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Letter to the Editor

The usefulness of incorporating three-dimensional heart models during cardiology consultations in the Neonatal Intensive Care Unit

ABSTRACT

A quality improvement project was launched to address the effectiveness and communication potential of incorporating three-dimensional heart models during cardiology consultations in the Neonatal Intensive Care Unit. The complexities of congenital heart defects pose numerous challenges for both clinicians and the families of infants awaiting cardiothoracic surgery. The education provided to parents during consultations influences the ability to make informed decisions regarding medical and surgical plans of care. This exchange of knowledge can be daunting, leaving parents with feelings of anxiety and distress (Biglino et al., 2015). In 2014, the Society of Thoracic Surgeons database reported Phoenix Children's Hospital performed 550 cardiothoracic surgeries and ten heart transplants. By the year 2016, Phoenix Children's Hospital performed 664 cardiothoracic surgeries and 24 heart transplants. This data highlights substantial increases in surgical volume, contributing to the need for improved education and communication among this vulnerable patient population (Phoenix Children's Hospital, 2017).

Introduction

The incorporation of three-dimensional (3D) heart models during cardiology consultations was a quality improvement (QI) initiative to facilitate open communication and improve information exchange between healthcare providers and parents of critically ill children (Biglino et al., 2015). The tangible anatomical models have allowed parents and families to become familiar with the anatomy of a normally functioning heart, comprehend the complexities of congenital heart defects, and understand the intricacies of pediatric cardiothoracic surgery. The current methods of communication used during cardiology consultations lack user-friendly images and tangible media that replicate specific congenital heart defects. The intricacy of general cardiac anatomy is difficult to understand, and the use of 3D heart models in the Neonatal Intensive Care Unit (NICU) during cardiology consultations helps to captivate the attention and curiosity of families. This curiosity further entices questions and eases the understanding of complex congenital heart defects (CCHD), which bridges the communication gap between the 'novice' and 'expert'. The following manuscript will outline project aims and objectives, methods used to measure the significance of the QI initiative, the outcomes of the practice improvement project, and the ability for future continuation and sustainability within the institution.

Methods

The overarching aim of the project was to improve communication between the healthcare provider and the families and parents of infants prenatally diagnosed with CCHD (see Appendices A & B). One of the objectives chosen to achieve that aim included providing education to clinical staff and interpreters who were directly involved with the population of interest. Education was provided on normal cardiac anatomy, as well as the most common congenital heart defects seen within this population. The effectiveness of that education was measured using teach-back methods at the bedside. The second objective chosen was to assess parental knowledge base and identify gaps in communication before the introduction of anatomical heart models. This objective was measured using pre-intervention questionnaires distributed immediately following initial cardiology consultations and then collected within 24 hours. The intervention itself was scheduled with families at the bedside within 24–48 hours after initial consultations. Parents and families were provided education on normal cardiac anatomy, as well as specific congenital heart defects using the aid of 3D anatomical heart models. This objective was measured using post-intervention questionnaires distributed immediately following the intervention and collected within 24 hours. The post-intervention questionnaires assessed the overall effectiveness of the QI initiative and helped determine the need for additional education and communication strategies (see Appendix C).

Results

The QI intervention using 3D anatomical heart models during cardiology consultations resulted in an improved understanding of normal cardiac anatomy for all support staff directly involved with patient care. The clinical intervention aimed to educate clinical staff proved to be an effective teaching strategy that was measured using teach-back methods at the bedside.

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Following education, support staff correctly identified basic anatomical structures of the heart and named at least two of the most common congenital heart defects seen in the population of interest. The incorporation of 3D heart models during cardiology consultations helped further educate and improve the understanding of normal cardiac anatomy and specific congenital heart defects for the parents and families of infants awaiting cardiothoracic surgery. These outcomes were measured using both pre and post-intervention questionnaires. Post-intervention questionnaires showed the majority of parents were able to name their infant's congenital heart defect, describe how this defect affects their infant's growth and development, and have more realistic expectations of their infant's hospital course. Post-intervention assessments also showed parents had more confidence in the ability to communicate their infant's complex medical condition to future caregivers and healthcare providers. Post-intervention, 100% of participating families stated the incorporation of 3D anatomical heart models in cardiology consultations helped to improve their understanding of congenital heart defects. Results demonstrated the QI intervention facilitated communication and improved knowledge and information exchange between the healthcare provider and the parents of infants prenatally diagnosed with CCHD, further closing the communication gap in clinical best practice methods (Biglino et al., 2015).

Discussion

The QI project to incorporate 3D anatomical heart models during cardiology consultations was an initiative to facilitate open communication and improve information exchange between healthcare providers and parents of infants prenatally diagnosed with CCHD (Biglino et al., 2015). The need for effective communication between clinicians and parents was strategically aligned with the institution's mission and values to identify and implement change to improve clinical quality and patient safety while promoting family centered care (PCH, 2017). The parents and families of these critically ill infants had expressed the need for additional modes of education during cardiology consultations. This information was obtained through the institution's Family Advisory Council (FAC), personal communication with parents and families of children with CCHD, and through the expressed interest of the program director at Phoenix Children's Hospital (PCH). At the close of the QI project, the feedback from parents was exceptionally positive and further reinforced the need for the continuation of additional modes of education to encourage communication between healthcare providers and families of these critically ill patients. The two things parents found to be most helpful during the QI intervention included conducting consultations in a quiet environment and having an unaffected 3D anatomical heart model available to show normal structure and function before teaching families about complex cardiac defects.

When parents were asked what would have been more beneficial during consultations, several families provided recommendations. Some of these suggestions included having more colorful handouts to show complex cardiac defects before and after surgical correction, having computer software applications available to directly visualize their infant's heart following 3D reconstruction, having the surgeons use the 3D models to explain how they plan to “fix” their infant's heart during surgery, and the desire for more communication on surgical aftercare and recovery expectations. Several barriers such as time constraints, increases in patient census, and staff shortages have greatly impacted the ability for the QI initiative to make a smooth transition for continuation into the future. At the close of the project, the cardiologists and neonatologists at PCH had shown great interest in continuing parent and family education using 3D heart models at the bedside. To facilitate this, a library of 3D heart models replicating the most commonly seen congenital heart defects will be kept in the NICU for this intended purpose. Additionaly, because 3D anatomical models used for medical education in specialities other than cardiology have shown to improve communication between healthcare providers and surgical residents, the extension of education using 3D heart models for this purpose is being addressed (Jones et al., 2015).

Conclusion

One of the most difficult diagnoses to medically manage and surgically correct in the pediatric patient is CCHD. Challenges in communication between clinicians and parents greatly impact the ability to share and exchange knowledge (Biglino et al., 2015). The QI initiative addressed the incorporation of 3D heart models during cardiology consultations and aimed to improve the communication between healthcare providers and parents of infants diagnosed with CCHD awaiting cardiothoracic surgery. Aligned with the institution's strategies to improve quality care and patient outcomes, continued opportunities to incorporate 3D anatomical heart models during cardiology consultations will be considered for long-term continuation and sustainability (PCH, 2017).

Conflicts of interest

The authors have no conflicts of interest to declare.

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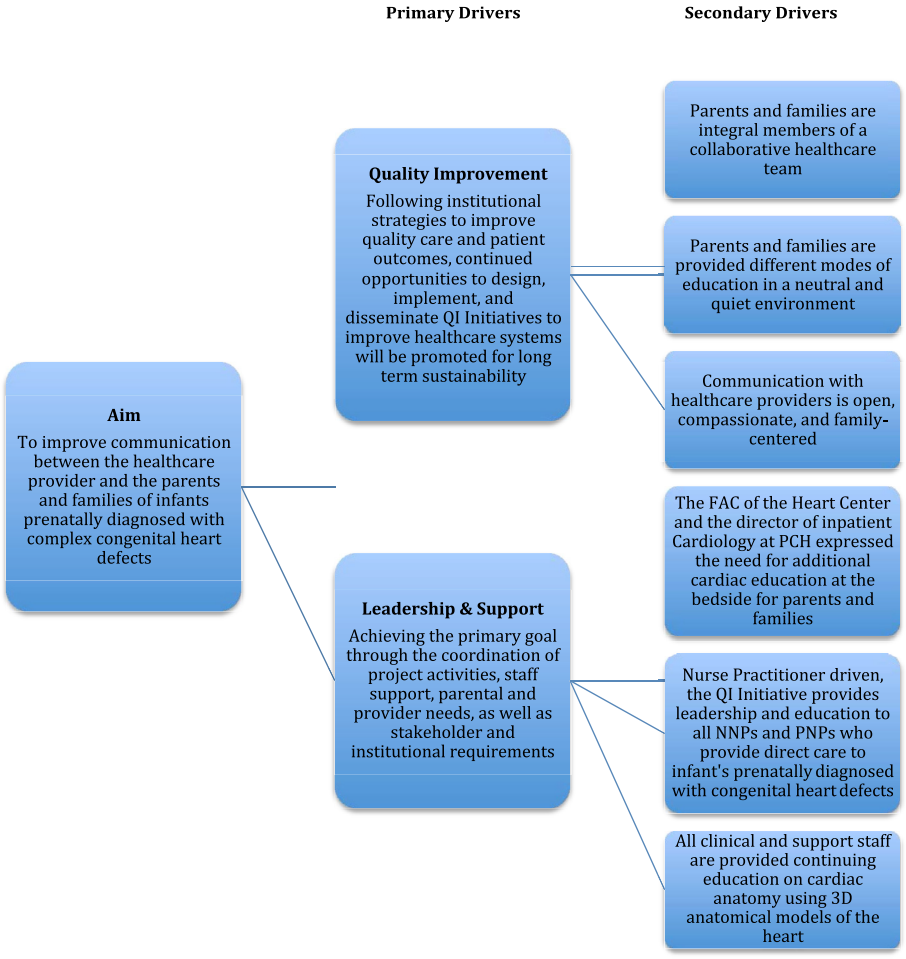
Appendix D. Supplementary data

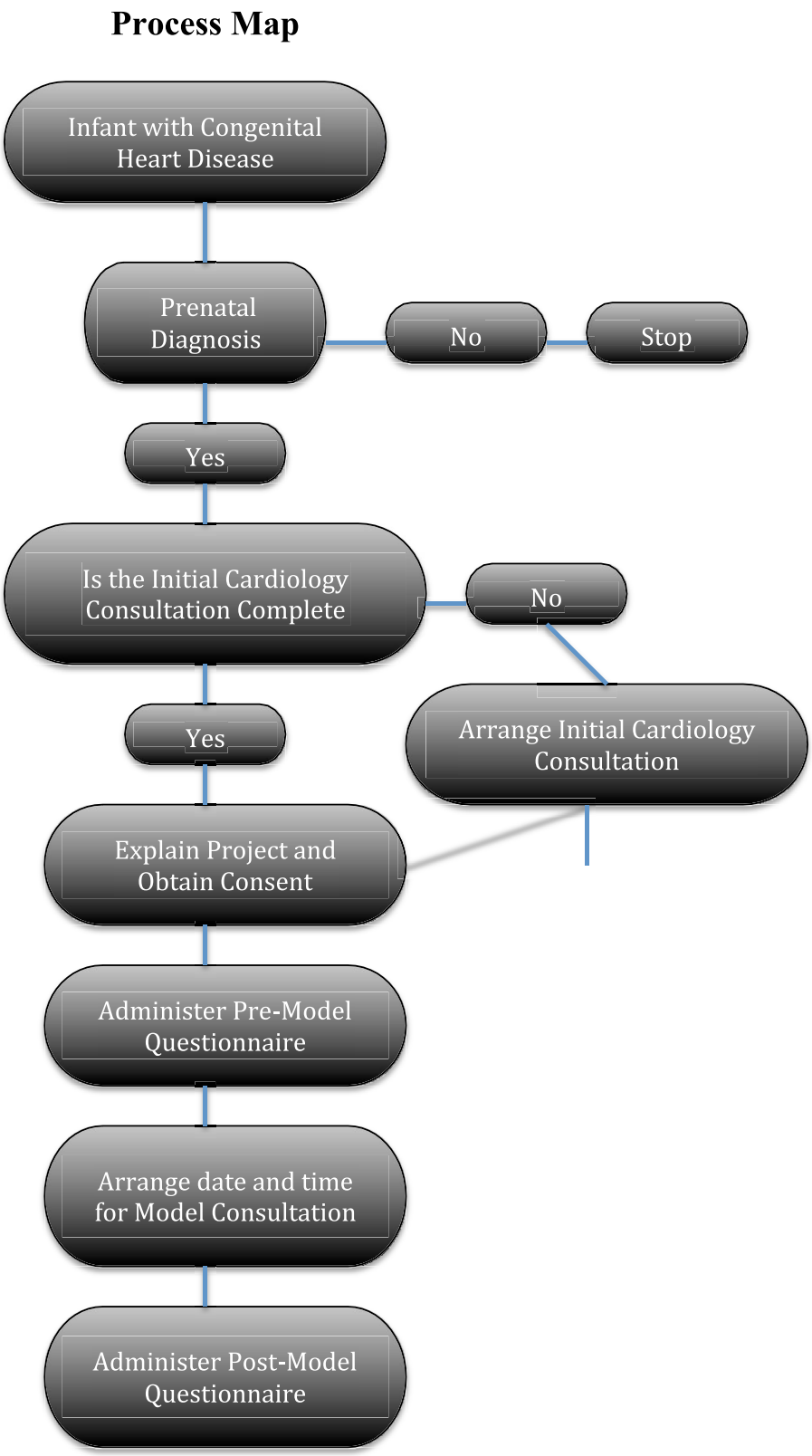
Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.jnn.2018.06.004

Appendix A

Primary and Secondary Drivers to Improve Communication



Appendix B


Process Map
Infant with Congenital Heart Disease
Prenatal Diagnosis
No
Stop
Yes
Is the Initial Cardiology Consultation Complete
No
Yes
Arrange Initial Cardiology Consultation
Explain Project and Obtain Consent
Administer Pre-Model Questionnaire
Arrange date and time for Model Consultation
Administer Post-Model Questionnaire

Appendix C

Cardiology Consultation Communication Questions.

1. What is the highest level of education you have completed?
2. Did you receive prenatal care throughout your pregnancy?
3. Was your infant's cardiac defect prenatally diagnosed?
4. Can you tell me the name of your infant's congenital cardiac defect?
5. How long do you anticipate you infant will be hospitalized?
6. Do you know the name of the cardiac surgery your infant may have?
7. In your own words, please explain the surgery.
8. I am comfortable explaining my infant's cardiac defect and surgical procedures to future caregivers and healthcare providers.
9. I feel that the drawing provided during my cardiology consultation helped me to have a better understanding of my infant's complex cardiac anatomy.
10. I feel that the 3D used during my Cardiology Consultation helped me to have a better understanding of my infant's complex cardiac anatomy.
11. In your own words, please describe your infant's cardiac defect.
12. What do you think would have been more helpful during your Cardiology Consultation to make it more satisfactory?

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