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## **Madame Angélique du Coudray: pioneer of medical simulation and unsung hero**

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### **Editorial**

In obstetrics, the use of simulation has exploded over the past 10 years [1]. For shoulder dystocia, for example, simulation training of an obstetrical team for 12 years contributed to avoiding all neonatal brachial plexus injuries, due to better skills in the delivery of the posterior arm during this complication [2]. Nevertheless, simulation is not such a new training modality. The earliest examples of simulation for delivery teaching were introduced by a singular woman, Mme du Coudray, a French midwife during the mid-to-late 18<sup>th</sup> century (Fig1).

Angélique-Marguerite le Boursier du Coudray, or more commonly Madame du Coudray, was born into a family of doctors in Clermont-Ferrand in central France in 1712. She was born in the final years of the reign of the absolute monarch Louis XIV, whose centralization of the aristocracy to the Palace of Versailles allowed for the growth and relative independence of the middle class [3]. She obtained her midwifery diploma on September 26, 1739 and afterwards practiced as a midwife and taught her own apprentices in Paris for fourteen years.

A devotee of the philosophy of the Enlightenment, Mme du Coudray left Paris in 1754 to give free lessons in midwifery in her native region of Auvergne. She first used the same pedagogical philosophy that she received herself in Port Royal. She soon found herself needing to update the standard of education in the field, leading to some minor conflict with other established midwives and thus to principally take on younger and less-established students.

A decline in population in rural France and subsequent decline in French military capacity worried Louis XV [4] and, in 1759, he commissioned du Coudray to teach midwifery throughout France to boost the population of the state by reducing neonatal mortality and birth complications. For example, a quantity of neonates died of strangulation solely due to some people not knowing how to deliver the shoulders. Instead of continuing to push while lowering the head, they would ask the women to stand and walk, advice that resulted in neonatal asphyxia. In 1759, Louis XV awarded her a brevet (a royal decree allowing her to practice) as well as a salary: she was to give lessons throughout the entire French kingdom. At the age of 45, and despite her arthritis and obesity, she traversed France to teach delivery practices to over 5000 women and even surgeons for a quarter of century until 1783. Her patience and her fervor earned consideration in all places.

Madame du Coudray modernized obstetric pedagogy and promoted a practical approach for managing childbirth and its complications through a course of forty sessions over two months. She wrote a manual to accompany the course, *Abrégé de l'art des accouchements* (or *The abridged art of delivery*) that went through six editions between 1759 and 1785. Unusual for the time, the book was heavily illustrated with colored images, as literacy, especially among female students, was not yet uniform.

For practical skills training, du Coudray built an obstetric mannequin, that she called “La Machine.” (Fig 2) It was a life-size replica of the female anatomy made of wood, fabric, and cardboard and was covered in pink material to simulate skin. Anatomically, it consisted of the pelvis, genitalia, and upper thighs, as well as a removable uterus with a silk ribbon allowing for different levels of cervical dilatation to be simulated. The basic set also included a life-size newborn, a seven-month-old fetus, and even twins which could be inserted into the mannequin in various ways to simulate both normal and more complex births. These fetus mannequins too were complex, with important anatomical structures, such as the fontanel, carved into them to allow for midwives in training to learn crucial skills such as navigation via palpation. These mannequins were also connected via a detachable red- and blue-colored umbilical cord to a simulated placenta. Sponges were used to release clear and red liquids (simulating amniotic fluid and blood respectively) to increase the fidelity of “La Machine” [5]. In 1758, this mannequin was approved by the Academy of Surgery.

Despite the improvements in training resulting from the popularization of her pedagogical methods, du Coudray had detractors [6,7]. As a midwife, she suffered from critiques both from the orthodox establishment of *master midwives* (who were largely older uneducated women) hesitant to change the approach to midwifery education from one side and from the encroachment of the exclusively male scientific and medical establishment from the other. One of her most notable enemies was Alphonse Leroy, a professor of gynecology and pediatrics (and later midwifery) at the Faculty of Medicine of Paris, who denounced du Coudray, mocking her and referring to her as “the *demoiselle* (a derogatory term for an unmarried woman) who teaches delivery with a doll,” not-so-subtly comparing her mannequin to a child’s toy. The Parisian surgeon, Jean la Bas, wrote in 1776 that her mannequin was “no more than a fable, a phantom, a simulacrum, a shadow of reality, capable of giving false ideas to begin-

ners who, once their heads are thus filled, will not be able to avoid practicing bad work on live subjects.” [8]

The French Revolution broke out suddenly in 1789 with the storming of the Bastille in Paris, leading to the quick collapse of royal administration throughout France. Midwifery instruction was no longer a priority in the early days of the French Revolution and the newly formed Republic canceled funding for the rural obstetrics teaching program that had previously been funded by the crown. Mme du Coudray, now almost 74 years old, found herself stripped of her royal salary and also her brevet, the key to any opportunity to continue teaching as her employment. Thus, she moved to Bordeaux where she was to live with her niece and fellow midwife, Mme Coutanceau.

Despite obtaining a *certificate of civism*, the document needed to avoid arrest during the Terror, the most violent phase of the French Revolution, Mme du Coudray, who had received payments from the now beheaded Louis XVI, was hounded by those of extreme revolutionary zeal. She experienced increasing alienation from the public and, her niece being absent at the time, Angélique-Marguerite le Boursier du Coudray died in solitude on April 17, 1794.

Her views were not universally accepted but eight years later Coutanceau wrote that du Coudray’s mannequins, were “still in use throughout the kingdom, especially in the regions of Picardy, Dauphiné, Touraine, Anjou, Champagne, Flanders, Normandy, Brittany, and Lorraine.” Demographers have recorded a notable decrease in the neonatal mortality rate beginning in the 1750s especially in rural France, but have yet to be credited to the proliferation of du Coudray’s pedagogical methods. Unlike many of the great scientific and medical figure of her day, her body has never been interred in the Pantheon, largely seen as the highest posthumous honor in France. Due to the time elapsed since her death, it is unfortunately unlikely that she will never receive this honor. Despite this, she is now widely considered one of the pioneers of medical simulation, not only in obstetrics but in medicine as a whole. “La Machine” is now on display at the Musée Flaubert, a museum of medical history, in Rouen, Normandy. Her recognition has also broadened to the wider public; there is a Angélique du Coudray Street in Thorigné Fouillard and another in Clermont-Ferrand, her native town. The maternity hospital in Melun also bears her name.

Today, there are numerous simulation centers and hospitals that each use a variety of human patient simulators and standardized patients (i.e. actors). Notably, this still includes physical mannequins, ranging from low to high fidelity, the most sophisticated of which are capable of responding to stimuli such as drug administration, compression, and other elements of physical examination and intervention [9]. There has also been an increasing role of non-physical training simulations such as desktop or screen-based simulations and, more recently, virtual and augmented reality. Nowadays, obstetricians require a combination of interventional and communication skills as well as fast decision-making and emergency management skills. These are not only aimed at satisfying the high medical expectations and demands, but also teaching the self-knowledge skills necessary to navigate difficult situations while avoiding mistakes and developing the emotional intelligence skills to comfort patients during what is still one of the riskiest parts of their lives [10]. Training simulations in obstetrics have since expanded to complex and multidisciplinary scenarios, such as preclam

sia, post-partum hemorrhage, and cardiac arrest, which hearkens back to du Coudray's initial desire to include more complex scenarios such as twin births in her original mannequins.

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Figure 1. Angélique-Marguerite le Boursier du Coudray (1712-1794)

**Figure 2.** “La Machine”, the first life-size obstetric practice mannequin, now on display at Musée Flaubert et Histoire de la Médecine, Rouën.

