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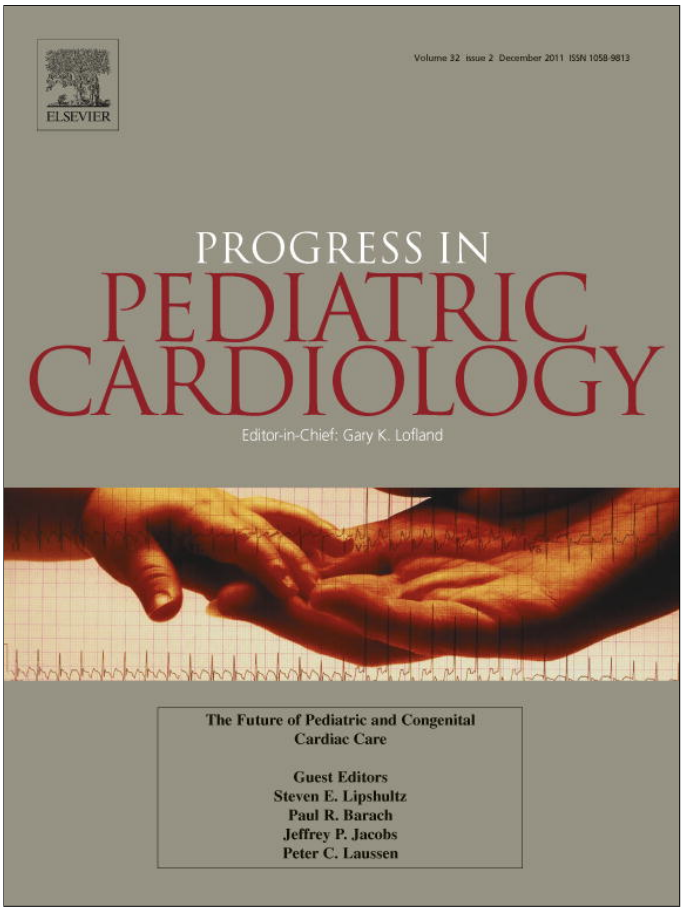

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Leadership, surgeon well-being and non-technical competencies of pediatric cardiac surgery

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ABSTRACT

Expectations of pediatric cardiac surgeons grow as the specialty evolves and yesterday's challenges become tomorrow's routine. The pioneering era of fast-paced major technical advances is behind us. Integration of surgery, cardiology and intensive care is now the basis of incremental improvements in perioperative and long term outcomes. Surgeons can be natural leaders of this process because their skills, roles and experience are crucial in the preoperative, intra-operative and postoperative care of the patient and their family. However, the personality traits that draw physicians to the specialty and contribute to the drive to become a successful technical surgeon may be at odds with the collaborative aspects of this microsystem, both inside and outside the operating room. The potential for disruptive behavior on the part of the surgeon to impede the functioning of a large multidisciplinary team providing care of the upmost complexity raises fundamental questions about how to design reliable pediatric cardiac surgery teams. A new dynamic is needed to support team members, including the surgeon, in times of extreme stress and to help them avoid destructive, maladaptive responses. Focusing these efforts around the clinical microsystem requires a detailed analysis of the team interactions, the underlying culture and support, and the clinical engagement of staff. Building and nurturing a resilient system in a highly specialized environment where burnout, bullying and loss of staff exist remains a constant challenge.

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1. Introduction

In just a few decades, technical solutions for the majority of common congenital heart defects have been proposed and refined. A diagnosis of major structural heart disease remains a diagnosis for life but there is a defined path and predictable outcome with relatively low mortality for the majority of lesions. This now extends to 'standard risk' infants requiring complex single ventricle reconstructions for hypoplastic left heart [1]. Nevertheless, there is much to be done in reducing morbidity, particularly in neonatal operations, and in addressing the lifelong adult complications of repaired structural heart disease. In this paper, we explore a range of nontechnical aspects of the pediatric cardiac surgical practice, with reference to the literature and experiences common to pediatric cardiac surgeons.

2. Risk, complexity and cooperation in the Pediatric Cardiac Operating Room

One of the riskiest and most complex of all hospital environments is the pediatric cardiac surgical (PCS) suite. PCS procedures are among the most serious pediatric interventions, encompassing anatomic diversity, hemodynamic vulnerability, and the need of a highly skilled, multi-specialty team. Medical advances in the past three decades have resulted in increasing survival among children born with even the most complex cardiac defects [2]. In an analysis of 95,357 congenital and pediatric cardiac operations in the in the Society of Thoracic Surgeons (STS) Congenital Heart Surgery Database, in the four year time interval of 2007–2010, inclusive, mortality prior to hospital discharge was 3.5% [3]. The overall mortality in PCS is below 4%, In at least 20% of cases. that lead to death, the outcomes are preventable. Around 10% of children with complex PCS die within 30 days of surgery in the neonatal age group [4,5], with a low margin of error and limited ability to retrieve poor outcomes. As a result of the intensity of the work and the expectations of team members as well as those of the broader community, pediatric cardiac surgeons suffer high rates of burnout, and this problem may lead to a truncated working life [6,7]. Although the affirming nature of successful PCS procedures might be conceptualized as protecting the surgeon from depression,

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the impact of less successful outcomes and of other stressors can be significant.

PCS is a specialty with very low tolerance for error. It encompasses many complex procedures that are dependent upon a sophisticated organizational structure, it requires coordinated efforts of multiple individuals, and it demands high levels of cognitive and technical performance [8]. Factors that have been linked to poor outcomes in PCS, include low institution and surgeon-specific volumes [9], complexity of cases [10], and systems failures [11,12] such as miscommunications [13] and inadequate team planning. This indicates that there are real opportunities to improve PCS outcomes, including in neonatal mortality and complication rates by addressing systems issues in the PCS settings. Areas of consideration include the compromises between clinical responsibility and leadership versus an overly rigid hierarchy with consequent failure to identify and communicate errors in real time, pressures of time leading to suboptimal planning, and limited debriefing after complex procedures. The trade off between establishing safe and effective practices and the need for innovative change is an ongoing challenge.

3. Non-technical errors in the PCS

Research has shown that errors in the operating room (OR) occur both within and between clinical teams[14,15]. Quite often, errors result from a breakdown in coordination and communication between the OR sub-teams [16]. For example, the scrub nurse and the surgeon failing to anticipate and synchronize their actions so that a particular instrument is not available at a critical moment, leading to excessive bleeding or haemodynamic instability; or, the anesthetist acting unilaterally because he does not understand the immediate priorities of the surgeon. Other things that are known to distract and aggravate team mindfulness include: interruptions, traffic through the OR, uncertainty regarding access to pediatric intensive care (PICU), ambiguities about team membership, and communication [17,18]. The impact of errors that other team members commit such as OR nurses, orderlies and perfusion technicians during open-heart surgery is not well known but is likely to be significant [19–21]. Instructions from the attending surgeon and anesthetist to their assistants (or vice versa) can also result in errors (e.g. failure to administer anticoagulants leading to a delay in being able to commence cardiopulmonary bypass). Faulty communication and follow through handovers to the intensive care unit team have been identified as critical [22]. Another major source of error is the handover of responsibility for a patient by one health professional to another. In similar complex environments, referred also as complex socio-technical systems, human factors research has been a major contributor to safety and reliability enhancement during the past two decades [23]. The importance of human factors and systems research in improving outcomes for pediatric cardiac surgery was highlighted in the Bristol Royal Infirmary Report [24], the Report of the Manitoba Pediatric Cardiac Surgery Inquest [25] and multi-national professional groups [26].

In pediatric cardiac surgery the expectations of families, administrators and clinicians are uniformly high and pediatric cardiac surgery has become a microcosm from which the wider medical community has sought to understand how to provide complex multidisciplinary care. Unit failures continue to occur with repeating themes including initial publication of apparent excess mortality from small units and the naming and shaming of surgeons involved [27]. Subsequent enquiries often highlight system issues including tenuous coverage and supervision of at admitting trainees, excessive reliance on a small number of key individuals and failures of effective communication between specialties [27,28].

Clinical governance systems have generally focused on dealing with bad outcomes and these are generally not recognized in advance. Robust and widely adopted risk stratification systems that allow cases to be classified on the basis of operative complexity and risk (RACHS-1, Aristotle, EACTS-STS scores) allow comparison of audited outcomes [29] between diverse pediatric cardiac units. It is generally accepted that open reporting of outcomes on a regular basis is ideal, as is done in the UK [30,31]. Real time analysis and reporting of outcomes for internal purposes, to identify early trends and system under-performance is possible but difficult to achieve in practice [32]. For many of us, the questions are i) how to build a sustainable model of quality improvement, ii) how to create an enjoyable and rewarding working environment, and, iii) how to build resilient systems that ensure excellent outcomes and protect against avoidable poor clinical outcomes.

4. Improving surgical leadership of teams

Most applicants for training in cardiac surgery are high achievers with high self-confidence. They are goal oriented and have a strong sense in their ability to control their actions and environment. They are used to subjugating their personal needs to those of their career, although the balance considered acceptable is changing [33,34]. 'Being' a cardiac surgeon also brings a degree of positional power within the institution and status within the medical and wider communities that may be attractive to some. Cardiac surgeons need to marshal the resources in the operating room and initiate rapid changes in management, which requires mature and adaptive skills in the command and control of others. There are also some surgeons, many of them undoubtedly talented, who blur the margins between forceful behavior and demonstration of narcissistic personality. According to psychiatric nomenclature, these include an exaggerated sense of self importance, unreasonable demands for special treatment or automatic compliance, a lack of consideration of the feelings of others and arrogant and haughty conduct [35]. Other disruptive features include a tendency in some circumstances to externalize the reasons for failure where they exist, rather than taking a share of responsibility or acknowledging the difficulty associated as a result of patient related factors. In extreme cases these behaviors might include throwing instruments, yelling and diminishing members of the team.

These actions can be seen as intimidating and threatening the psychological safety of other team members, hampering both the safety of patient care as well as the willingness of team members to speak up and to report process and outcome failures [36]. Unchecked, such individuals tend to damage or destroy relationships within their working environment to the point where a serious breakdown – either personal or professional – is likely to occur. When recognized early, an understanding of the underlying complaints or frustrations needs to be undertaken and addressed, in tandem with clear guidelines on what constitutes unacceptable behavior. Often senior surgeons are involved and the authority gradient makes those outside the operating environment reluctant to speak up and engage but it can only be resolved with commitment from such individuals and tackling the issues as a team problem. A calm analysis of episodes of unacceptable behavior might reveal genuine problems with training, competence or cooperation on the part of team members that could improve the standard of care and lead to a reduction in the surgeon's stress levels. Alternately, unacceptable behavior might give the surgeon and his or her colleagues cause to reflect on their own levels of stress, be it due to occupational or personal circumstances.

The consequences of not acting are clear — a blame culture and lack of psychological safety can not only lead to under reporting of incidents [37,38] but also to cover up strategies, justification of inadequate performance [39] and interpersonal situations where PCS members refrain from speaking up about difficult issues or asking questions [40]. Expressions of frustration and real time verbalization of stress can have important functions such as communicating the urgency or seriousness of a situation. Some forms of disruptive behavior might even be tolerated by the team in the interests of doing the best for the child, however, behavior that erodes the very concept of teamwork on which good outcomes are built must be addressed as it

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concerns all team members because ultimately it is patient outcomes that suffer [41].

5. Improving surgical mentorship of trainees

Surgeons specialize in PCS after completing a general surgery residency and then a 1 to 4 year adult cardiac surgery fellowship that provides a solid theoretical and technical base. Training in PCS requires them to step back from a reasonably high level of autonomy for 2–3 years while gaining experience before commencing as an admitting medical officer or consultant post.

The closeness of working relationships between surgeons and pediatric cardiologists is an attraction to some and a problem for others. This relationship requires intense communication and negotiation and intersects with the care and managing of the relationship with the family. Although much of the subsequent discussion deals with mentoring of surgeons by surgeons, some of the most expert mentoring of young surgeons is performed by pediatric cardiologists who are one step removed and see the whole landscape.

Low volumes of pediatric cases make it more difficult to acquire a critical mass of experience and sustain the multiple competencies required for complex procedures in a short fellowship when compared to adult practice. Younger surgeons need more experienced ones to mentor and direct them, inside and outside the operating rooms, at least for the first few years of consultant practice [33,34]. This mentorship requires a significant investment on behalf of the senior surgeon and inevitably brings different stress, as junior colleagues are mentored through more complex cases. During this time, the senior surgeon is essentially taking responsibility for the conduct and outcomes of the procedure. Learning is seen as a rational, linear and developmental process involving the learning of new knowledge and skills around which service improvements can be delivered. The act of learning can be portrayed as being free from bias and politically neutral, but a more realistic view is that questions of power, hierarchy and control are interweaved with the processes of learning and mentorship [42,43]. This relationship between mentee and mentor can be mutually satisfying [33,34] but the relationship requires frequent renegotiation for which frameworks usually don't exist. It is not uncommon for these mentee–mentor relationships to become strained as the junior surgeon transitions to independent practice.

Identifying and retaining the ‘joy’ of operating is, for many, something that requires active planning and attention. Thoughtful mentorship is required throughout a surgical career and consultant surgeons operating together on difficult or rare cases is more than ‘sharing the load’ or ‘spreading the experience’. In some circumstances it is an uncontroversial way of staying in touch with colleagues, speaking a common language, and achieving a level of collegiality that powerfully models trust, respect, learning and personal support within the operating environment. Successful individuals usually cite strong mentors. As most pediatric cardiac surgeons are not ready to take on the full range of emergency and major elective operations at the time they become attending surgeons, mentorship is key to developing the talent, supporting the intellectual and technical growth and development as well as actively addressing weaknesses [33,34].

Low case volumes and financial incentives lead a significant proportion of practitioners into mixed adult and pediatric practice. This increased work can make it difficult to contribute to the non-operative elements of service development and mentoring. It does bring advantages through cross-pollination with adult practice and participation in the innovations learned in the high volume settings of adult cardiac surgery. Diversity in the models of engagement (mixed adult vs. pediatric only practice) is a good strategy and assists in construction of a sustainable roster. Such individuals also bring with them the expectations of operating room conduct from the adult context that may be more hierarchical, than the pediatric environment. It also however might lead to a lower overall number of PCS cases that must be factored into overall competency in the early career of a surgeon.

6. Recognizing team difficulties before bad outcomes occur

PCS involves long and complex operations. All proceduralists will have observed that not all teams are equal in their ability. Some teams seem to be able to complete complex tasks with ease and in a good spirit whereas other teams show disharmony and conflict sometimes with less than ideal clinical outcomes. Understanding what makes the one team perform more effectively than the other remains elusive and learning from ‘mistakes’ is difficult [44]. An obvious approach is for more harmonious and functional teams to work more closely with members of less functional teams in the hope of modeling better team behavior. Very major operations that require additional hands present a natural opportunity for this cross fertilization but such cases in themselves are the cases that are most likely to be stressful for all concerned and although they might be an opportunity to improve on some technical aspects might not be ideal cases for illustrating good team dynamics.

Where known issues with individuals or combinations of individuals exist, this may create stress in anticipation because of the internal perception by many members of the team that they will need to rise above the usual input to achieve a good outcome. These expectations of ‘compensating’ for the other team members can be distracting and undermining. The challenge for the operating team is to learn how to improve the reliability — or consistent performance at high levels of safety over long periods of time, and differentiate between true underperformers and intrinsic failures of teamwork. In instances where things go wrong, surgeons may become tense or angry, and fail to perform at their best. Collective responsibility would imply that that scrutiny of the conditions triggering these states, including an individual's own performance is important for every member of the team. Systems theory would suggest that the overall performance of the team is related to the entire team's work and yet surgeons can feel quite put out when poor outcomes are attributed to them when other members of them performed poorly [45].

7. Making effective and sustainable teams

The stress of ‘doing’ cardiac surgery is experienced by all members of staff. The surgeon carries with them the shared responsibility for the child through the post-operative period. The unrelenting nature of the work, with very little ‘down’ time completely off call and the need to routinely participate in care on the night/weekend generates ongoing occupational stress. There is a natural tension between the need for individual learning and skills maintenance, practice building and the need for a team that can allow for leave, research and learning opportunities. This can be addressed by better sharing of work arrangements between surgeons but even when such arrangements exist, most pediatric cardiac surgeons describe that they are never truly ‘off call’ unless they are out of the city and in some cases out of the country. Vacations interrupted by the demands of transplantation are common. With high levels of application to work it is not surprising that surgeons report high levels of job satisfaction but also high rates of burnout [7] with the associated susceptibility to error [46]. High rates of self reported de-personalization and emotional exhaustion are key findings. Difficulties in negotiating a home–work life balance [33,34] and failure to look after one's health are common parts of the burnout complex. Interestingly, most of these aspects of the work are accepted as ‘part of the job’, but it is the apparently ‘minor’ factors that become incendiary, such as tardy team members, poor scheduling, and cancelation of cases because of constrained PICU resources, and the flow-on implications of rescheduling patients and balancing of their clinical and non-clinical priorities[47]. The cost of re-scheduling a case has far-reaching implications for the patient

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and the family of the patient, and often the surgeon and the family of the surgeon.

The impact of an unpleasant and unsafe organizational and physical environment on younger surgeons can be particularly profound and is magnified by the importance of the master–apprentice relationship. This stressful setting with lack of mentorship was felt to have contributed directly to the poor outcomes of several children, which led to the Manitoba pediatric cardiac surgery inquiry [25,26]. Although contemporary training programs emphasize the relationship between a trainee and the group as a whole, the senior surgeon is the gatekeeper to further operative experience and thus there will be an inevitable reluctance of the junior staff to disagree, or express dissatisfaction with the circumstances.

The inability to speak truth to power even when patient care is at stake can lead to patterns of withdrawal and assumption of a passive role [48]. These patterns can be a block to learning technical skills where self-confidence is an essential prerequisite. Younger trainees may have little life experience outside medicine or enter after a period of high-achievement in another field such as medical research but need to learn new skills in an environment where simple mistakes have significant repercussions and a blame culture can be devastating.

8. Bigger teams and communities of practice

Creating larger units with up to four full-time surgeons and greater depth of experience has been proposed in some countries such as the UK [49], and carried out in others such as Sweden [50]. Gaining superior outcomes through internal sub-specialization, better efficiency, opportunity for training, research and work–life balance is an established path learned from other domains for increasing reliability [51]. Except where geography and population distribution demand a local service, the days of small volume, single surgeon units seem numbered and changing expectations of the workplace from younger surgeons is also driving this trend. In parallel with these changes, it is now time to rethink the working environment including the psychological safety needed to encourage staff members to speak up [36] and create a more sustainable model of engagement of surgeons treating pediatric heart disease.

Considerable evidence exists to demonstrate that a lack of information sharing, professional secrecy and a failure to learn from mistakes are partially to blame for serious adverse events [52]. An emerging organizational vehicle to address these challenges in cardiac surgery, networks of communities, has emerged as a powerful tool in improving safety and performance in adult cardiac surgery. The Northern New England Cardiovascular Disease Study Group [53] has been able to dramatically improve outcomes across all members over a period of 20 years by sharing data, visiting each other and actively learning in practice how each cardiac team applies the knowledge of cardiac surgery in their own, customized manner. This community of practice is shaped less by managerially designed systems and more by activities of clinical practice and professional allegiance. These informal networks are seen as providing a significant basis for learning [54]. The Pediatric Heart Network [55] and Congenital Heart Surgeons Society [56] are two further examples.

The Joint Council on Congenital Heart Disease (JCCHD) National Pediatric Cardiology Quality Improvement Collaborative (NPC-QIC), described elsewhere in this Special Issue of Progress in Pediatric Cardiology [57], is another example of a powerful tool to support pediatric cardiac programs and improve the outcomes across the system. The JCCHD initiated the National Pediatric Cardiology Quality Improvement Collaborative (NPC-QIC) in 2006 with a vision to improve outcomes for patients with hypoplastic left heart syndrome. The development of this collaborative has been described elsewhere and is based on the Institute for Healthcare Improvement (IHI) Breakthrough Series Collaborative Model [58]. The relative rarity and heterogeneity of patients with hypoplastic left heart syndrome in most individual practices necessitates a multi-institution approach to achieve sample sizes required for meaningful learning through measurements in process and outcome. The NPC-QIC has focused its initial efforts on the interstage period of patients with hypoplastic left heart syndrome. As the patient outcomes after Norwood (Stage 1) palliation improve, interstage mortality and interstage failure to thrive have become increasingly important challenges. One of the desired outcomes of the NPC-QIC is that "no infants experience growth failure during the interstage period".

These networks, or 'Communities of Practice', can help mentor and grow trust across geographic distances and are often better suited for sharing of knowledge amongst clinicians by providing an informal, rapid and service facing basis for problem solving and growth. These national and international collaborative efforts are similar to the regional effort of the Northern New England Cardiovascular Disease Study Group; however, because of the lower incidence of congenital heart disease and the large distance between many programs, regional collaboratives may not be feasible. In the domain of pediatric cardiac surgery, these national or international quality improvement collaboratives may function as "virtual regional quality improvement collaboratives" and achieve the same objective as regional collaboratives such as the Northern New England Cardiovascular Disease Study Group. Evidence suggests that the quality of outcome for complex neonates, as one example, is more dependent on the integration and orchestration of care than any single operative variable [59], highlighting the importance of this work.

9. Conclusions and recommendations

Pediatric cardiac surgery is a model of high complexity health care, which has great relevance to unrelated fields where technical performance, decision-making and personal engagement are key determinants of patient outcomes. We have learnt from our well publicized successes and failures, and are well placed to put these lessons into practice in our own institutions, but seek tools to implement these learnings. The development of the cardiac surgery workforce will need to focus on technical as well as non-technical areas of practice.

10. Recommendations

1. Individual surgeons and program directors regularly review the working environment and acknowledge the impact of safe climate, human factors on the quality of teamwork in their institution.
2. Assessment of the working environment includes the risk of burnout in individuals and the impact of related behaviors on other team members.
3. Particular attention should be given to mentorship of vocational trainees in the specialty during their transition from trainee to accomplished surgeon and that this process of mentorship include a dedicated and committed overseeing surgeon who may need to be outside the place of employment.
4. Engage like-minded institutions in 'communities of practice' to support quality improvement in a collaborative, non-competitive manner.
5. Practitioners take responsibility for patient outcomes by discontinuing support arrangements known to be associated with poor outcomes — including arrangements where outcomes are not widely disseminated, where there is excessive reliance on key individuals and where volumes are insufficient to maintain a high quality and resilient team.

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