**Insights-CAPE Sims: Physical Environment Challenges 1/12/16**

**Emily Pang:**

This past Tuesday, our class trekked out to the Stanford Barn to visit Stanford's Center for Advanced Pediatric and Perinatal Education (CAPE). At CAPE, there are a number of initiatives: simulation-based learning, medical device development and testing, and research services. The main opportunity it offered for our class was a chance to experience simulations of possible birthing situations, and to observe what interesting problems or need areas exist that may need solving. Here are three insights that I gained from our visit to CAPE:

**1. Everyone in the room is really, really busy. Solutions that aim to increase flexibility and efficiency are necessary.**

One of the first impressions I had during every simulation scenario was how chaotic the room was: doctors and nurses were rushing in, out, and around the room, and the mother and/or child were often experiencing distress or confusion. Because of this, a need that this environment may have would be for ways to improve clinical flow and interactions.

For instance, some problems involved issues with communication, organization, and space. Direct communication was still an issue - on top of not having name tags or other easy identifiers, the people at CAPE mentioned that everyone in the room, including the father, oftentimes wears the same scrubs - leading to potential confusion and delayed communication. Additionally, the labor and delivery room could benefit from methods of maximizing free space - I noticed that many of the materials doctors used were dragged around on large, clunky carts - whether it be the doctor's surgical tools, pediatric resuscitation materials, or tray for placing a premature baby directly after a C-section is performed. While necessary, the management and organization of these materials contributed to the cramped and limited work environment for the clinicians, making it difficult for people to move around freely.

Furthermore, some things were simply hard to quickly obtain - for example, neonatologist Henry Lee mentioned that clinicians within the room often had no idea whether other doctors or nurses were busy or could easily respond when called for help. I also learned that materials such as blood could be delivered anywhere between 10-30 minutes after being requested. These delays all lead to extended wait periods that may be detrimental to the health of the mother or child.

Nevertheless, it can be difficult to improve efficiency without opening up the possibility of health hazards. For example, I had inquired about the resuscitation mask that blows oxygen for the baby; the doctor or nurse essentially had to keep both hands busy in assisting with this - I had wondered (and still do) whether a redesign of the mask could allow the clinician to be freed of that task. However, it was explained that the mask must be fitted correctly, and removed or swapped when necessary. This therefore requires a certain degree of judgment and careful monitoring by a clinician. This is an example in which attempting to simplify a procedure could lead to higher risks of causing harm to the patient.

**2. Having two incredibly vulnerable patients means a multitude of potential health problems may arise.**

Another insight I gained from our visit at CAPE was simply how many factors were at play in the labor & delivery room. I was astounded at how a life experience as common as childbirth could go wrong in so many ways - all in a blink of an eye.

Firstly, important problems to watch out for are whether the baby has sufficient body warmth and whether any breathing problems or irregularities are happening. A common solution is to either wrap the baby in warming blankets or keep the baby close to its mother, as to allow her body warmth to be absorbed. However, the risk of a baby experiencing breathing problems is a very real and naturally occurring one - the CAPE employees taught us about how babies are still practicing to breathe during their first few hours, and blockages such as mucus plugs are also frequent and risky if gone undetected.

Furthermore, the mother can also rapidly experience major problems. For example, abruption, or placental detachment, occurred in a simulation scenario that we witnessed, in which the nurses and clinicians had to act quickly to provide blood and assist in uterus contraction. Currently, nurses have to rely on signs such as heavier blood flow to identify abruption in its early stages - after which, they will need to act quickly to respond.

Sterilization is also a problem for both the mother and child - after childbirth, each are extremely vulnerable. While clinicians take care not to introduce potential agents to the environment, this is still an area that can pose severe harm and prove difficult to manage.

**3. More information/tracking of the patients would be good, but stay away from over-medicalization**

One of the first lessons Henry Lee impressed on us was that the L&D department can be susceptible to over-medicalization; for families it can be difficult to witness traditional medical standards and practices interfere with their experience, as each childbirth is certainly a special one. Thus, while more information can help ensure better safety for the delivery, it can also serve as an annoyance to the families involved.

For example, our discussions brought up the potential benefits of monitoring factors such as oxygen, temperature, heart rate, blood pressure, and even time of delivery and umbilical cord clamping. This data may prove useful for earlier detection of complications or problems that may arise.

However, we were constantly reminded about the harms of over-medicalization. Attaching the patients to numerous cables, separating the mother and child, and other practices that are meant to better prevent potential health hazards are faced with patient dissatisfaction, making it difficult to continue. This therefore calls for a need for good design that can still achieve the goal of continuously collecting and monitoring health metrics. This is an area I would be interested in learning more about to better understand the need area.

**Ribhav Gupta**:

1. Limited Space
Operation rooms have very limited space for doctors due to the current layout of trays, materials, and more. When there are multiple doctors and family members congregating in a room it can quickly get out of hand. In the noise and business of the room it is easy for doctors to forget who is there to assist them in the room. At the same time, communication can become a problem with multiple conversations going on simultaneously. This can prove problematic in requesting help or ordering medications. Lastly, with small stations, or devices within the room, it is easy for something to fall, get damaged, or simply move around in an efficient manner.

2. Timeliness of Support is Variable

In the case that extra support is needed in an operating room, the staff within the room has little knowledge regarding how long it will take for blood, medications, or more doctors to come to their aid. In some cases it can take up to 30 minutes for the care to be provided. Without a general idea of how long it will take for this support to arrive, the staff in the room is left in the dark regarding what they should do in the mean time to mitigate any further harm. Even in the cases of a blood transfusion, using unmatched O- blood, large hospitals can take up at best 10 minutes. There is not only a need to create a more consistent timetable, but to increase real time communication within the hospital regarding when more doctors can arrive and to find other ways expedite the process of bringing blood and medications.

3. Limited Information

Many medications cannot be used if a patient — in this case mother — has a pre-existing conditions such as some allergies. When it is late at night, an emergency, or with a limited staff it is easy for the medical staff to remember these facts without having to spend the time pulling up a mother’s medical file. There must be a more efficient means to pull up the general information about the mother and keep it visible for all doctors in there room.

Another example of limited information is when doctors have no way of estimating the time that has passed when they are delaying the clamping of the umbilical cord. This sort of basic information can especially be hard to keep track of when the majority of the staff is working to resuscitate a baby or assist the mother. This information should be more easily accessible.

4. Cannot Measure Babies Vital Signs

**Karthik Ramasubramanian:**

In a seemingly routine operation, the baby’s vital signs are not carefully monitored after the baby is with the mother. This is due to an effort to slightly de-medicalize the L&D system. However, in the case that the baby is fatigued, or is for some reason unable to breathe, the mother and doctors need to know. This can especially be problematic in hospitals with limited staff and in situations where the mother is too fatigued from labor to be as attentive as possible. There is a need to create non-invasive devices which are both calming to see but also careful monitor a baby’s vital signs.

1. The oxygen mask requires a tight seal that needs to be maintained with constant pressure by the physician. This is because the surface is generally wet and slippery.

2. The umbilical cord must be clamped, but there significant benefits in delaying the process by 30 to 60 seconds. This is because it enables more blood transfer between the mother and child.

3. Babies often have issues switching from reliance on placental oxygen to breathing by themselves. Even though they have practice using their lungs, they still sometimes forget to breathe.

**Albert Ho:**

1. Childbirth in different hospitals or home birth. In the situation that emergency blood transfusion for mother or baby is required, the longer preparation time in a community hospital may cause different outcome from mothers/babies in a larger institution like Stanford. As the numbers of parents choosing out-of-hospital birth increasing, each scenario can be more complicated if not even happened in the hospital.
2. The de-medicalization in the process of delivery is not only from parents’ words but already present in the practice of postpartum care from normal term delivery. However, assessment by experienced nurse is still required in the first hour of transition period for the baby. There is a need of an obscure device that monitors baby’s vital sign without making the recovering room like NICU.
3. The guideline suggestion of delayed cord clamping may not be performed with exact time the guideline suggests in the current clinical setting. The difficulty of practicing precisely may have effect in the result of clinical trials.

**Ana Ordoñez:**

1. Space is constrained in maternity ward rooms, because of the amount of personnel and equipment needed to take care of both patients.
2. 2. Sensors and alarms often add to the chaos, rather than being helpful to the health professionals.
3. 3. Smart and sensitive monitoring is necessary for saving a baby's life.

**Johanna O’Day:**

* 1. When you hear about birth being super “medicalized” I guess I also mistook this as meaning it was also super-quantitative but what these simulations showed (whether intentionally or not) me was that the whole process still involves a lot of medical intuition and *human* analysis. No matter what kind of machines or technology we have we still need the human physicians and nurses and staff to carry out the processes and make the right decisions. This also showed where there the gaps in technology lay - proper/accurate heart rate monitors, temperature sensors, time-keeping devices, personnel tracking (so you know what staff are in the room) etc.

	2) I am a bit surprised that there isn’t a simple color coding system to differentiate between staff members, or even some kind of badge system that allows you to easily identify the different physicians, technicians, nurses, patients’ family members etc. Perhaps this type of system is unnecessary but to me it seems important to be able to quickly identify visually who is who in the hospital room.

	3) The medical history of the patient is not readily available which seems strange - perhaps with the electronic medical records system now it would not be difficult to post at least the important medical history notes on a screen in the room? I am visualizing a split screen that both tracks the staff in the room (perhaps by some kind of FitBit type tracker) and also displays the medical history of the patient.  (Maybe some time in the future it could even have some kind of voice recognition to call in back up staff if a doctor or nurse dictates “Call in PEDs (sp?) team” and then that would act as a paging system to the nearest staff members. In the simulation the team was very closeby, but perhaps in a real situation they would be further away).

**Hadley Reid:**

1. Complications in delivery lead to crowding in the delivery room, and even during normal delivery body positioning can be unideal.

When the newborn had to resuscitated in both the first and second simulation the influx of the peds team blocked the newborn from the mother's view (although in the c-section this view was already obstructed by the drape) which presumably might cause greater anxiety on the part of the mother. In the second simulation there was space to position on the opposite side of the resuscitation cart which would have left a clear viewing path for the mother but the peds team positioned themselves between the mother and the cart, with their backs to the mother. Even the charting station was positioned in such a way that the nurse had to face away from the new mother to begin charting. This type of body positioning impedes communication between medical personnel and the mother as well as the other attending members of the family.

2. Placental abruption is difficult to anticipate in delivery and cannot be confirmed until after the placenta itself has also been delivered.

This was surprising to me as it seems like some of the other complications with delivery we have heard about in this class can be anticipated in some way (ie an obese, diabetic or hypertensive mother will be anticipated to have a tougher delivery). However the diagnosis of placental abruption seemed to occur at earliest right as the baby was being delivered. This makes this complication especially challenging as personnel need to react quickly, call in additional staff, and explain the situation to mom with little advance warning.

3. There is a trade-off between warmth and visibility.

Newborns chill easily which can lead to serious complications or even death. However the system of allowing the baby skin to skin contact with the mom and then covering them with blankets means the baby is less visible for the nurse to monitor their transition. So, what would be a way to keep the baby on mom's skin, warm and visible?