



Technologies in Perinatal Nursing:  
Time to Accept & Embrace  
the Challenge

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**Abstract:**

The explosion of technology in healthcare has led to the real possibility of providing quality patient care that is safe, efficient and cost-effective. Perinatal nurses working concurrently with health information technology is becoming increasingly important in contemporary obstetrics. Because nurses are considered to be one of the leading providers and coordinators of care, the profession is a pivotal stakeholder in the use of health information technology at the bedside.

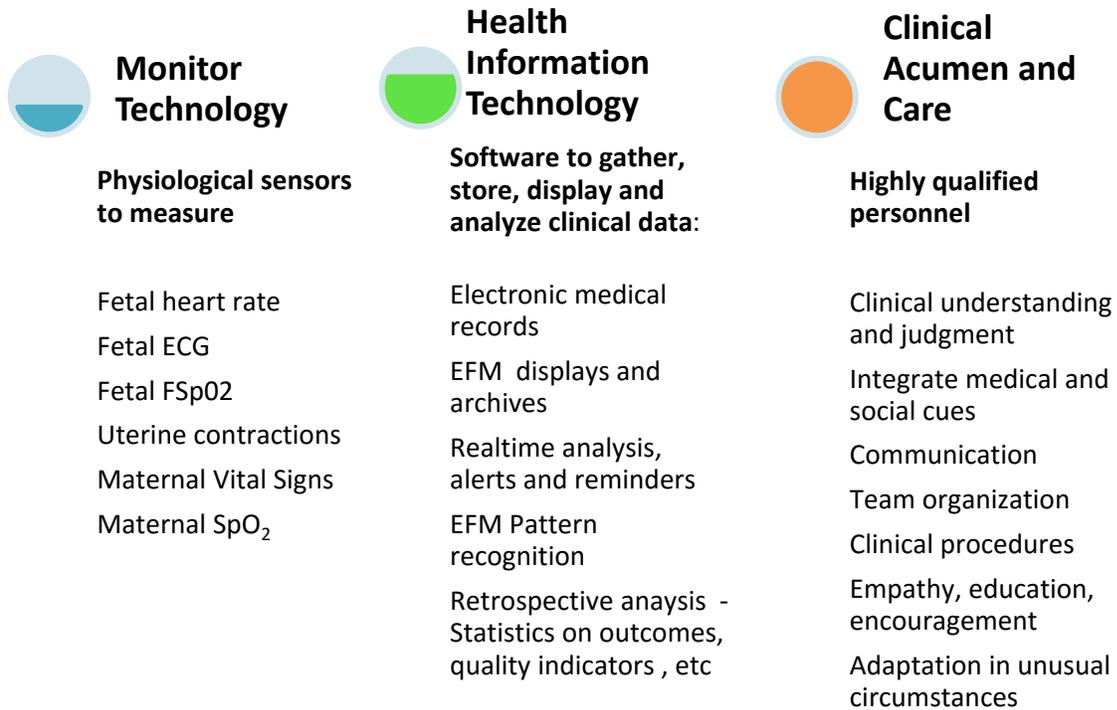
**Introduction**

In every country, climate and culture, women in labor seek assistance from other individuals.<sup>1</sup> While this fundamental sociological phenomenon is universal, the nature of that assistance varies greatly. Today’s perinatal nurses carry immense personal and professional responsibility in meeting childbearing family's healthcare needs. On a regular basis, nurses care for patients and families who have high expectations for optimal maternal and neonatal outcomes. Furthermore, hospitals have great confidence that nurses will provide top quality care. Nurses must keep up to date with evolving evidence-based practices, meet incredible documentation demands and maintain mastery of complex equipment. Time and human capacity are finite and the only way to meet these rising expectations without reducing quality of care or compromising patient safety is to increase human resources and/or system efficiency.

In 2010 the Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN) tackled one aspect of human resources by revising and publishing registered nurse staffing guidelines on desirable nurse to patient ratios.<sup>2</sup> Originally published in 1983, these much needed revisions came as a result of clinical changes that have occurred over thirty years. The patient population has become more complicated with conditions such as hypertension, diabetes, and obesity. Use of high alert medications including oxytocin and magnesium sulfate has escalated. More complex technology such as newer generations of fetal monitoring equipment require more technical expertise to operate. Management plans involve more bedside interventions. These staffing guidelines had a profound effect on increasing staffing levels. However, with current nurse staffing challenges and finite hospital financial resources, the recommended nurse to patient ratios are often difficult to maintain. Humans have a long history of inventing tools to survive and achieve goals more efficiently.<sup>1</sup> Some tools survive the test of time and evolve while others are abandoned. Healthcare is no different. Monitoring devices and healthcare information technologies (HIT) are key tools used in modern healthcare and time will tell how well they advance as healthcare changes.

Perinatal nursing is just one example of where HIT has had a significant influence on integrating technology with a nursing process framework.<sup>3</sup> Monitoring technology, information technology and clinical acumen can be thought of as an interdependent hierarchy. (See Figure 1). For example, at the most basic level, electronic fetal monitor (EFM) sensors measure fetal heart rates (FHR) and uterine activity. At an intermediate level, HIT consolidates and analyzes the monitoring data for clinicians. At the highest level, nurses decide what the data means, what is likely to happen next and implement the most beneficial interventions. Each level depends, in part, upon the former. Historically, nurses did everything including auscultating FHRs with a fetoscope, palpating uterine activity, recording data in a paper record, and made FHR decisions based on what could be heard and recorded. Now EFM and software accomplish several of these tasks. For some nurses, these new technologies evoked insecurity, a feeling that professional value and roles would be diminished. For others, new technology provided a release from endless listening, counting and transcribing and consequently freeing time to focus on clinical judgment and hands on patient care. In fact, while fetal monitors did reduce the counting tasks they also elevated the expectation for medical reasoning or tracing interpretation.

Figure 1. Three interrelated aspects of clinical care



The purpose of this document is to broadly outline the evolution in each of the three levels of data collection via monitors, interpretation and clinical intervention. In addition, we will discuss relative strengths and weakness of clinicians and HIT in the context of modern perinatal care and how they complement each other.

Clarity on this subject is important to:

1. Emphasize that clinical acumen for diagnostic and therapeutic decisions and compassionate care is paramount
2. Determine where and why technology can be a help or a hindrance for nurses
3. Provide guidance for designers of new technology to meet a nurse's greatest clinical needs

### Monitoring Technology

By 2004, 89% of births in the United States were monitored electronically. <sup>4</sup> In view of the high and stable rate of electronic monitoring *Vital Statistics* ceased reporting EFM utilization rates in annual birth-related reports. Monitoring sensors and signal processing have evolved to

provide excellent measurement of FHR, uterine activity and maternal vital signs.<sup>5</sup> Fetal monitors can indicate signal coincidence when two sources of heart rate measurement are the same. On the other hand, monitoring faces new physical challenges. Obesity impedes monitoring by Doppler ultrasound based external sensor technology.

Given the imprecise relationship between FHR and fetal brain oxygenation or acid- base status, a considerable effort has been devoted to finding other physiological measures that would be more discriminating. Unfortunately, prospective clinical trials show no clinical benefit in using EFM with additional sensors that measure fetal oxygen saturation or fetal ST segments of the fetal ECG compared to using EFM alone.<sup>6,7</sup> Thus, for the near future, the obstetrical world remains dependent upon standard EFM.

## Healthcare Information Technology

HIT has evolved considerably in contrast, to the relative stagnation of the monitoring devices. Early electronic medical records allowed clinicians to collect, display and store information in a legible fashion, but at considerable inefficiency. Data entry was often arduous, time-consuming and error -prone. “Cut and paste” shortcuts led to nonsense entries with costly legal repercussions. Lack of interoperability wasted time with redundant documentation.

Perinatal nurses have played an important role in this evolution. Working alongside HIT experts, nurses have been vital members of multidisciplinary teams in which integrating, implementing, and maintaining fetal surveillance technologies with clinical practice has become a priority in patient centered care and safety. This is especially apparent in organizations that promote high reliability units.

There has been considerable industry consolidation on a few types of hospital-wide electronic medical records boosting interoperability. IT networks, smartphones and cloud-based computing give nurses unprecedented and speedy access to information and human expertise. The computational power and reliability of basic computers and networks means very complex analytical methods can be available in real-time at the bedside.<sup>8,9</sup> Computerized analyses can now be applied to EFM tracings or evaluate labor progression to bring consistent interpretation, reducing clinical variation.

Psychological testing has underlined the importance of simplicity and clarity of information displayed on computer screens. Overcrowded or confusing displays can lead to medical error. Better graphical designs mean critical information is consolidated for efficient review by clinicians. High rates of false alarms lead to frustration and disregard of the device. Truly discriminating alerts based on better evidence-based algorithms alleviate this alarm fatigue.

## Clinical Acumen and Care

While the fundamental technology in standard fetal monitoring equipment has changed little in recent decades, clinical behavior in response to FHR monitoring *has changed considerably*. Clearly defined nomenclature,<sup>10, 11</sup> standardized clinical guidelines,<sup>12-16</sup> and structured communication techniques are now part of obstetric care. Moreover, published nursing position statements and other resources have highlighted that skilled clinicians are essential to ensure maternal and fetal well-being when fetal monitoring is utilized. Additional publications focus on HIT's vital healthcare role in terms of enhancing opportunities for reducing error in perinatal settings.<sup>3, 11, 17, 18</sup>

There is increased awareness that environmental and human factors can impair clinical judgment resulting in delayed intervention and birth-related injury. To address some of these issues healthcare professionals have:

- Legislation that limits working hours
- Updated recommendations on nurse-patient ratios
- Stricter and more frequent credentialing
- Chain of command procedures
- In-house coverage rather than on-call at home

Despite these measures, assessing a clinical situation is still challenging. Nurses must often project what will happen in the future. Furthermore, these same nurses prefer to avoid allowing patients to deteriorate to a suboptimal status because, once changes have occurred, safe recovery may be impossible. To make decisions, the clinical mind must focus on what is important and disregard the irrelevant. The human brain is vulnerable to well described biases in this task.

Recent “vivid” experiences affect individual's perception of risk. The psychological phenomenon of “Tunnel Vision” refers to a tendency to perceive and confirm only the information that aligns with a particular viewpoint and discard contradicting information.<sup>19</sup> Variations of this phenomenon include “Wishful thinking.” For example, a belief that a patient will deliver soon or not deteriorate on a shift can lead to poor FHR tracing assessments which is inconsistent under the best of conditions. Occasionally, humans get tired, distracted, have memory lapses, take risky shortcuts, or get diverted by competing interests. Furthermore, inadequate training or clinical experience can compound problems at the bedside. The objective, unbiased, statistical methods offered by HIT can counter these types of human bias,

reduce information overload and assist novice and seasoned nurses to make more confident decisions.<sup>20, 21, 22</sup>

Another attractive HIT feature for perinatal leaders is the ability to collect and organize outcome and performance data such as the number of cesarean births or elective inductions. Instead of hand counting data from multiple sources, which takes up valuable nursing time and resources, HIT can collect this data and provide written reports on a regular basis. Performance can be compared over time, to other unit level quality improvement goals or datasets of core measure such as those established by the Joint Commission and the National Perinatal Information Center. Policies and procedures can then be further refined based on benchmarked data in order to provide safer care to patients.<sup>18, 23</sup>

The divisions between fetal monitoring technologies, technologies in healthcare information and modern nursing care have been become increasingly blurred. Monitors contain software. Systems in HIT employ clinical algorithms. Clinical algorithms are often based on research using huge datasets derived from HIT systems. Clinicians make decisions on monitoring data and research findings. A brief comparison of strengths and weakness related to computer and human faculties is outlined in Figure 2. Both are fallible but each one has strengths in specific areas. The strengths of one counter weaknesses of the others. Computers crunch numbers well. Let the computers apply that capacity to analyze, organize and display critical information without bias so that nurses can be empowered to use technology and focus on higher order clinical reasoning, collaborative dialogue with colleagues and compassionate quality care. Surely valuable nursing time should not be consumed by the repetitive, manual labor of measuring, counting and calculating. On the other hand, nurses are essential to seek out and integrate information from additional sources, see exceptions to the general rule, cue in to unspoken patient fears, and even make do with missing data. Nurses communicate, reason, educate, encourage and empathize with patients and families. The profession makes a profound difference as hands-on patient contact, visual interpretation at the bedside and having an underlying basic foundation in obstetric care is absolutely necessary to validate HIT information. The perception that technology will take over nursing responsibilities, such as FHR interpretation, leaving all data to be interpreted, documented and managed by artificial intelligence is not only incorrect but illogical. However, given what is known about human error, surely one could not advocate for one approach without the other i.e. nurses without equipment or equipment without nurses.

Figure 2. Complementary Strength and weaknesses



As HIT related to antepartum and intrapartum fetal surveillance techniques evolve, the profession is often concerned with how to integrate them without challenging or devaluing the role of nursing. This is where an understanding of HIT strengths is important so that they can insist on HIT functionality that is truly helpful allowing nurses to have more time with patients. Perinatal nurses must continue to be involved in the design of state-of-the art systems at the bedside that optimize time for hands-on patient care and streamlined workflow and patient safety.<sup>18, 24</sup> Additionally, nurses play an important role in collaboratively developing and utilizing a variety of quality improvement and risk reductions strategies with the aid of HIT to improve patient care, reduce adverse perinatal and neonatal outcomes (e.g. emergent cesarean section or neonatal intensive care unit admission) and potentially reduce liability.<sup>13,25-28</sup> These include but are not limited to

Developing clear fetal monitoring guidelines that include multidisciplinary protocols for interpretation, intervention, and documentation

Educating nurses, residents, nurse midwives, and physicians on fundamentals of fetal monitoring using standardized fetal monitoring nomenclature

Applying HIT to patient care by using high quality up to date decision aids, bundles and toolkits

Implementing peer reviewed evidence based information, such as clinical protocols, checklists (i.e. oxytocin), and guidelines in a high reliability organization to reduce clinician practice variation

## Why Should Nurses Care

Between 2008-2012, there were 2.8 million registered nurses (including advanced practice nurses) in the United States workforce making nursing one of the largest health-related professional groups.<sup>24, 29, 30</sup> According to Gallup polls, these professionals are regarded by the public as the most trusted in the United States. Nursing is a caring profession that requires licensure, knowledge and clinical skill. Nursing demonstrates the best side of humanity. Well-designed HIT augments nursing capacity. Nurses must be clear in thinking and understanding the relative strengths and limitations of all parties in order to direct the evolution of these technologies. In turn, nurses can harness these technologies to support the mission of providing high quality patient care that is evidence-based, individualized, efficient and safe.

Government agencies expect a 21% increase in demand for nurses nationwide by 2025 though considerable variation of supply and demand at the state level is anticipated. Nursing employment will continue to be affected by factors including population growth, a shift in demographics as the median age increases, economic conditions, employment and retirement of nursing personnel and changes in health care reimbursement. Workforce projection models demonstrate that the rapidly changing health care delivery system, which includes HIT, is shifting how patient care is delivered and the specific role the nursing workforce plays in these changes.<sup>31</sup>

Perinatal nurses are using technology in conjunction with clinical knowledge that has been accumulated through hands on experience and education. This combination assists in improving care and facilitates multidisciplinary communication. Technology allows nurses to ask the right questions at the right time, perform streamlined nursing assessments, accurately determine a correct diagnosis from a multidisciplinary approach, and perform appropriate tasks and intervention on the front and back end of decision-making processes.<sup>32</sup>

## Conclusion

In this modern era, technology is commonplace whether it's embedded in households, communication methods, modes of transportation or healthcare. In these areas technology continues to be created, refined and updated on a regular basis. Advances in technology, whether it's a new cellular phone model or component of medical equipment, are requisite in order to provide and improve efficiency, convenience, accessibility and safety. As nurses provide day to day quality patient care in the perinatal setting, technology will continue to influence many facets of the nursing process framework. In today's healthcare environment, few perinatal nurses can envision delivering patient care without assistance from some form of technology, whether that technology be an automatic blood pressure machine or fetal

surveillance with an electronic fetal monitor. Nursing is what we as individuals do best and nurses working in conjunction with HIT is clearly an investment in optimizing efficiency, perinatal outcomes and patient safety. Throughout time women in labor have sought assistance from others with experience and skills. Clearly nurses will continue to fill that essential role backed by increasingly complex technology as HIT evolves.

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