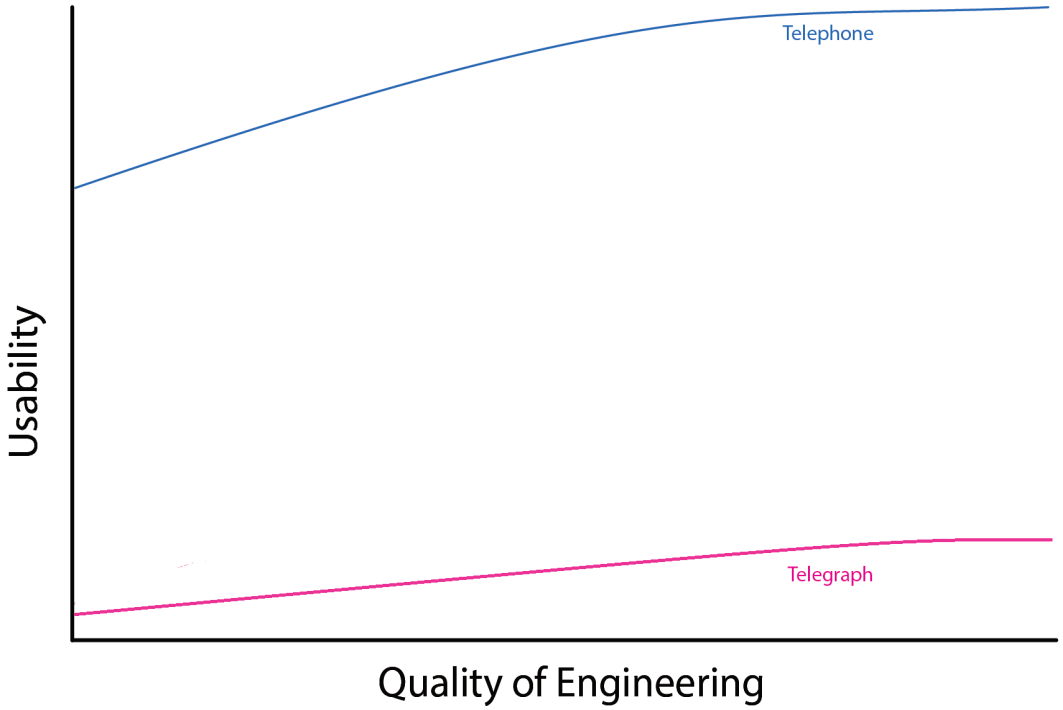



Figure 31. *As true in the late 19th Century, when some wondered why telegraphs had not been made more user friendly, why children could not be taught the Morse Code, and why there was no telegraph in every home and in every office, and then came the telephone, today some blame the lack EHR usability on way the template-based EHRs develop their user applications. It is like saying that if we only made the Morse-code key more user-friendly, this would have everyone accept the telegraph in their homes! Back then, many attempted to improve the telegraph's usability to no avail.*

Clearly, a telephone is not a better-built telegraph. This is not about improving EHR usability by simply implementing improved methods of software engineering, as many pundits in the Health IT industry love to proclaim, but of simply moving to a different paradigm, one not based on the failed paper approach but on the very power of the computer to be of assistance to doctors at the point of care. Template-based EHRs could be worked on forever; they cannot get better. In fact, the more they are developed, the worse they are performing the real world, as the level of complexity of use increases and their usability goes down even further. As is the case in medicine, the wrong diagnosis here invariably led to the wrong software being developed, and that accounts for the usability problems reported with the template-based EHRs.

That being said, usability is an art-form. For example, whenever we at Praxis receive

a request from a client, the first thing we do, unless this request is crystal clear from the outset—which is rarely the case—is to contact the user directly and ask why the feature is needed. We actually brainstorm with the user regarding alternative approaches that may result in features which not only resolve this specific problem presented by our client, but also solve many other issues that our client may not have thought of, resulting in major improvements of the application. The continuing and intense dialog with clients results in practical features that no single user could have figured out on their own—and clearly, we could not have either—without being privy to these two-way communications. As Stephen Gold MD, MPH, described in his book "The Magic of Praxis", a magic act is one where one does not know all the works underneath[xlviii].

Thus, from single requests we move on to what we could call “meta-ideas,” or ideas that, when resolved, will also shine a light on many issues not obvious to anyone prior to that moment. Thus, software development implies a very close collaboration between the clinicians and nurses using our EMR and ourselves. Our clients are effectively the co-developers of Praxis, as 99% of the great ideas that you have read here came from them and their daily use of the software.

Thus, software usability is not a science, as many Healthcare IT experts maintain, but rather an art form resulting from extensive and intensive dialog, using remote desktop access for full view of the issues being presented. The idea that software usability is a science comes, no doubt, from industrial-age thinking. An airplane is an airplane is an airplane. The same may be said for building a home, or for making a pair of shoes. We know exactly what we wish to end up with. We know exactly what these physical entities are and what they are meant to do. In software, however, we are not dealing with something physical. We have no idea what software can become. Because we are not dealing with a physical object, software development is limited only by our imagination and that of our clients. We do not even know of all the potential benefits that a given software program could deliver until we or, better yet, our clients dream about it. We know what we know, but we don't know what we don't know. So, a third party, who is not practicing medicine using our application, nor developing this software application for those who are actually using it on a daily basis, cannot possibly preach usability to the rest of us as though it were an exact science.

Finally, many confuse something that is intuitive to learn with something that is intuitive to use. A tricycle is intuitive to learn—even three-year-olds have no problem with it—but most would agree that an automobile is more useful than a tricycle, and, once you know how to use it, equally intuitive. Thus, performing usability studies on new software by an outside lab is nothing short of ridiculous!

So, it is the crucial communication between users and developers of software which leads to a profound understanding of the tasks required, and therefore improvements in usability. There is no mathematical science for it, or computers could develop their own programs without any human intervention. This is perhaps

the only critique of the government: its attempt to legislate EHR usability, a role that the market is best qualified to judge. We believe that the government should focus on setting the rules of interoperability and refrain from evaluating usability, trusting the market to determine that for itself.

## EMR vs. EHR

Throughout this paper, we have used the term Electronic Medical Records (EMR) instead of Electronic Healthcare Records (EHR) when referring to Praxis. This was not a mistake. Praxis is a certified Electronic Healthcare Records program as defined by the Office of the National Coordinator of Health Information Technology. However, the spirit of Praxis is that of an EMR, not an EHR. What difference does a single letter make?

In his latest piece in the New Yorker, Doctor Atul Gawande once again hit the nail on the head when addressing "Why Doctors Hate Their Computers." In this fascinating real-life story of his ordeal when learning to use an infamous EHR system, Gawande described one of the key usability issues found in all EHRs.

> *"As I observed more of my colleagues, I began to see the insidious ways that the software changed how people work together. They'd become more disconnected; less likely to see and help one another, and often less able to. Jessica Jacobs, a longtime office assistant in my practice—mid-forties, dedicated, with a smoker's raspy voice—said that each new software system reduced her role and shifted more of her responsibilities onto the doctors....*
>
> *'But we think of this as a system for* us *and it's not,' Greg Meyer, Chief Clinical Officer at Partners HealthCare said. 'It is for* the patients*.' While some sixty thousand staff members use the system, almost ten times as many patients log into it to look up their lab results, remind themselves of the medications they are supposed to take, read the office notes that their doctor wrote in order to better understand what they've been told. Today, patients are the fastest-growing user group for electronic medical records...*
> *Yet it's perfectly possible to envisage a system that makes care ever better for those who receive it and ever more miserable for those who provide it."*[xlix]

About ten years ago, the government began to use the term "Electronic HEALTH Record (EHR)" in place of the Electronic MEDICAL Record (EMR). The change seemed innocent, but it was not. The name change was pushed by the large hospital software systems to convince third parties that EMRs were not just meant for doctors, but for all the healthcare stakeholders. Despite arguments by smaller vendors including ourselves, that this approach would destroy usability because you cannot be all things to all people, no one seemed to understand the problem involved. The argument in favor of an all encompassing EHR sounded reasonable to many.

The counter argument for focusing development of a medical program on providers and their staff rather than on everyone consists of three parts. First, we have the wonderful siblings known as interfacing and interoperability. The most powerful feature of a computer lies precisely in its ability to interface with others, allowing a user to operate it using his or her own language, time preference, and personal nuances and yet be able to communicate seamlessly with the many other disparate stakeholders of the healthcare ecosystem who may use different programs for different functionalities and at different times. In this scenario, computer systems, then, may cater to each type of user, whether that be patients, administrators, third-party insurers, or even the government. This interfacing then lowers information overload—data overload as described in this paper—by decreasing noise for all. Computers perform that interface functionality to a degree that dwarfs human imagination. As a proud Electronic MEDICAL Record, Praxis caters to, and focuses entirely on, the medical practitioner, looking at the rest of the world from the provider's viewpoint. This is not to say that the hospital administrator's role is not important: on the contrary. Our big competitors play a vital role assisting with hospital administration, just as long as they allow the different healthcare stakeholders to choose software applications that are best suited for them, and permit, not hinder, ease of interfacing[i]. For medical providers, the answer is clear: The big hospital systems do not work, so all health IT systems should interoperate with ease. Doctors should be able to walk into any hospital with the EHR of their choice and simply connect with the local clinical information for seamless transfer of information. This will make everyone happy, particularly doctors and patients, who are the final victims of these unwieldy systems, but also larger hospital software systems, for whom the medical part is paradoxically the Achilles heal, as they know so well. This is also where the government is and should be focusing: creating the rules of engagement, leveling the playing field, and preventing big competitors, particularly those working with large hospital systems that cater to the needs of hospital administrators rather than those of providers, from data blocking.

The second part of the argument against EHRs and in favor of EMRs focuses on the needs of third parties to obtain significant information, which is deemed irrelevant by clinicians and that, as Doctor Gawande so well points out, produces disconnection, requiring providers to play the odious role of data entry, which is truly irrelevant to the task of healing the sick and a horrendous time waster and stress generator. Fortunately, as has been described, the Concept Processor in Praxis resolves this with great ease by learning from the provider's own previous charting to generate the required data every time it is needed. In fact, providers will not find complying with odious administrative and bureaucratic requests unreasonable if they were required to respond only once in the provider's life and not for every patient and for every encounter. Here is precisely where the Concept Processor recalls and generates the minutia of irrelevant clinical data required by specific third parties—irrelevant from the physician's point of view—and automatically sends such data exactly where it is needed by the third party, with codes and all.

The final part of the argument in favor of going back to the EMR concept is a subtle one. When it is all said and done, users, including clinicians, really don't know what they want, but they sure know what they don't want. This is a corollary to the argument that one cannot be all things to all people. So, when a client requests a feature, or even a specific button on the screen, the worst response is to actually comply with each request on the theory that "the customer is always right," without evaluating its impact as a generator of noise. Unfortunately, this is the case with many vendors who have never been medical providers themselves, and, as Doctor Gawande also points out, it is worse with large EHR systems which attempt to keep the peace among different requests emanating from different user roles within a large organization. Attempting to please all is a clear recipe for disaster.

So, we applaud the government's enforcement of protocols of interoperability, because this will allow superior applications like Praxis, which caters specifically to providers and their staffs, to work seamlessly within the larger healthcare organizations which have so many other stakeholders and requirements.

# Conclusion

We fully agree that MACRA legislation will lead to a dramatic increase in the education of how disease processes might be prevented to help lower the costs of healthcare and improve outcomes. Indeed, accurate statistical analysis will help us provide the highest quality care possible to our patients and prevent disease from happening in the first place. Once disease is present, statistical analysis would help determine the best possible outcomes. We will learn how patient behavior, nutritional habits, exercise, work, home stress, genetics, and many other factors impact patient outcomes and the disease process. From a financial standpoint, we will also learn how outcomes using different healthcare approaches impact healthcare cost, and all that is not a bad thing at all. If the resulting knowledge can be instantly provided as feedback to the clinicians at the point of care—and to their patients—so that we receive appropriate advice without noise, then the statistical approach to disease management will ease the burden of decision-making when it counts the most: at the very moment the patient is in front of the provider.

Overall, Praxis EMR is a medical tool. The Concept Processor becomes an extension of the clinical mind—an extension of the physician who is treating the patient. However, the clinical queries and practice guidelines often come from the outside. They are the product of other minds that may interact with the mind of the provider at the point of care. Praxis facilitates this type of collaboration, effortlessly. Furthermore, this virtual communication between clinicians and public health experts will not only result in vital new information about compliance with guidelines, but more importantly, will uncover alternative solutions that providers in the trenches may have discovered accidentally through daily contact with their patients. Indeed, a dynamic feedback loop between providers and public health researchers will generate vital new information regarding “best practices,” as this information may come from anywhere and everywhere and will be instantly available for all healthcare participants and their patients. With the Praxis concept processing technology, the sharing of clinical information between providers, researchers, and also patients will become a reality that will improve the practice of medicine and enrich us all.

Although the approach described in this paper can co-exist with EHRs that are template-based—particularly in this new age of interoperability where we think the government should take an even more aggressive approach—we believe that the concept processing technology will emerge as the only practical one for medicine in the end. Indeed, we believe that the use of template-based EHRs is unconscionable because they pose a risk to patient health, and contribute to eventual burnout of the dedicated men and women who work tirelessly to improve our health.

The Concept Processor allows for excellence in healthcare. The other EHRs, based on

templates, simply do not.

To view the full demo of how Praxis works, *please click here*.
[1]

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***[1] The author wishes to thank his son, Daniel Mark Low MS, currently pursuing his PhD in cognitive neurosciences at Harvard University, for his invaluable teachings and critiques.***

# References

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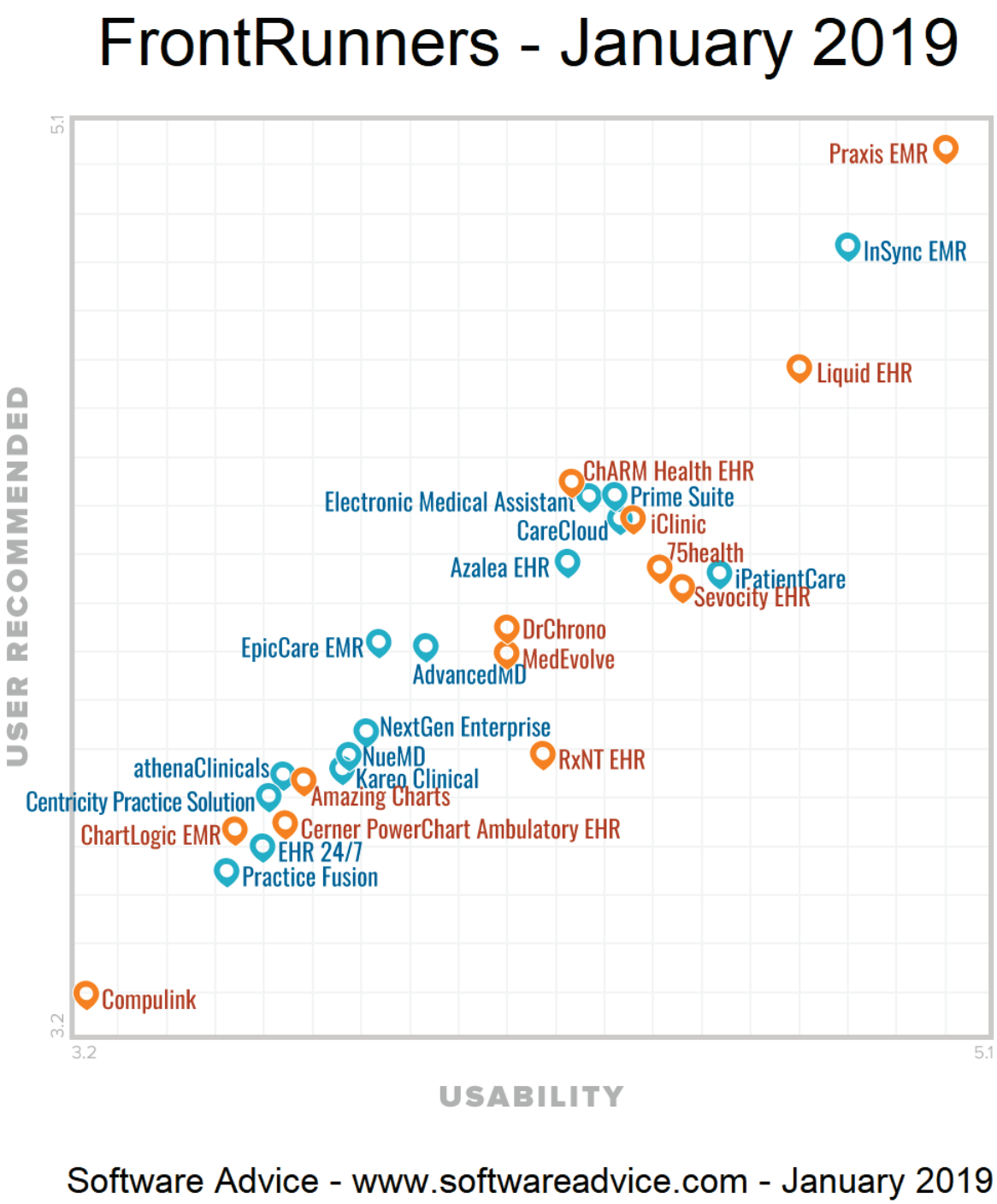


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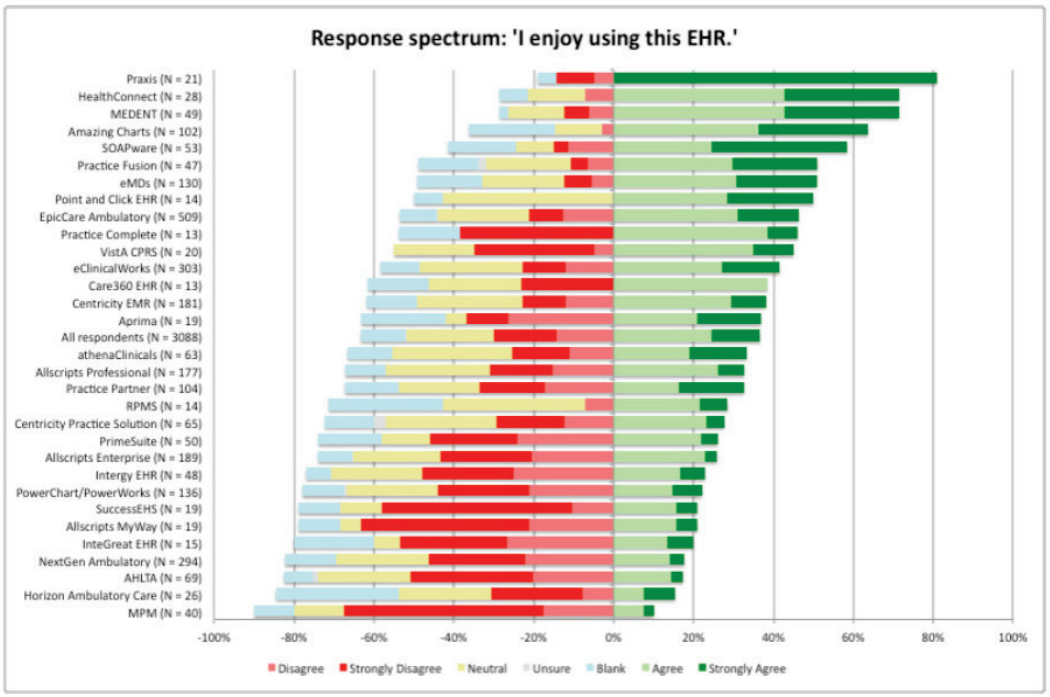


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[ii] Michel Foucault; The Birth of the Clinic (Routledge Classics) by (Paperback - July 3, 2003)

Some experts call this “abductive reasoning” (https://en.wikipedia.org/wiki/Abductive_reasoning), and they may be correct. We still prefer the more generally known term of “inductive reasoning”, or “a method of reasoning in which the premises are viewed as supplying some evidence for the truth of the conclusion” (https://en.wikipedia.org/wiki/Inductive_reasoning)

[iv]

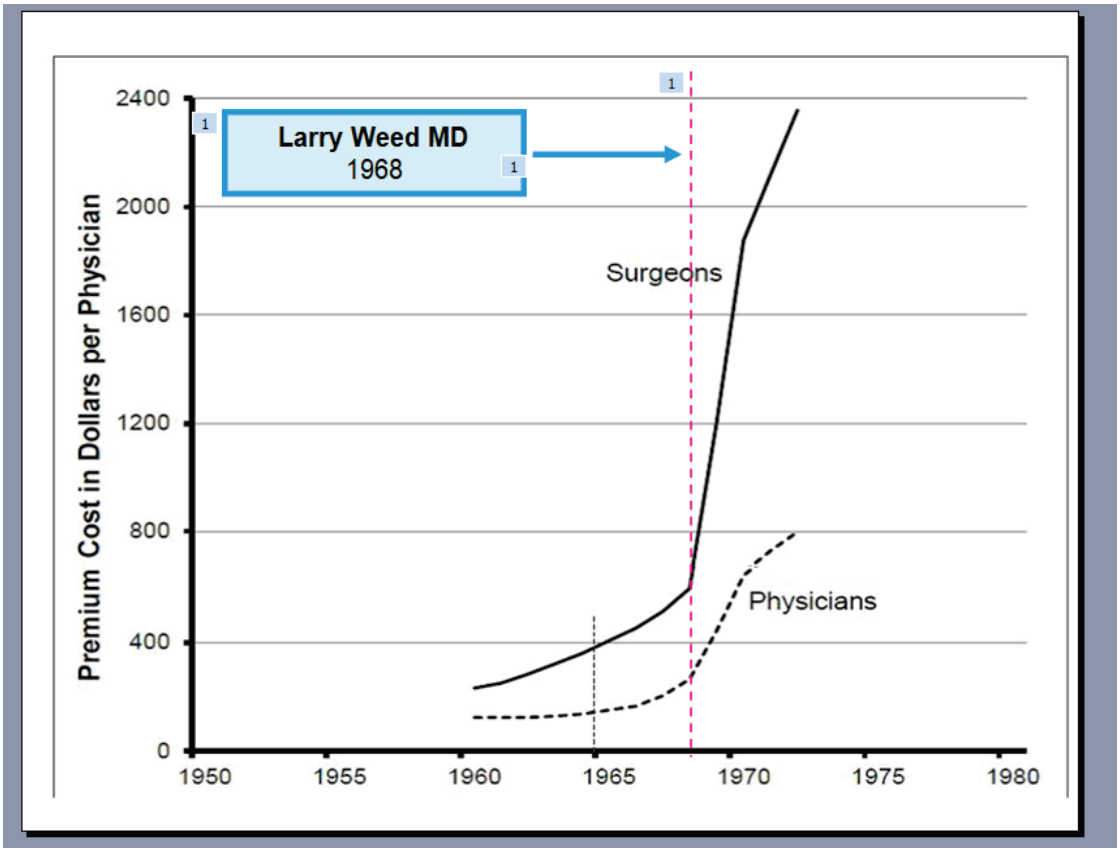


Figure 1. *Malpractice litigation soared dramatically starting in the 60s. As a result of this defensive charting made the medical record bulimic. In 1968 Doctor Larry Weed proposed the Problem Oriented Clinical Record (otherwise known as the SOAP Note (Subjective-Objective-Assessment-Plan) as rational way to order all that medical documentation. The POMR is currently the ipso- facto charting standard in the US. As excellent as it is, this method of charting requires significant effort and time, stressing the life of most healthcare practitioners.*

[v] https://www.snomed.org/snomed-ct

[vi] Greenhalgh, Trishia, et all, Tensions and Paradoxes in Electronic Patient Record Research: A Systematic Literature Review Using the Meta-narrative Method, Milbank Quarterly Vol. 87 No. 4 – 2009, pages 1-25

[vii] Downing NL, Bates DW, Longhurst CA. Physician Burnout in the Electronic Health Record Era: Are We Ignoring the Real Cause? Ann Intern Med. 10.7326/M18-0139 "Physician burnout is reaching crisis proportions in the United States (1). Studies have noted a rising prevalence of emotional fatigue. One study suggested that more than half of physicians in some disciplines are burned out and that this proportion is increasing. The number of clinicians leaving the workforce represents a major

concern to health care professionals and to the health of the nation. Many factors contribute, but the physician's interaction with electronic health records (EHRs) is especially important now that EHRs have been broadly adopted across the country.

Although EHRs have great potential to improve care, they may also have negative effects. Some studies suggest that U.S. physicians now spend as much time on "desktop medicine" (interacting with the computer) as they do face to face with patients (2, 3). Providers must divide their attention between patients and the EHR, and many believe that this compromises patient–physician relationships (4). Although few physicians support reverting to paper, there is a growing sense within the medical community that the EHR is driving professional dissatisfaction and burnout."
Also see:
https://www.healthcare-informatics.com/news-item/ehr/survey-physicians-cite-ehrs-biggest-contributor-burnout

https://www.zerohedge.com/news/2018-09-04/obamacare-requirement-blamed-doctor-burnout

[viii] Brian G. Arndt, MD, John W. Beasley, MD, Michelle D. Watkinson, MPH, Jonathan L. Temte, MD PhD, Wen-Jan Tuan, MS, MPH, Christine A. Sinsky, MD3, and Valerie J. Gilchrist, MD; *Tethered to the EHR: Primary Care Physician Workload Assessment Using EHR Event Log Data and Time-Motion Observations*; Ann Fam Med September/October 2017 vol. 15 no. 5 419-426
http://www.annfammed.org/content/15/5/419.full
[ix] Risha Gidwani, DrPH1,2, Cathina Nguyen, MPH3, Alexis Kofoed, MPH2, Catherine Carragee, BA2, Tracy Rydel, MD2, Ian Nelligan, MD, MPH2, Amelia Sattler, MD2, Megan Mahoney, MD2 and Steven Lin, MD2; Impact of scribes on Physician Satisfaction, Patient Satisfaction, and Charting Efficiency: A Randomized Controlled Trial, Ann Fam Med September/October 2017 vol. 15 no. 5 427-433
http://www.annfammed.org/content/15/5/427.full#ref-32

[x] http://www.medicaleconomics.com/editors-choice-me/its-time-get-doctors-out-ehr-data-entry

[xi] http://www.idealmedicalcare.org/blog/depressed-doctor-im-angry-and-frustrated-and-lost/; http://time.com/4383979/doctor-burnout-electronic-health-records/; http://www.futurity.org/doctors-electronic-health-records-1476362/
[xii] http://medicalhistory.com/company/index.asp. This twenty-year-old application's brilliancy is in the way it queries the patient to conclude with a well written paragraph of subjective findings for the provider to evaluate. In fact, IMH copied the highlighting/de-highlighting Praxis editing approach within its system. If used the way it is indicated, the technology is most useful.
[xiii] In 1962, Thomas Kuhn wrote the *Structure of the Scientific Revolutions*, a landmark event in the history and philosophy of science. This timely book addressed the very nature of scientific thought. We say it was "timely" because it coincided with the advent of the computer, which requires a re-thinking of the two-hundred-year-old

concept of the scientific method.

In his brilliant work, Kuhn demystifies the absoluteness of science and proves that scientific theory is also very subjective and self contained within the collective subconscious of its practitioners in the form of deeply held and sometime unproven beliefs. Kuhn termed these beliefs "scientific paradigms."

Kuhn went on to describe a unique phenomenon in scientific thinking. Periods he called "Normal Science," where subconscious universally held beliefs he termed "paradigms" strongly shared by the entire scientific community, are broken by periods he termed "scientific revolutions," where the very premises under which the scientific edifice stood until that moment is completely demolished every time. Each time this happened, argued Kuhn, a major re-writing of scientific truth and scientific history takes place to whitewash what was learned up to that point in time to give the appearance of continuity of knowledge. In reality, said Kuhn, there is a complete discontinuity of "Truth" from the previous "Truth." Kuhn claimed the new Truth was "incommensurable" with previous knowledge and was not an increase in knowledge at all. Kuhn's position was hotly debated by the historians of science at the time led by no less than the equally brilliant British philosopher and historian of science Karl Popper (https://philpapers.org/rec/LAKCAT), who argued that scientific knowledge was always subject to what Popper called "falsificationism" and that it was indeed continuous. What Kuhn argued, on the other hand, that this incorrect belief in the continuity of scientific knowledge helped young scientists to work hard to uncover what they felt was the Truth. Truth, said Kuhn, was always imaginary and doomed to failure when a new discovery made that truth obsolete and meaningless. In short, according to Kuhn, science resembled a religion, in no way different than any other.

Although when his work was first published, Kuhn caused havoc in the scientific and educational establishment—mostly rejection—soon his position was supported by others, and today Kuhn is recognized as a pillar of the modern history of science and ideas, and his work has influenced many fields such as sociology and psychology.

Yet, Kuhn's ideas were not new. At the very start of the Scientific Revolution other thinkers of that period questioned the very scientific approach being proposed by the French Rationalists and the British Empiricists, beginning with Emmanuel Kant, who pointed to major inconsistencies in the logic behind the scientific method itself. Kant's position was that reality could not be divorced from the observer of such reality. All reality was subjective, explained Kant. And if reality was independent from the perceiver, such reality may only be known by God, but never by us humans. Therefore, all knowledge deriving from such perception is also subjective, stated Kant. With time, these Kantian ideas and objections to the scientific method were simply ignored by the scientists of the industrial age. The industrial revolution required that a single doctrine, the scientific method, revealed to independent observers in the same way down to the same language, prevail upon subjective reality, to push forward the complex new technologies and improve the world, and

so it did although at a high price. That price was the sharing of ideas of thought and, most important, vocabulary for communication, within sharply defined mental boxes that defined reality for its practitioners.

Thomas Kuhn simply brought these disturbing Kantian ideas back to life into the scientific fold by using terminology that we scientists could easily understand. After all, Kuhn had received his PhD in Physics from Harvard way before he became a historian of science, and could speak both languages, the humanist and the scientist, with great ease. He simply used scientific language to demonstrate the very subjectivity of scientific thought, reviving the Kant of two hundred years before.

[xiv] in 1959, CP Snow, the well-known English writer and philosopher, presented an influential lecture at the University of Cambridge where he stated that two cultures had emerged across the modern intellectual word, two cultures that could not even communicate with one other much less comprehend each other. He was referring to the split that had taken place between thinkers of sciences and the humanities starting around the late 18th Century, when a rift appeared between the French Rationalist School, led by René Descartes, and the German Idealist School following the philosophies started by Immanuel Kant. As mentioned, Kant had earlier presented a rational critique to the scientific method in his book The Critique of Pure Reason. The rift deepened to a point where thinkers of either side of the intellectual divide could not even comprehend the other's language, to say nothing of the ideas behind the very words used.
https://en.wikipedia.org/wiki/The_Two_Cultures
[xv] If you believe thought is often equivalent to language, then why do we edit when we write? If we thought in language, we would just write the language of our thoughts and would have no need to edit it. But as it turns out, we re-read what we just wrote and often think "that's not exactly what I was thinking" and need to further edit until the written language matches thought.
[xvi] For great medical bloopers, refer to this page:
http://www.doctorslounge.com/humour/bloopers.htm
[xvii] https://en.wikipedia.org/wiki/Saccade
[xviii] https://www.youtube.com/watch?v=oPA-LAAMuHE

[xix] This is a fascinating study where people miss very obvious findings right before their own eyes https://www.youtube.com/watch?v=vJG698U2Mvo. This is what magicians use for their tricks.
[xx] For an interesting comparison between Praxis EMR and IBM's Watson, a system that does attempt to figure out diagnosis from symptoms and findings, please read this short article that was also published in PC Magazine
http://www.extremetech.com/extreme/228830-the-next-major-advance-in-medicine-will-be-the-use-of-ai

[xxi] "Human working memory can hold only a few items at a time. Psychologists used to think that its capacity was around seven items (plus or minus two), but later

downsized that estimate, and today believe it id closer to three or four... " Steven Pinker; The Sense of Style. Professor Pinker is Johnstone Family Professor in the Department of Psychology at Harvard University, and is known for his advocacy of evolutionary psychology and the computational theory of mind.
https://en.wikipedia.org/wiki/Steven_Pinker

[xxii] Doya, Kenji; Ishi, Shin; Rao, Rajesh; Bayesian Brain: Probabilistic Approaches to Neural Coding; From Computational Neuroscience Series;
https://mitpress.mit.edu/books/bayesian-brain
Also, more information on Predictive Coding
https://www.quantamagazine.org/to-make-sense-of-the-present-brains-may-predict-the-future-20180710/
https://www.newyorker.com/magazine/2018/04/02/the-mind-expanding-ideas-of-andy-clark
https://www.sciencemag.org/news/2018/03/does-autism-arise-because-brain-continually-surprised

[xxiii] This may be distorted by our prior statistical belief and by our final diagnosis. New evidence may make us update our hypothesis, but it would have to be very salient since it must overcome our prior belief. This is why so many more rare disorders are misdiagnosed for more common ones.

[xxiv] Andreja Bubic, D. Yves von Cramon, Ricarda I. Schubotz; *Prediction, cognition and the brain;* Front. Hum. Neurosci., 22 March 2010 |
https://doi.org/10.3389/fnhum.2010.00025
Prediction, cognition and the brain
https://www.frontiersin.org/articles/10.3389/fnhum.2010.00025/full

[xxv]
**https://www.ted.com/talks/anil_seth_how_your_brain_hallucinates_your_conscious_reality/transcript?language=en**

[xxvi] " The average rate of speech is about 150 words per minute, while the rate for speed reading or silent reading can reach rates of 300 words per minute. This gap between the speech and reading rates leaves the possibility of comprehending audio up to another 150 words per minute, or listening at twice the speed."
https://medium.com/@kylecrocco/can-you-really-speed-listen-podcasts-science-explains-a078bdab76

[xxvii] For an interesting story on the relationship between practicing medicine and flying an aircraft, please see Fountain, Tamara MD; “Of Pilots and Physicians, Passengers and Patients”; Harvard Medicine; Winter 2019; pilots-physicians-passengers-patients?utm_source=Harvard%20Medicine%20Magazine&utm_medium=email&utm_term=3&utm_content=Winter-20195218 7600 0426 2628

[xxviii] Abdaal, Ali, " How I take notes on my iPad Pro in medical school (2018) - Cambridge University medical student", https://www.youtube.com/watch?v=waR3xBDHMqw. Both Microsoft and Apple allow for this kind of handwriting on tablets which may then be attached to the Praxis note

as desired. In fact, no full notes are needed. Simply jotting down ideas may help us think of the diagnosis and therapy and then use Praxis to chart the note. Nevertheless, as we see in this paper, even this approach is inferior to that of letting Praxis simply help us think more effectively. The two approaches are not mutually exclusive.

[xxix] Haynes, Alex B; Gawande, Atul, et all; *A Surgical Safety Checklist to Reduce Morbidity and Mortality in a Global Population, N Engl J Med 2009; 360:491-499. See also Gawande, Atul; The Checklist Manifesto: How to Get Things Right;*

[xxx] What is even more interesting and perhaps frightening is that we can prove many of our memories are false since they can be implanted to fit personal narratives. Professor Elizabeth Loftus (https://en.wikipedia.org/wiki/Elizabeth_Loftus) has led many experiments since the 1970s showing that subjects will "recall" events that never took place, such as being lost in a mall as child, if they are suggested during an interview. In another study, participants will report seeing a car crashing faster in a video if they were asked: "how fast were the cars going when they smashed each other?" in contrast to when the verb of the question was bumped or contacted. The memory is changed according to the present recall environment.

More links on the issue of false memory:
https://blogs.scientificamerican.com/mind-guest-blog/what-experts-wish-you-knew-about-false-memories/
https://en.wikipedia.org/wiki/False_memory
http://www.slate.com/articles/health_and_science/the_memory_doctor/2010/06/the_memory_doctor.single.html

[xxxi] 1. C. William Carspecken, Paul J. Sharek, Christopher Longhurst, Natalie M. Pageler; *A Clinical Case of Electronic Health Record Drug Alert Fatigue: Consequences for Patient Outcome*; Pediatrics
May 2013
Vitaly Herasevich;Daryl J. Kor;Arun Subramanian;Brian W. Pickering;Connecting the dots: rule-based decision support systems in the modern EHR era; Journal of Clinical Monitoring and Computing;August 2013, Volume 27, Issue 4, pp 443–448
3. Leventhal, Rajiv; *Survey: EHRs, Value-Based Care Causing Docs to Sour on Profession; HealthCare Informatics; October 1, 2018*
https://www.healthcare-informatics.com/news-item/ehr/survey-ehrs-value-based-care-causing-docs-sour-profession

[xxxii] Several university groups, including the team at NYU lead by David J. Rothwell, MD, Richard Wheeler, MD, and Ngô Thanh Nhàn, Ph.D. (see A Medical Logic Lexicon, New York University Computer Science Department,http://cs.nyu.edu/~nhan/fcompling.html) and the group at SUNNY lead by Werner Ceusters MD, Ontology Research Group (http://www.referent-tracking.com/RTU/?page=index) have been working on this subject: parsing natural language into discrete information that can be queried and transmitted to different

health information systems. The technology is far from practical yet, but when it becomes practical, then Praxis EMR would be ideal for it because it is based on free text. Yet, as discussed in this paper, the problem of quality medicine is not resolved by querying electronic medical records retrospectively, even if this task could be done intelligently today.

[xxxiii] Praxis is linked to the Direct Trust Network via EMRDirect
http://www.emrdirect.com
[xxxiv] C-CDA Clinical Document Architecture: This is an interface standard intended to specify the encoding, structure and semantics of clinical documents for exchange.
https://en.wikipedia.org/wiki/Clinical_Document_Architecture
[xxxv] Fuchs, Victor R. Who Shall Live? Health, Economics and Social Choice; World Scientific Publishing Co. Pte. Ltd. This is a foundational textbook on the economics of medicine in the US today. Here is just one fascinating excerpt from the book:

> *"A substantial portion of this book deals with the roles of medical and non-medical factors in health. Writing at a time when most policy discussions called for more physicians and more hospitals, I thought it was crucial to emphasize the importance of individual behavior in health. This theme is widely accepted today. Indeed, so much publicity is now given to jogging, diet, and similar phenomena that I now want to warn against neglecting research that increases our understanding of health processes and behaviors. There is no doubt that we could improve our health by modifying our life styles, but it is also true that most of the great advances in health have come from discovering new and better ways of preventing or treating disease. In arguing that the marginal benefit of medical care is small relative to its cost, I have always tried to distinguish between the payoff from increasing the quantity of care and the benefits from raising the quality of care through scientific research. The latter is of crucial importance because only limited improvement in health can be purchased by increasing the number of physicians or hospital beds."*

The argument of this White Paper addresses precisely the issues raised by this book. Without a way to obtain healthcare information via an effective EMR such as Praxis, these goals will remain a dream.
[xxxvi] Kane, Leslie; Medscape National Physician Burnout, Depression & Suicide Report 2019; Medscape, January 17, 2019; https://www.medscape.com/slideshow/2019-lifestyle-burnout-depression-6011056?faf=1#1

Another great article can be found here:
https://medcitynews.com/2019/03/physician-burnout-ehr-satisfaction/

[xxxvii] Reynolds, Clayton L, MD; *The three Rs of medical quality: Reminder, Record and Review*; Canadian Healthcare Technology; May 2008
http://www.praxisemr.com/downloads/articles_downloads/Clayton_Reynolds_MD_The_three_Rs_of_medical_quality.pdf

[xxxviii] Greenhalgh, Trishia, et all, Tensions and Paradoxes in Electronic Patient Record Research: A Systematic Literature Review Using the Meta-narrative Method, Milbank Quarterly Vol. 87 No. 4 – 2009, pages 1-25 (also see previous entry)

[xxxix] Bayes Theorem is known to most healthcare providers. Sensitivity (also called the true positive rate, the recall, or probability of detection in some fields) measures the proportion of actual positives that are correctly identified as such (e.g., the percentage of sick people who are correctly identified as having the condition). See Wikipedia Sensitivity_and_specificity.

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codeSystem="2.16.840.1.113883.6.96">
    <displayName value="Eye color"/>
  </code>
  <text>Green eyes</text>
  <value xsi:type="CD" code="371246006|Green|"
codeSystem="2.16.840.1.113883.6.96">
    <displayName value="Green"/>
  </value>
</observation>
```

[xl]

SNOMEDESE for green eyes!
The American College of Pathology attempted to become such omniscient programmer! They developed a system called SNOMED, and yes—the color of the eyes, among tens of thousands of other clinical descriptors (millions of others if you use a combination of these)—is displayed above! Supposedly everyone in healthcare would write in the above SNOMEDESE format instead of plain English! The federal government of the US, as well as those of many other foreign countries, actually bought these licenses and are currently part of the MACRA mandate.
www.snomed.org

[xli] According to the CMS Quality Payment Program an Exclusion is a reason for removing a recommendation from the criteria that would normally trigger it, whereas an exception is a valid reason for not having performed the recommendation during the "reporting period" (an arbitrary period of time between two arbitrary dates (i.e., a year, 90 days). Either of these removes the patient from the denominator to generate the performance percentage.
Performance = Unique Patients where guidance was followed / (Unique patients who meet the criteria - Unique patients who are excluded - unique patients who are excepted) x 100

2018-ecqm-measure-logic-guidance-v113-

[xlii] See the Value Set Authority Center of the US National Library of Medicine for the https://vsac.nlm.nih.gov/
[xliii] QPP Quality Measures

[xliv] "The Hawthorne effect (also referred to as the observer effect) is a type of reactivity in which individuals modify an aspect of their behavior in response to their awareness of being observed. The original research at the Hawthorne Works in Cicero, Illinois, on lighting changes and work structure changes such as working hours and break times was originally interpreted by Elton Mayo and others to mean that paying attention to overall worker needs would improve productivity." https://en.wikipedia.org/wiki/Hawthorne_effect
[xlv] Assuming 5 days a week, 50 weeks per year and a 40-year professional career.
[xlvi] "Deux ex Machina" or the human body seen as a complex machine. Michel Foucault; see above
[xlvii] Framingham Heart Study. For an excellent non-technical review of this important study, review Wikipedia https://en.wikipedia.org/wiki/Framingham_Heart_Study (Yes, the author is one of the thousands of Wikipedia's financial donors. By and large we believe that this source gives a balanced view on issues, making arcane information digestible to an interested reader, and provides further references. Wikipedia allows anyone to participate in its editing, relying on its own readers to maintain a clear and balanced discussion on countless issues. You might see other references in our paper to this virtual, non-profit, encyclopedia).
[xlviii] Stephen Gold MD, MPH, is the only known doctor who has written a book about his own EHR, writing from a user's perspective. Interesting, Doctor Gold starts the book comparing Praxis to a magic act. Indeed, what the user sees in Praxis is the tip of the iceberg, resulting from decades of hard work and corrected mistakes to what this EMR is today. It is all hidden within this unique software application. http://www.praxisemr.com/the_magic_of_praxis.htm
[xlix] Gawande, Atul, MD; Why Doctors Hate their Computers, The New Yorker, November 12, 2018.
[l] For the US government's position on Interoperability, please read "Promoting Interoperability (PI)"; Centers for Medicare and Medicaid Medical Services; https://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/index.html?redirect=/EHRIncentiveprograms/