THE OBSTETRIC DILEMMA

ELINOR HILLS

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The Obstetric Dilemma: Natural Selection and the Persistence of Maternal Mortality

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Over the course of human evolution, childbirth has become more complex and painful and remains dangerous today even with the prevalence of modern medicine (Trevathan 2010; Weaver & Hublin, 2009; Wells et al., 2012). A substantive breadth of research exists driven by the desire to comprehend why natural selection would select for a behavior that has the potential for distinctly adverse effects for mothers and infants (Lipschuetz, 2015; Wells et al., 2012; Underdown & Oppenheimer, 2016). Most anthropologists agree that dangerous childbirth was not "fixed" through natural selection but instead evolved as a non-adaptive epiphenomenon wherein other beneficial characteristics to human development were able to evolve. The obstetric dilemma has been widely considered the cause of the high rates of maternal and infant mortality persistent today (Wells et al. 2012).

Critics of the Obstetric Dilemma hypothesis argue that the biomedical logic is valid but that research evaluating the role of human performance has not been sufficient (Dunsworth et al., 2012). While it is important to consider the role of bipedalism and encephalization may have played in the evolution of human childbirth more recent findings, namely Dunsworth & Eccleston's findings on the coevolution of the birth canal and maternal metabolism provides new insight into why human infants are born more helpless and underdeveloped than other species (Dunsworth & Eccleston, 2015). Furthermore, the dangers of childbirth today cannot be explained by the obstetric dilemma alone as it is necessary to consider the socio-cultural and psychological factors that contribute to childbirth-related deaths. The question thus arises: is it the dilemma itself or the fear-born belief instilled in physicians and birthing mothers that women's bodies are not naturally equipped to give birth safely? (Dunsworth & Eccleston, 2015)

From early Neanderthals to modern humans, analysis of pelvic fragments has indicated physiological changes of smaller pelvises and a birth canal that requires the infant rotation during delivery has contributed to birth becoming more painful and dangerous (Weaver & Hublin, 2009). Childbirth came to resemble what it is today, physiologically, less than 500,000 years ago whereas more recent agricultural changes have likely also contributed to changes in fetal and maternal growth. Over the course of human evolution, the shape of the pelvis became more basin-like in shape to allow for minor gluteal to support the body and trunk in walking and running. With this, the shape of the birth canal opening became condensed: less elongated and more mediolaterally oblong (Dunsworth & Eccleston, 2015). While it is undeniable that these changes occurred, there is less certainty surrounding the chronology of these evolutionary events (Dunsworth & Eccleston, 2015; Wells et al. 2012).

Though not nearly as widely discussed, it is possible that there were adaptive benefits to childbirth being intensive and painful. Perhaps the pain associated with childbirth persisted in the human species because it discouraged having as many offspring and frequent reproduction. This could align with hypotheses of amenorrhea during lactation as an adaptive function wherein there exist benefits of investing more energy into fewer children (Haig, 2014). Other studies have suggested that pain itself had adaptive evolutionary benefits in promoting close interpersonal bonding between a woman and her partner and support system. This hypothesis suggests that physical pain could promote emotional fitness in a way that impacts the wellbeing and survival of the newborn (Maul, 2019). Regardless of whether childbirth pain itself is an adaptive trait, the evolution of the human birth process must have allowed for beneficial traits to develop and not solely created adversity (Cruz, 2015).

Researcher largely agree that the dangerous conditions of human childbirth are the result of trade-offs that have facilitated enhancement to the human species (Cruz, 2015; Rosenberg & Trevathan, 2002; Wells et al., 2012). Consequently, the development of concordant evolutionary traits that contributed to dangerous and painful childbirth, allowed for humans to develop larger brains, and subsequently complex language and social neworks. Trevathan refers to the human body as being, "a bundle of 'compromises shaped by natural selection in small increments to maximize reproduction, not health.' This leaves us vulnerable to lots of diseases and disorders, but it also makes us amazingly resilient" (Trevathan 2010, 7). It is likely that resilience born from evolutionary trade-offs contributed to the success of the human species. Among other behaviors, the pain and suffering related to childbirth has influenced empathy development, ritual, and mother-infant en-

gagement that are key values of human beings (Cruz, 2015). Furthermore, trade-offs that necessitate dangerous childbirths have allowed for the development of creative thinking, intelligence, and cooperation in human beings. Some studies argue for the indisputability of the pattern between stature, neonatal head size, and pelvis shape (Fischer & Mitteroecker, 2015). However, most researchers agree that there is more complexity surrounding the evolution of childbirth and that finding a single definitive justification for the obstetric dilemma is near impossible (Lipschuetz, 2015; Wells et al., 2012; Underdown & Oppenheimer, 2016).

One of the most prevalent theories to difficult childbirth is that it developed as a ramification of bipedalism. Whereas many innovations that have set humans apart as a species can be attributed to bipedalism, one of the concerns of bipedalism is that it makes pregnancy and delivery longer and more painful, and consequently more dangerous, for women and newborns (Trevathan 2010). The theory that the obstetric dilemma occurred because of bipedalism considers the co-development of encephalization of human infants paired with a smaller pelvis. Researchers have used fossil records to trace the development of maternal pelvises and infant skulls in order to determine where in the timeline of human and pre-human history the obstetric dilemma became more apparent for humans as opposed to other species (Wells et al. 2012). Some studies hypothesize that the mechanism of rotational birth in which human infants much make two rotations to navigate the birth canal, may have developed before the evolution of much larger brains in Homo infants. This follows evidence that suggests Australopithecus infants were not considerably encephalized and yet a rotational mechanism was needed in birth. Instead it is possible that it was the combination of bipedal pelvises with larger infant shoulders that necessitated rotation (Wells et al. 2012).

On the other hand, studies suggest Neanderthals gave birth to infants transversely and lacked any rotational mechanism (Franciscus, 2009). Further, more recent research on skeletal material from Australopithecus sediba (MH 2) suggests that there is greater pelvic morphology variability that developed independently from changes in obstetric dimensions (Wells et al., 2012; Weaver & Hublin, 2009). A considerable limitation to the hypothesis that difficult births evolved due to antagonistic pressures that selected for encephalization of neonates and bipedalism is that the fossil records indicate contradictory evidence for the timeline of modern pelvic development (Wells et al. 2012). Wells et al. (2012) however, propose the possibility that

“Claiming a single definitive justification for the obsteric dilema is near impossible”

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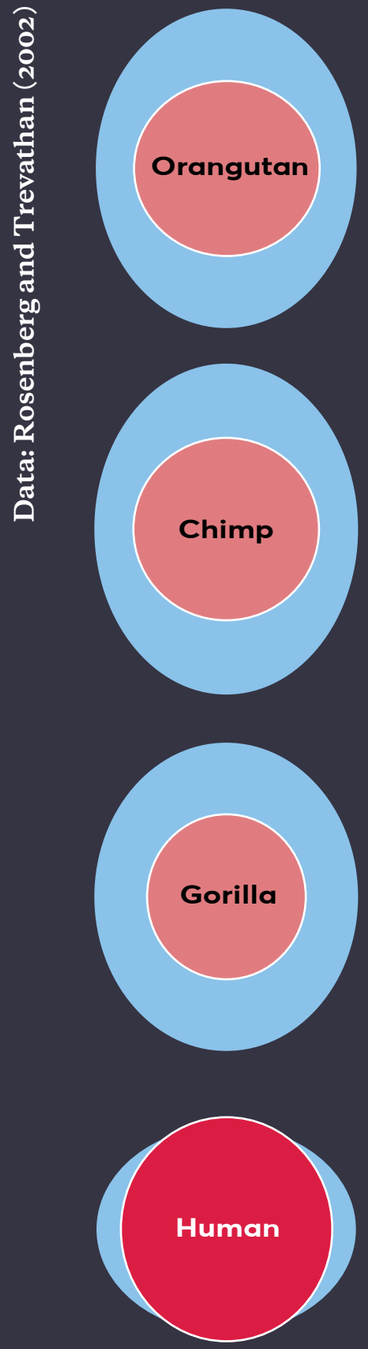

some early human ancestors experienced an intensified obstetric dilemma but at some point in time the issue lessened through evolution of the rotational mechanism common in modern delivery. It is then possible that over many years the obstetric dilemma was re-intensified due to emergent ecological stressors. Other studies have indicated the effects of environmental factors such as diet, sunlight, and parity on pelvic morphology and create variability in the severity of the obstetric dilemma (Cox & Scott, 1992; Merewood et al., 2009; Wells et al., 2012). The impact of proximal environmental factors on the intensity of the obstetric dilemma illustrates the importance of considering the perpetuated issue of maternal mortality from a range of perspectives beyond evolutionary explanations alone.

A lack of consistency in fossil record analysis has lead other anthropologists to agree that the obstetric dilemma was not caused solely in order to allow for bipedalism and encephalization. The graphic on the left represents the relationship between human birth canal inlet diameter (blue) and offspring cranial diameter (red) compared to other contemporary close biological relatives.

As Wells et al. propose, “it seems logical that the ‘bipedalism-encephalization conflict’ hypothesis is either insufficient as an explanation of perinatal mortality, or overstated” (2012, pp.40-41). Along this vein, some believe that the relationship between encephalization and bipedalism is more about bioplasticity and less about genetic evolution. (Underdown & Oppenheimer, 2016). Pelvic dimensions

as well as patterns of fetal growth can be significantly affected by ecological factors including thermal environment and nutrition. Trends in body size, of both stature and weight, can have a substantial impact on the obstetric dilemma (Wells et al., 2012). Certain changes in the span of human life history relating to agriculture and dietary shifts have lead to decreased stature in women and increase fetal growth. Even in many modern populations, low maternal stature and obesity place women at higher risk of perinatal mortality. A more recent theory presented by Dunsworth and Eccleston proposes that neonatal helplessness evolved based on the benefits it served from the maternal perspective.

It is widely accepted that the human species' arrested development has adaptive value in human evolutionary history (Bjorklund & Ellis 2014). While some studies have pointed to infant helplessness as an adaptive response to bipedalism and pelvis morphology, Dunsworth and Eccleston argue that bipedal pelvis anatomy is related to childbirth difficulty and more involved parenting but did not necessary cause its development (2015). Counter to beliefs that intrauterine investment is less significant for humans, human gestation is longer than would be expected for a primate of a similar size (Dunsworth et al. 2012). Human neonates have large brains compared to other primates of similar size and is only considered underdeveloped in comparison to adult human brains. Human brains at birth are only 30% of adult brain size meaning human infants must accomplish more brain growth postnatally than other primates (DeSilva & Lesnik, 2005, p. 207). Human infants for example do not possess the mechanism to cling to their mothers as most primates do. They must instead rely on their mothers as well as alloparents. In turn this may lead to greater socialization for the infant and surrounding social and cultural reproductive practices (Dunsworth & Eccleston, 2015; Dunworth et al., 2012).

It is evident that brain growth in utero is thus truncated at some point, due either to the obstetric dilemma theory or because there is another benefit of infant development outside of the womb. An early explanation of the latter hypothesis is Portmann's "extrauterine spring" hypothesis that suggests that infants must be born early in their development for their brains to be enriched by stimuli outside of the womb (1969). Dunsworth & Eccleston propose along this vein that there is a metabolic and energetic limit to gestation, the energetics of gestation and fetal growth (EGG) perspective. The EGG theory posits that the birth process begins when the mother's body can no longer support the needs of the fetus. Therefore, women give birth when a threshold is reached and their bodies can no longer provide the energy needed to sustain infant development. Thus, human infants are born underdeveloped but can receive the energy they need more efficiently through breastfeeding (Dunsworth & Eccleston, 2015).

"Neonatal helplessness evolved based on the benefits it served from the maternal perspective"

To understand the factors that perpetuate dangerous childbirths in modern societies without considering those beyond the evolutionary perspective as well. Recent studies of the sociological and cultural factors that influence maternal and infant mortality during childbirth argue that focus on the obstetric dilemma as a repercussion of human evolution has had adverse effects on mediating safe childbirth (Dunsworth et al., 2012; Stone, 2016). Stone states, "Biomedical and paleoanthropological assessments of the pelvis have implicated it as an unchanging structure that endangers women, putting them at mortal risk each time they give birth" (2016, p. 150). The obstetric dilemma as it is normally discussed and studied, assumes that women's bodies are in danger due to "flawed" evolutionary development. This assumption leads to culturally embedded beliefs and system medical practices that take power from women and emphasize the need for intervention of trained individuals (Rosenberg & Trevathan, 2018; Stone, 2016). Frameworks that emphasize the pain and dangers of childbirth lead to greater numbers of women electing planned cesarean sections out of fear rather than necessity (Dunsworth & Eccleston, 2015; Wells et al., 2019). The overwhelmingly biomedical and paleoanthropological narratives that surround the obstetric dilemma in academia have ignored the role of culture on women's reproductive lives. The perpetuated subtext of the obstetric dilemma is that women are not capable of having safe births without intervention. As a consequence, women face structural violence in biomedical spaces and are put at greater risk through their loss of agency (Stone 2016).

Many of same factors of human evolution that necessitated complex mechanisms of birth have also allowed for the intellectual and cognitive capacity necessary for modern medicine. Humans have the capacity to "fix" complications of childbirth and yet efforts to make childbirth less painful or dangerous have had negative effects

dilemma has led to the perception that women's bodies are physiologically incapable of birthing naturally (Rosenberg & Trevathan, 2017; Stone, 2016). Humans have evolved to the point where their brains have to capacity to solve issues of painful and dangerous births and yet women continue to die during childbirth. Even the development of modern medicine has not been able to solve the issue fully (Stone, 2016). Many anthropologists have argued that modern medicine and technocratic models for birth have led to increasingly dangerous births even in developed societies (Davis-Floyd, 2004; Thies-Lagergren et al., 2013). Childbirth remains dangerous today due not exclusively to biological and evolutionary reasons but also sociocultural practices and the increasing desire to "fix" the obstetric dilemma through technocratic interventions evident in the increased rate of cesarean sections (Dunworth & Eccleston, 2015). In poorer countries and wealthier countries alike, rates of CS have been steadily increasing, especially in private facilities. In South Africa between 2010 and 2014, more than 90% of births were performed via CS in private facilities and in Brazil's private facilities, 83% of deliveries were through CS (Wells et al., 2019). CS is especially common in short women and in overweight and obese women. This could be due to environmental factors increasing stunting in childhood, but it could also be cause by socialized perceptions by physicians that these conditions would inhibit women from delivering naturally (Dunsworth & Eccleston, 2015; Wells et al., 2019).

The troubling state of birth in the developed world becomes increasingly evident when considering the disparities in birth outcomes between white women and women of color (Thies-Lagergren et al., 2013). Even in the wealthiest countries, birth is significantly more dangerous for black and Latinx women and infants than for white women and infants. Furthermore, even when controlling for socioeconomic status, black and Latinx mothers are at risk of poorer health outcomes than their white

"Humans have evolved to the point where their brains have to capacity to solve issues of painful and dangerous births and yet women continue to die during childbirth"

counterparts (Villarosa, 2018). More than twice as many black infants in America die during infancy than white infants. This disparity is even more dramatic now than it was in the 1850s, more than a decade before the abolishment of slavery. During a time when black women's bodies were bought and sold as commodities, black infants survived at more comparable rates to white infants than do today (Villarosa, 2018). It is still more common for an infant born to a black mother with an advanced degree to die due to pregnancy or birth related complications, than it is for a white infant born to a mother with less than an 8th grade education to die during the same time frame (Matthew, Reeves, & Rodrigue, 2017; Villarosa, 2018).

In order to understand why childbirth remains dangerous today is necessary to consider the social and cultural implications as well as biological and evolutionary histories. In order for positive change to be made in ameliorating maternal and neonatal mortality, childbirth must be studied in terms of how it occurs today and not solely through the evolutionary perspective of the obstetric dilemma.

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