

# Will Artificial Intelligence Have a Place in the NICU? Are We There yet, or Should We Be?

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***“Artificial Intelligence (AI) is machine-oriented, in contrast with natural intelligence, which is humanistic. This concept promotes computerization that mimics the natural intelligence demonstrated by humans.”***

First described by John McCarthy (1927-2001), the use, or sometimes misuse, has become a significant part of everyday life. The field began in 1956 where after a short period, computers were defeating humans in checkers, solving word problems, and predicting mathematical models. Basically, an algorithm is designed to make decisions that have previously been the responsibility of the physician.

Research in AI includes both objective and subjective components. The objective relationships include statistical methods, probabilities, data mining, and logistics. However, subjectively can algorithms be developed that deal with ethical issues, policies, symbolism, and logic?

There are pros and cons when incorporating artificial intelligence into the healthcare arena. Since the algorithms inputted are well researched, there is a decreased chance for errors to occur. If the data input and the algorithm are robust enough, the time involved in making a clinical decision will be shortened. Also, the artificial intelligence system, unlike the “human variety,” does not fatigue. In the NICU, information can be voluminous and complex. Algorithms can focus and simplify decisions. The cost of implementing such a program can be high, but if we shortened the time to diagnosis and targeted care, the cost-benefit ratio will be positive. Despite more comprehensive input of data and information, the dependency on human decision-making remains essential. Finally, the algorithms and their machinery are not creative, and frequently protocols and guidelines cannot adapt to a changing situation. The answer is to use both machine learning (algorithmic) and human interaction.

However, this type of automation has been present throughout history. The industrial revolution was just the beginning. In today's world, the assembly line facility often has more robotics than human interaction. AI will inevitably achieve more sophistication and intelligence than is demonstrated by humans today.

The automobile industry demonstrates an example of this type

of progress. We now have self-driving cars that can accelerate or decelerate, change lanes, turn on lights, and use braking intelligently to prevent accidents. Would you be comfortable in a self-driving car?

If utilized correctly, there can be a convergence of human and artificial intelligence, improving morbidity, mortality, productivity, and even workflow. Intelligence is created, but do these machines function intelligently? There is expert knowledge, commonsense knowledge, inferential knowledge, and default reasoning. Can the machine be perceptive, recognize sentiment or engage in reasoning? These are questions that remain at present and will become more complicated in the future.

So.....can artificial intelligence become part of the daily NICU environment?

As data in the NICU becomes increasingly comprehensive, there is a need for a mechanism to analyze, interpret and respond to this information. The machine learning models use an extensive amount of input data to predict therapeutic interventions. Unfortunately, one weakness is that no explanations deal with any logic based on these decisions since the recommendations are based upon the type of algorithm used.

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In 2019 Masino et al. investigated a machine learning model which could recognize infant sepsis before it became clinically suspected. A prediction model was developed utilizing the electronic medical record to predict general applicability. They identified 30 features obtained from the NICU Sepsis Registry known or suspected of infant sepsis. Using a “logistic regression model,” researchers identified infant sepsis hours before clinical symptoms. The machine models evaluated in this study produced a numeric output that interpreted the probability of sepsis. (1) In the United States, a neonatal sepsis risk calculator designed by Kaiser Permanente is a multivariate model which assesses the probability of early onset of sepsis using maternal risk factors algorithms and the infant's clinical appearance after birth. (2) The Kaiser Permanente early-onset sepsis calculator's sensitivity compared with the National Institute for Health and Care Excellence (NICE) guidelines have been evaluated by Pettinger KJ et al., who believe that a large proportion of early-onset sepsis cases were “missed” by the calculator. (3) The Heart Rate Observation system or HeRO is a monitoring technology that incorporates an algorithm that detects changes in the infant's heartbeat which can be an early sign

of infection. This concept can be considered a form of AI. (4)

Since the whole concept of AI depends on the development of frameworks or algorithms, can we program these algorithms to avoid pitfalls? We are looking for a method to make better decisions. Since the algorithm itself is developed by humans, shouldn't we be concerned about bias? Since AI's predictions are a reflection of input information, there must be an accurate representation of patient demographics. For example, are there enough males in the data set? Are minority populations included? An algorithm can be designed for a do not resuscitate order. However, there are morality issues with such an order, and will the algorithm which is designed be able to assist the healthcare team in making important, life-changing decisions? Someone needs to monitor the bias, which can be overwhelming, and make certain that the program is working efficiently within some structured guidelines. However, to date, these guidelines have not evolved significantly. In addition, another benefit of the use of AI is decreasing medical costs since the goal is a more accurate diagnosis and a more organized and accepted treatment plan.

Since respiratory disease is at the forefront of essential neonatal care, consider the following scenario concerning ventilator management in the newborn.

A 3850-gram male infant is delivered emergently after a clinical history of abruptio placenta. The baby's Apgar score is 1 (5), 2 (10), 3 (15). A cord arterial blood gas is 6.95 with a pCO<sub>2</sub> of 31 and a base deficit of -18. The baby is resuscitated, admitted to the NICU, and placed on a ventilator. The ventilator has been inputted with ten algorithms that represent data collected with everyday ventilator-associated events. The physician and respiratory therapist set parameters for the amount of oxygen, respiratory rate, peak inspiratory pressure, PEEP, compliance, inspiratory, and expiratory time. The neonatologist and respiratory therapist allow the computerized ventilator's AI to make adjustments in ventilator settings depending upon the algorithms' data.

Is this scenario futuristic? Is it reliable? Will the artificial intelligence algorithm adjust these settings and modify lung compliance, oxygenation, and other parameters?

Previously I would have thought that a similar patient that is presented above needed to have active input from the medical, respiratory therapy, and nursing personnel to make all therapeutic decisions

A second example that neonatologists often encounter is the interpretation of imaging studies. The following patient illustrates this point.

A 28 day old late preterm infant with a history of perinatal asphyxia is recovering in a NICU step-down area. At three days of age, the baby developed a grade III intraventricular hemorrhage (on head ultrasound examination) and has been recovering. Over the last week, the patient demonstrated increase tone, and an MRI was

performed. On clinical rounds, the neonatal team was evaluating the MRI images. An artificial intelligence database suggested signal abnormalities which included the deep nuclear grey matter and not the watershed area. These findings allowed the neonatologist to offer a more accurate prognosis to the parents based upon a more extensive database. (5)

A third scenario that is timely involves the following patient.

An 1850 gram male infant is born by cesarean section to a Covid positive mother who has a temperature of 101F and is tachypneic at delivery. The baby was admitted to the NICU for prematurity. Due to the maternal history of symptomatic Covid-19, her information was entered into the hospital's infectious disease database to determine the newborn's care and treatment. This database is constantly updated with current guidelines (CDC), and the artificial intelligence algorithm suggests the need for isolation (negative pressure), nutritional support (including breastfeeding), and visitation guidelines.

Information regarding Covid-19 continues to be presented and modified as new scientific data emerges. A cohesive approach based upon factual material is essential for a successful outcome. (6)

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Artificial Intelligence will have an increasing role in administering medical care. It will eventually enter the Kingdom of the NICU. When this occurs, will the number of needed personnel (neonatologist, respiratory therapist, and nursing) decrease? What will be the impact of artificial intelligence on the future role of the physician? (7) The real question revolves around the displacement of particular physician's specialties. Will algorithms help radiologists or pathologists become more effective? Imagine a court proceeding where a defendant physician is asked why a specific therapeutic approach was utilized. In the past, the answer would be, "I choose this approach due to my personal experience and understanding of the literature on this topic." In the future, will the answer be, "I choose this approach due to the healthcare data using interactive systems which exceed the capacity of any human

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in making finite decisions”?

I predict that there will shortly be a curriculum added to medical school education dealing with artificial intelligence. We will utilize data in order to make decisions which we believe are robust. The machine intelligence used for this process at some point in time will surpass human interaction.

For now, I still am hesitant about getting into a self-driving car. Am I too cautious? Am I old-fashioned? Am I not progressive enough?

Are you?

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**Acknowledgments:** The author would like to acknowledge Reese Clark, MD, for his “perspective” advice regarding this manuscript.

**Disclosure:** There are no reported conflicts.

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