

Prenatal Care: Punch Cards, Paper, People, and Promise

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Punch Cards

Many U.S. citizens were appalled after the 2000 presidential election when the covers were pulled away from the voting process to reveal a system that seems to define obsolescence. The fact that voting in many locales was reduced to punch cards, chads, and voting contraptions that haven't been manufactured for decades was a rude awakening for all but those who have been working quietly within that system. The fact that hundreds of thousands of cast votes were not counted for purely technical, apolitical reasons, and that this misadventure has occurred with every election for decades, escaped the notice of the public who shouted for reform.

Many pregnant patients may be similarly appalled if they were allowed to look behind the covers of the system that most still use to deliver prenatal care. What they will find is a decades-old paper-based system that is conducive for errors and oversights. Prenatal providers practice quietly within a system that regularly leads to uninformed decisions just when timely information is needed most. The misadventure of patients presenting at a hospital before 36 weeks in premature labor or bleeding, and no one knows anything more than what the patient tells them, occurs with disquieting regularity. This misadventure occurs in spite of the fact that hundreds of pieces of information are collected on all patients and that it is known with absolute certitude that each will eventually present to a hospital. So, where are the shouts for reform?

Paper

At the epicenter of the current prenatal care system is the paper prenatal record.

Because the prenatal record is a physical object it can only exist in one place, only one person at a time can use it, and it can be lost, stolen or misplaced. This physical nature is an inherent flaw that severely limits access to the information necessary to manage care. Providers working at any one of a number of locations where a patient may present, will at times have no authoritative information available to them because the paper record is likely to be locked up somewhere else.

Since outdated information at the hospital is better than none, it has become customary to make copies of the prenatal record at various milestones during pregnancy and somehow get them to the hospital. Many practices send a copy of the record to the hospital only at 36 weeks, while more meticulous practices send copies after the first prenatal visit, at 36 weeks, and weekly thereafter until the patient delivers. Besides being labor-intensive, this copying process deliberately introduces multiple "snapshots" of records circulating between the office, satellite offices and maybe several different hospitals. It is quite easy to imagine scenarios where a patient presenting at a hospital might be treated inappropriately based on old information from several visits prior or with no information at all.

Besides the physical access problem with the paper prenatal record, efficiently retrieving information from that record is yet another challenge. First of all, to retrieve the information contained on any kind of paper document it must be legible. This is not always the case with handwritten records, or copies of copies, or the fourth non-carbon copy down in a form. Second, assuming the record is legible, a human being must actually read the document to retrieve the information contained therein. This is not a problem in day-to-day care, but it takes on greater significance and expense when there is a desire to review care for large numbers of patients or practitioners. In this case, someone has to physically retrieve and read charts one-by-one to pull out the data elements of interest. With the 2000 election as a notable exception, most of the time even punch cards do not have to be individually “read” or inspected to determine what facts they contain.

As one moves from a solo practice to a larger community of providers, the prenatal record that should also serve as a communication tool between providers actually inhibits efficient communication. It is not uncommon that even within single-specialty groups, several different prenatal forms are utilized. Even when individual groups may choose to use one form, multiple groups within a community may not choose the same form. It is all too common that Labor and Delivery staff must wade through and interpret many differing forms that degrades their ability to quickly locate relevant information. Also, with this proliferation of forms, each with their own unique terms and semantics, it is nearly impossible to collate and compare care and outcomes across a city, much less a nation.

Familiarity with the paper record has also blinded many to the fact that in these days of heightened concerns about securing patient information and their right to privacy, the security and privacy of paper prenatal records is worrisome. Paper records, and particularly the multiple copies of those records that circulate between offices and hospitals, are touched and seen by innumerable people, some of whom have no business viewing any portion of the record at all. There is an opportunity every day for anonymous, unauthorized, and untraceable breeches of a patient’s privacy.

Paper technology has over the years developed into elaborate and ingenious formats (e.g. organization, risk-scoring, color shading, folding, effective use of type and typestyle, etc.) to squeeze out the most functionality and utility from the media. The acceptance of commercially produced paper prenatal records has no doubt substantially contributed to the standardization of prenatal care and rewarded some of those who use them with lower malpractice premiums. Paper has served patients and providers adequately only when there were no other choices.

People

The environment where prenatal care is often delivered is typified by largely routine, high volume, and brief encounters with relatively healthy patients. This care is often times provided by rotating “anonymous” providers who may see the patient once, and then never again, or it could be delivered by-proxy (e.g. midwives, nurse practitioners, residents, medical students) by people whose expertise may not match that of their supervisor, or even by a provider who was awake the night before delivering babies. With everything we know about people¹ and medical errors², it is exactly this type of environment that can lead to errors, oversights, and patients “falling through the cracks.”

It is only human nature and not personal imperfections that, in the course of delivering prenatal care, providers do not always deliver the care that they intend. Along with the sticky notes acting as reminders placed everywhere in charts today, studies in clinical decision support have shown that automated reminders and alerts³ effectively raise the proportion of care items that get done to what is intended.

Lessons from cognitive psychology and the science of information visualization can also assist in the delivery of clinical information by overcoming some of the foibles we all share as human beings. People can easily see patterns (e.g. fetal heart rate patterns and faces) but can only direct their attention to 3-5 “chunks” of information at a time. Accordingly, the goal of information design is to impart information at a glance, rather than by study. This type of cognitive assistance can help prevent oversights, direct focus to key facts, and probably saves many minutes of mental processing throughout the day. However, dynamic information displays require data that can be interpreted by a computing device.

Promise

A premise of care in the 21st century should be that clinicians must have the right information at the right time and at the right place. In order to make this a reality in obstetrics, there must be a transformation of paper-based prenatal care to digital care.

One of the first steps in making the transformation to digital care is to capture prenatal information as discrete data items that can be “read” and interpreted by machines. This first step was realized and implemented in some centers over a quarter of a century ago^{4,5}. Frigoletto reiterated in his Presidential Address⁶ at the 1996 ACOG Annual Clinical Meeting the need for computerized obstetric records with a focus on obtaining national data that can be mined for evidence-based research. The advantage of a digital form for prenatal data is not only limited to data aggregation and reporting, but discrete data is also necessary to drive expert systems, trigger alerts and reminders, and create graphic displays that can dynamically highlight areas of concern.

Once clinical information is captured as discrete data, pregnant populations can be automatically stratified according to risk based on their history, physical or laboratory findings – from the very same lifeless data that is entered on paper today. Once risks are identified, computers can automatically generate (e.g. based on an organization’s preference) a care plan for an individual patient including such care items as educational topics, lab tests, consultations, or interventions. This kind of clinical decision support can ensure that appropriate prenatal care is rendered independent of the expertise or focus of the provider at any one visit.

Digital data also allows an unprecedented level of security for prenatal records. Those who would view digital patient information typically have to first identify themselves to the system, the system may then assign a “role” or set of permissions to the user, and then based on that role, the system will parse out information on a “need to know” basis. All of this activity can be recorded to produce audit trails detailing who saw what, when, and where they saw it, in stark contrast to the anonymous access of everything by anybody with the prenatal record today.

The real power of digital data is that it can be placed centrally on a digital network. Anybody that has access to that network can retrieve the most current, up-to-date information on a patient, simultaneously with other providers. This access to a single “source of truth” is again in contrast to reviewing paper-based information that may be missing, incomplete, or several visits old. The limitation to access with this technology is, of course, the physical boundaries of the host network.

Enter the Internet.

The Internet is the now familiar network originally designed to withstand a nuclear holocaust and still keep running. The physical boundary of this network is literally the planet Earth. By placing prenatal data on the Internet, clinicians can access a patient’s prenatal record anywhere there is an Internet connection whether it is at home, office, hospital, or even in the palm of a hand. Along with this universal access, comes the simple Internet-browser software that people, eight to eighty, have little trouble using and has become second nature to most. There have been reports of web-based obstetric record prototypes^{7,8} but none of these have evolved to a level where they can scale to nationwide, commercial use over the public Internet.

Only by moving prenatal data to a ubiquitous network is there even the possibility to invite patients to view and interact with their own clinical information. Patients would be able to review results and explanations of their lab tests, view graphs of their weight and blood pressures, and the potential exists for them to enter data from home such as weights, blood pressures, glucose levels, or fetal movement counts. This interaction with their own information is in addition to general Internet services such as educational content or non-urgent communication like email. Although some feel that such patient interaction will lead to a deluge of spurious information and time-consuming requests, others feel that this interaction will actually save staff time and phone calls with the benefit of informed and engaged patients.

Because of the existence of such an omnipresent non-proprietary network like the Internet and free, easy-to-use software that enables its use, computing services can now be delivered in a cost-effective and affordable fashion that was not possible even a year ago. The Application Service Provider (ASP) model of providing computing services lets organizations “rent” sophisticated software on a subscription basis without the large upfront capital expenses of server hardware and installation, hiring technical support personnel, extensive staff training, or hefty initial licensing fees. Periodic software upgrades, management of the system hardware, security and backup of the data, are all relegated to the ASP provider leaving subscribers free to focus on their own core competencies rather than technical issues. The return on investment for an ASP model can be measured in months rather than in years for traditionally purchased services. While the first examples of ASP services include accounting, contact management, or scheduling services, the ASP model can also be extended to prenatal care services⁹ leaving clinicians and their staff free to focus entirely on the care of their patients.

In conclusion, the promise is to transform paper-based prenatal care to affordable digital care, allowing secure, simultaneous and universal access to clinical information by both providers and patients, along with interactive clinical decision support, aggregate data reporting, and information that is apparent at a glance.

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- ⁹ eNATAL - An Internet-Based Prenatal Care System. eNATAL, LLC.