measures of a repair likely can identify many important modifiable process shortcomings. Irrespective of the technical result of a surgical correction, intraoperative and perioperative complications occur at a steady rate, and ultimate patient outcome depends more strongly on processes that reduce the “failure to rescue” than on those that reduce the incidence of complications.⁴ Ventilator-associated pneumonia, blood or urinary infection, and arrhythmias are important complications, possibly unrelated to intracardiac structural adequacy, and whether RLS can shine predictive light on these outcomes remains to be seen. Perhaps a future iteration of the RLS will include scoring of structure, function, and intensive care unit performance.

It is appealing to learn that a discharge echocardiogram has the potential to serve as a composite measure of multiple elements in the course of care after surgery. As the scoring system recognizes more elements beyond technical

performance of the surgeon and encompasses a more holistic view of the patient’s course, the RLS may grow in importance.

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Commentary: Relational coordination... a mechanism to improve data interoperability

Aaron J. Weiss, MD, and Tara Karamlou, MD, MSc

Dr Jody Hoffer Gittel has spent her career popularizing the theory of relational coordination, which proposes that interdependent work for organizations is best optimized by “frequent high quality communication supported by relationships of shared goals, shared knowledge and mutual respect.”¹ She proposes that relational coordination can unite fragmented organizations to facilitate excellence in outcomes and has applied this concept to various industries, including the field of health care. Furthermore, she contends that we can provide systemic change that accelerates

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CENTRAL MESSAGE

The field of health care suffers from a lack of data interoperability, resulting in untold amounts of lost information, EMR fatigue, financial waste, and caregiver burnout.

excellence in performance by using relational coordination to strengthen the weak links and reduce the inefficiencies that exist in the health care industry.

Medical professionals are undoubtedly familiar with the inherent bureaucratic and technological inefficiencies present in contemporary health care systems. Much of this inertia can be attributed to a lack of semantic interoperability between cumbersome electronic medical records

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(EMRs) and siloed health care systems that function as if designed in a vacuum. This failure of interoperability across the numerous EMR platforms encountered both within and between various health care systems prevents the use of real-time data analytics and fosters redundant and disorganized efforts. The inability to translate information content seamlessly across platforms is further inhibited by regulatory and administrative obstacles that prevent fluid data collection (or cohesion) for patient care or research studies. This results in the need for manual abstraction of health care data by inexperienced data collectors using nonintuitive EMR systems that far too often leads to preventable data capture errors. Interference by third-party payors, outside organizations, and disconnected hospital administrators can further impede data coordination, causing additional downstream inefficiencies in workflow. The cascade of unsynchronized efforts and shortage of health care information interoperability results in untold amounts of lost data, EMR fatigue, financial waste, and caregiver burnout within medicine.

In the article by Nathan and colleagues² in this issue of the *Journal*, the Pediatric Heart Network (PHN) once again embarks on a tremendous undertaking with their prospective validation of an updated tool, the Residual Lesion Score (RLS), that assesses associations between residual lesions and early- and mid-term postoperative outcomes in infants undergoing surgical repair for 1 of 5 common congenital defects. The trial, as it is articulated in the specific aims, is a large-scale, multicenter undertaking with significant resource commitment, specifically in the areas of data capture and analysis. It is anticipated that successful completion of this work will advance the practice of congenital heart surgery and have far reaching implications for patients with congenital heart disease.

Although not the main point of their study, but nonetheless of importance, the PHN collaborators made significant efforts to develop data-coordination processes between their RLS study and previously designed perioperative clinical registry databases for automated capture of a selected set of study variables. As outlined by Prospero and colleagues,³ data capture for ~10% (~240 variables) of all study variables through a direct feed from the Society of Thoracic Surgeons Congenital Heart Surgery Database data warehouse was desired, but due to multiple issues with financial restraints, timing, and coordination, this was unable to be performed. Instead, the PHN performed data registry queries at individual centers by accessing identical formats in each site's clinical registry using 6 different software packages coordinated over multiple conference calls during a 6-month period. These queries were then vetted through various software vendors at each site to ensure accurate data capture and formatting. The authors admit to the requirement for several rounds of testing and revision to operationalize this effort. In the end, the research teams

were able to access their desired variable feeds for the RLS study for 1015 of 1149 enrolled patients (2 sites did not use registry data and manually entered each patient's data into the data-capture system). Unfortunately, the clinical registry database software was updated during the study period, and this required additional queries, revision, and retesting to further ensure the accuracy of this fractional data feed. Monthly extractions of the registry data were then reviewed with removal of protected health information (some of which had to be done manually—admittedly resulting in inadvertent personal health information disclosure) and uploaded to the PHN Data Coordinating Center.

The laborious and detailed steps taken by the authors are further described in Table 2 in the paper by Prospero and colleagues.³ Their conclusions mostly advocate that the potential benefits of saved time in future studies, as assessed through surveys administered to the various site coordinators and investigators, outweigh the time and resource-intensive process required. However, these survey conclusions are mostly theoretical and inherently biased, as those completing the surveys are emotionally invested in their hard work (as anyone would be). Furthermore, the downsides listed out from the survey results are quite numerous and substantial in effect in comparison with the potential benefits.³ A possible alternative to this avenue of biased query would be to objectively assess the time and personnel requisite in completely manual data abstraction and compare these metrics with the automated process. Moreover, ultimately, the reader of this study is asked to ignore the problems encountered in the present construct (and the minimal payoff of 10%) on the promise that future studies may be facilitated. While this outcome is one possibility, another could very well be that future investigators elect alternative and more efficient forms of data capture.

One such form of data interoperability that exists, albeit still in its infancy, is SMART (short for Substitutable Medical Applications, Reusable Technologies) on FHIR (short for Fast Healthcare Interoperability Resources) technology. SMART is an open, standards-based technological platform that allows for the creation of easy and secure applications within health data systems. FHIR is an application programming interface that enables access of structured EMR data across various electronic systems. In layperson's terms, FHIR provides the structure for how data lives and looks while patient data from an EMR populates that structure. SMART can then provide the translation for third-party applications to work across various different EMRs, preventing the need for individualized application development for each EMR system. EMR vendors such as Cerner, Epic, and Apple all have implemented this technology in products we use daily, including the omnipresent bio-wearables that trace daily physiologic parameters and activity.

Another adaption of data interoperability is Hill and colleagues' use of a "trial within a registry" paradigm to automate and expedite data collection.⁴ Their current National Institute of Health–National Heart, Lung, and Blood Institute study, Steroids to Reduce Systemic inflammation after neonatal heart Surgery (STRESS trial), is investigating the use of perioperative steroids in infants undergoing cardiopulmonary bypass by using existing registry data at surgical sites participating in the Society of Thoracic Surgeons Congenital Heart Surgery Database to obviate (or at least reduce) the amount of manually collected data that is necessary. This study will undoubtedly provide additional insight into the benefits and fallibilities of this research construct in the scope of increasing health care data interoperability.

We applaud the authors for their efforts to automate their data-collection process, even if only for a fraction of their study data variables. As physicians and researchers, we should strive to improve our data interoperability through the shared goal of providing optimal care for our patients efficiently and collaboratively. The results derived from the RLS study will no doubt provide valuable insight into one option to achieve this end. However, one is left wondering whether improved relational coordination between the EMR, national registries, third-party application

developers, and individual hospital sites would optimize the process. Globally, we must make a sustained and continued effort to develop the organizational structure that unites our fragmented health care system—a structure that allows us to better share our knowledge and data across platforms to achieve excellence in patient outcomes. Andrew Carnegie said it best... "Teamwork is the ability to work together toward a common vision. The ability to direct individual accomplishments toward organizational objectives. It is the fuel that allows common people to attain uncommon results."

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