The author reported no conflicts of interest.

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**REPLY:
REGIONALIZATION:
ONE GENOTYPE,
MULTIPLE
PHENOTYPES
Reply to the Editor:**

I greatly appreciate the contribution of Zheleva and Overman¹ to the ongoing discussion about regionalization of care for children with congenital heart disease. This discussion began with my recognition that the results of atrioventricular septal defect repair in Sweden were dramatically improved when care was regionalized from 4 centers to 2 centers.² Vervoort³ expanded on this concept and encouraged us to focus on regionalization of care for these children on a global level. He pointed out the confounding issues of revenue, pride, and politics. Specifically, he brought up several barriers involved in establishing new congenital cardiac surgical centers in low- and middle-income countries.

Zheleva and Overman¹ have expanded on the issues for low- and middle-income countries. They have brought to our attention real problems currently occurring in countries where reimbursements are based only on volume and not linked to quality. Clearly, regionalization must be accompanied by outcome tracking and transparency as we have painfully learned both in England and in the United States.

That being said, there is no question that in very general terms outcomes are better at larger regional centers than at multiple small centers competing for the same private-pay patients or government reimbursements. Regionalization of care will look very different in low- and middle-income countries based on whether programs are funded by the government through universal health care, private payers, or a combination of both. This will be especially true in countries that have great inequalities in wealth. Given the tremendous differences in governmental structures in low- and middle-income countries, I am sure that the organizational format and financial support for congenital heart surgery centers will be dramatically different from country to country. However, I am confident that an underlying strategy of regionalization of care for these children will have the highest chance of providing optimal quality at the lowest cost.

An undercurrent that may help unify the philosophy of caregivers is the ever-increasing vitality and participation in the World Society for Pediatric and Congenital Heart

Surgery. Recent World University teaching forums have attracted pediatric cardiac surgeons and cardiologists from around the world to free teaching sessions by experts in the field. This contributes to our feeling that we are a global community entrusted with caring for children with congenital heart disease.

As I mentioned in the title of this letter, we should have one “genotype”: A goal of regionalization that will be accomplished by multiple “phenotypes,” depending on the unique vagaries of the individual countries. With each “phenotype,” the quality of care and outcomes must be quantified and publicly reported.

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**REPLY FROM AUTHOR:
BRIDGING THE
PUBLIC-PRIVATE
DIVIDE
Reply to the Editor:**

As countries worldwide make great strides on the global health agenda, the burden of noncommunicable diseases, such as cardiovascular diseases, becomes ever so apparent. Each year, nearly 200,000 child deaths from congenital heart defects could be prevented with access to cardiac care, whereas more than 300,000 children contract rheumatic heart disease each year, and more than 4 million children already live with rheumatic heart disease.^{1,2} I thank Zheleva and Overman for their thoughtful commentary,³ sharing their experiences with pediatric cardiac care capacity building in Brazil, China, India, Malaysia, and Vietnam through Children’s HeartLink. Specifically, they highlight the importance and unique dynamics of public, private, and mixed care delivery and funding for pediatric cardiac surgical services in low- and middle-income countries. Indeed, a public-private divide impedes progress of the global health agenda, and thoughtful early integration will be critical to efficiently and effectively scaling pediatric cardiac surgery in variable-resource contexts.⁴

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Economic theory teaches us that competition typically results in increased efficiency and reduced costs in an effort to stay competitive. But although this phenomenon may hold true in more saturated healthcare systems with market-based principles such as the United States, this does not necessarily translate to similar advantages in growing health systems. Various countries across the globe still lack sufficient (or even any) pediatric cardiac surgical capacity whereby early competition between the public and private sector can cause (1) low per-center volume because of still having to scale, (2) resulting poorer outcomes as a result of volume–outcome relationships, (3) higher costs from a lack of economies of scale and higher rates of complications, (4) potential scrutiny of and reduced investment in public centers as a result of poorer infrastructure and outcomes, and (5) financial barriers to receive care in private centers in the event of monopoly or oligopoly (ie, no or limited competition).

In other words, public–private partnerships cannot be dismissed and should be leveraged as countries work toward universal health coverage and leaving no (cardiac) patient behind. Although rarely recognized, governments themselves have great incentives to invest in local cardiac surgical services, with the ability to save up to millions of dollars annually compared to relying on sending patients abroad and only having visiting teams in country.² Building cardiac capacity has health systems–wide effects that benefit all levels and services of a health system. Strategic public–private partnerships can accelerate this and provide greater purchasing power, shared learning, improved efficiency, and cost-sharing, all of which are necessary to better manage more patients. Data-driven efforts, such as the International Quality Improvement Collaborative,³ can further emphasize continuous quality improvement along with comprehensive monitoring and evaluation of surgical volume, patient populations, outcomes, and even financial metrics. Examples from centers in India (eg, Narayana Health) and China (eg, Shanghai Children’s Medical Center), which provide some of the highest annual per-center cardiac surgery volumes at some of the lowest costs anywhere in the world,⁵ are ones to follow, illustrating the power of bridging the public–private divide.

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STATISTICAL CONSIDERATIONS FOR THE DISAPPEARED SIGNIFICANCE IN REGRESSION MODELS

To the Editor:

We read with great interest the valuable study by Tjoeng and colleagues¹ reporting that compared with white children, African-American children had a greater mortality risk after cardiac surgery. This study is well designed. However, one limitation should be mentioned.

Multivariable logistic regression is widely used to adjust for potential confounders. In the current study, the authors concluded that the association between ethnicity and mortality was mediated by disease severity, as this result became nonsignificant after adjusting for severity scores. This speculation is possible; however, it is not rigorous enough. Therefore, we briefly summarize other possible statistical conditions in 4 schematic diagrams (Figure 1) that may lead to the nonsignificant result.

First, the multicollinearity² should be evaluated when the association between the independent variable (ethnicity) and dependent variable (mortality) is significantly affected by a confounding variable. For instance, in the case of Figure 1, A, ethnicity has a strong relationship with disease severity, and the intersection of ethnicity and mortality is basically covered by disease severity. Under this circumstance, the association between ethnicity and mortality could be overwhelmed after adding disease severity as a confounder. Tolerance and variance inflation factors are commonly used for multicollinearity detection and should be reported in the current study.

Second, the modulating or interacting effect between ethnicity and disease severity may also lead to a similar