

# Special issue on electrophysiology and arrhythmia management around the globe: Challenges and opportunities explored



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In this Global Voices Special Issue of *Heart Rhythm O<sup>2</sup>*, we bring to you articles from authors spanning 6 continents. Health care access in various regions of the world is dependent on health care expenditure, local medical needs, third-party payer system, or self-pay by the citizens. Many countries have overcome political turmoil, economic disadvantages, and limited access of expertise and are taking gentle steps toward providing advanced cardiac care. In this Editorial, we evaluate articles presented in this Special Issue under 3 main subsections: electrophysiology practice and outcomes in health resource constrained countries, region-specific arrhythmias, health care disparities, training electrophysiologists to practice in low- and middle-income countries, and collaborative clinical investigations.

*Electrophysiology practice and outcomes in health resource-constrained countries:* Ponnusamy et al<sup>1</sup> present their data from 11 of 19 patients who had successful left bundle branch area pacing. If left bundle branch block was corrected by predetermined criteria, the Medtronic 3830 lead was connected to the pace/sense portion of the implantable cardioverter-defibrillator (ICD). A significant reduction in QRS duration from  $176.1 \pm 21.3$  to  $118.4 \pm 18.7$  ms ( $P < .001$ ), stable thresholds, and improvement in left ventricular ejection fraction was noted. The authors conclude that the left bundle branch area lead can potentially obviate need for a more expensive cardiac resynchronization therapy (CRT) device for heart failure. From the Republic of Moldova, Darcicuc et al<sup>2</sup> report the beginning of their journey with CRT. Patients from the Republic of Moldova have previously been referred to neighboring countries because of access limitations. The authors highlight the initiation of an education program in 2015 and a gradual increase in implantation of CRT devices for class 1 indications with high success and low complication rates. From Chile, Salazar et al<sup>3</sup> report the feasibility and safety of the transvenous lead extraction program in a ter-

tiary hospital. They describe 15 patients undergoing extraction for infection of cardiac implantable electronic device (CIED) systems. Procedure success was 93% with utilization of mechanical tools in two-thirds of the patients. Rocha et al<sup>4</sup> have evaluated the effectiveness and safety of remote monitoring of CIEDs in Brazil. In a prospective cohort study, clinical events occurred in 63.9% during  $29.5 \pm 23$  months of follow-up, with 23.5% requiring immediate attention. In a country with 4% of gross domestic product used for the public health system, the authors recommend remote monitoring as a cost-effective method of following these patients.

Although these studies are from a small group of patients, we commend the authors for carrying out complex procedures in regions with challenging health care access and for providing us with scientific data from their performance.

*Region-specific arrhythmias:* Veerakul et al<sup>5</sup> trace the history of Brugada syndrome from its initial recognition in Southeast Asians to the evolution of genetic etiology, development of diagnostic criteria, and management. They provide details of the initial randomized trial of  $\beta$ -blockers vs ICD, which revolutionized the management of this syndrome. They discuss the limitations of medical management in patients with recurrent ventricular arrhythmias and the ablation therapy of premature ventricular complex triggers. From India, Shenthar<sup>6</sup> provides us a review of rheumatic atrial fibrillation (AF). He describes the epidemiology of rheumatic heart disease and highlights the role of vitamin K antagonists to prevent stroke with data from the INVESTigation of rheumatic AF Treatment Using Vitamin K Antagonists, Rivaroxaban or Aspirin Studies, Non-Inferiority (INVICTUS-VKA) trial.<sup>7</sup> In contrast to nonvalvular AF, tight rate control to achieve a resting rate of less than 80 beats/min is needed to reduce the gradient across the mitral valve in this population. Maintenance of sinus rhythm remains a challenge with a possible role of ibutilide in acute conversion and a limited role of ablation.<sup>8</sup> He also addresses the public health awareness in the prevention of rheumatic heart disease. From the United States, Sanchez and Marcus<sup>9</sup> provide a review of AF among the Native American population. Although Native Americans have a high prevalence of

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predisposing clinical conditions such as diabetes, hypertension, coronary artery disease, and chronic kidney disease and a disproportionately higher incidence of AF and AF-related stroke, the management is hampered by access to care, reduced enrollment in clinical trials, and other socioeconomic causes. The authors offer a road map to possible solutions to improving the health of this specific population.

*Health care disparities:* Björkenheim et al<sup>10</sup> present a review of disparities based on sex, ethnicity, and socioeconomic status in AF ablation. Even though older age and longer duration of AF have been attributed to lower referral for AF ablation in female patients, the authors report that female sex is not a predictor of AF recurrence or higher complication rate. While the incidence of AF is lower in ethnic minorities, mortality benefit from ablation is higher compared to the white population.<sup>11</sup> Vanderberk et al<sup>12</sup> review the sex and racial disparities in electrophysiology and present data on sex differences in ion channel expression. Female ventricular myocytes have longer action potential duration because of reduced expression of rapid delayed rectifier potassium channels by estrogen; testosterone is associated with stronger transient outward currents in the male ventricular epicardium. Similarly, sex differences have been observed in the left atrium and pulmonary veins of male mice. They indicate the lack of data on racial differences in cardiac electrophysiology and call for action from funding agencies to increase research in these specific areas.

Sharif and Ptaszek<sup>13</sup> elaborate on the global disparities in the epidemiology of arrhythmias, specifically because of limitations in registries and diagnostic studies. The rate of implantation of bradycardia devices in African countries dominated by lupus, sarcoid, or postsurgical atrioventricular block is 200-fold lower than that in high-income countries. They report low time in therapeutic range in countries such as India and China and in the African continent because of limitations in coordination of anticoagulation. There are also regional variations in the causes of sudden cardiac death: coronary artery disease, Brugada syndrome, hypertrophic cardiomyopathy, and Chagas disease; for these, the true benefit of ICD is unknown. Ursaru et al<sup>14</sup> also highlight that CIED care is underrepresented in most developing countries because of socioeconomic status and funding deficiencies. These authors suggest that some of the disparities in device implantation rates can be resolved by device reutilization. Alyesh et al<sup>15</sup> describe the safety of reutilization of devices in developing countries. Such practices require proper sterilization technique, testing, and regulation. They provide us information on the nonprofit organizations dedicated for this purpose and walk us through the workflow of the removal of the device to reimplantation.

Kiernan et al<sup>16</sup> present the racial and ethnic differences in implantation of ICDs. They report that most clinical trials differentiate race as white or non-white, thus largely ignoring subgroups such as African Americans, Hispanics, or Native Americans. The Atherosclerosis Risk in Communities (ARIC) Study reveals that African Americans carry the highest lifetime risk of sudden cardiac arrest, which is confirmed

by autopsy studies. However, they are less likely to receive ICD implantation than white populations for both primary and secondary prevention and have a lower rate of postimplant monitoring. Such differences indicate a need for race-specific outcome evaluation in clinical trials.

Amuthan and Curtis<sup>17</sup> from the United States present a review of sex gaps in clinical electrophysiology practice. They address gender inequality including transgender and nonbinary individuals, challenges of sex and gender identification in clinical research, gaps in health care utilization in female patients with heart failure and AF, and a need for sex-specific guidelines for clinical management. They highlight the benefit of CRT in female patients as an example of the need to have sex-specific outcomes in clinical trials. The solutions offered include implicit bias training, shared decision making, as well as diversification of the physician workforce.

*Training electrophysiologists to practice in low- and middle-income countries:* The University of Toronto has a unique electrophysiology training program for physicians from underserved regions. Clare-Pascoe et al<sup>18</sup> specifically report the benefit of training female electrophysiologists from Jamaica and St. Lucia in the University of Toronto Hospital. The fully trained physicians, upon returning to their country, have provided an advanced level of care by establishing an electrophysiology laboratory.

*Collaborative clinical investigations:* While contact force catheters have been studied in the adult population, Cruz-Baquero et al<sup>19</sup> present data from Columbia on safety and efficacy of using contact force ablation catheters in a pediatric population. Pitman et al<sup>20</sup> discuss screening for AF in Ethiopia using a KardiaMobile device (AliveCor, Mountain View, CA). Similar to the African American population, the study reveals relatively low prevalence of AF in the population from sub-Saharan Africa. In a meta-analysis of observational studies, Prasitlumkum et al<sup>21</sup> have evaluated sex-specific differences in the outcomes after ventricular tachycardia (VT) ablation for structural heart disease. They found increasing representation of women in more recent studies and no difference in mortality or rehospitalization for VT among men and women. In a review of out-of-hospital sudden cardiac arrest within the United States, Mehta et al<sup>22</sup> outline the racial, ethnic and socioeconomic disparities. They compare the difference in survival among patients from rural Alabama to those from suburban areas in Washington state and attribute that these are likely from deficient resources such as bystander cardiopulmonary resuscitation or automated external defibrillators. Remote monitoring for CIED management has been in common use in Western countries and has been shown to be beneficial in early identification of arrhythmias, worsening heart failure, and lead-related issues. Turek et al<sup>23</sup> report a case where smartphone technology was used to educate an implanting surgeon in Haiti to avert phrenic nerve pacing in a patient with a dislodged atrial lead. Varma et al<sup>24</sup> compared patients from the United States and Asian countries and report that only 5.6% of Asian population are followed remotely, despite wide popularity of smartphones in

those countries. Smartphone technology and the applications commonly used have long enhanced rapid communications globally.

In the spirit of collaboration across the globe, Srivatsa et al<sup>25</sup> elaborate on their experiences in a charity hospital in India. This Viewpoint article highlights the value of partnership and mutual learning by combining skills and resources that can set an example for forming alliances across the world.

In the Fellows Corner, Sanhueza et al<sup>26</sup> report a case of cardiogenic shock from atrial tachycardia. With extracorporeal membrane oxygenation support, the patient underwent successful ablation with complete recovery of systolic function during follow up.

In summary, this *Heart Rhythm O<sup>2</sup>* Global Voices Special Issue presents investigations and reviews of situations that are uniquely challenging in various regions of the world. We invite the readers to enjoy, appreciate, and learn about these situations so that we, as a global community, may develop partnerships to make health care equitable for all.

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## References

- Ponnusamy SS, Ramalingam V, Ganesan V, et al. Left bundle branch pacing optimized implantable cardioverter-defibrillator (LOT-ICD) for cardiac resynchronization therapy: a pilot study. *Heart Rhythm O2* 2022;3:723–727.
- Darciuc R, Boiciuc I, Ivanov D, Diker E. Cardiac resynchronization therapy in the Republic of Moldova: the beginning of the journey. *Heart Rhythm O2* 2022;3:728–730.
- Salazar P, Pérez-Silva A, Villablanca A, et al. Feasibility and safety of a transvenous lead extraction program implementation in South America: challenges, early outcomes, and global collaboration. A single-center experience. *Heart Rhythm O2* 2022;3:731–735.
- Rocha MEQA, Lima NA, Pinho LGB, et al. Remote monitoring of pacemakers and defibrillators—effective and safe in Brazil? *Heart Rhythm O2* 2022;3:736–742.
- Veerakul G, Khongphatthanayothin A, Nademane K. Brugada syndrome in Thailand: three decades of progress. *Heart Rhythm O2* 2022;3:743–751.
- Shenthar J. Management of atrial fibrillation in rheumatic heart disease. *Heart Rhythm O2* 2022;3:752–759.
- Connolly SJ, Karthikeyan G, Ntsekhe M, et al. Rivaroxaban in rheumatic heart disease-associated atrial fibrillation. *N Engl J Med* 2022;387:978–988.
- Shenthar J, Banavalikar B, Valappil SP, et al. Safety and efficacy of ibutilide for acute pharmacological cardioversion of rheumatic atrial fibrillation. *Cardiology* 2021;146:624–632.
- Sanchez JM, Marcus GM. American Indians and atrial fibrillation. *Heart Rhythm O2* 2022;3:760–765.
- Björkenheim A, Fengsrud E, Blomström-Lundqvist C. Catheter ablation of symptomatic atrial fibrillation; sex, ethnicity, and socioeconomic disparities. *Heart Rhythm O2* 2022;3:766–770.
- Thomas KL, Al-Khalidi HR, Silverstein AP, et al. Ablation versus drug therapy for atrial fibrillation in racial and ethnic minorities. *J Am Coll Cardiol* 2021;78:126–138.
- Vanderberk B, Chew DS, Parkash R, Gillis AM. Sex and racial disparities in catheter ablation of arrhythmias. *Heart Rhythm O2* 2022;3:771–782.
- Sharif Z, Ptaszek LM. Global disparities in arrhythmia care: mind the gap. *Heart Rhythm O2* 2022;3:783–792.
- Ursaru AM, Bogdan S, Kusumoto F. Electrophysiology and arrhythmia care in Romania. *Heart Rhythm O2* 2022;3:793–798.
- Alyesh D, Pavri BB, Choe W, et al. Advancing global equity in cardiac care as cardiac implantable electronic device reuse comes of age. *Heart Rhythm O2* 2022;3:799–806.
- Kiernan K, Dodge SE, Kwaku KF, Jackson LR II, Zeitler EP. Racial and ethnic differences in implantable cardioverter-defibrillator patient selection, management, and outcomes. *Heart Rhythm O2* 2022;3:807–816.
- Amuthan R, Curtis AB. From background to solutions: eliminating sex gaps in clinical electrophysiology practice. *Heart Rhythm O2* 2022;3:817–826.
- Clare-Pascoe N, Cenac K, Stephenson S, et al. Quantifying the impact of equity, diversity and inclusion in electrophysiology: training the first female electrophysiologists from Jamaica and Saint Lucia. *Heart Rhythm O2* 2022;3:827–832.
- Cruz-Baquero L, Pachón PP, Molano-Gonzalez N, Arenas A. Use of contact force technology for cardiac arrhythmia ablation in children. *Heart Rhythm O2* 2022;3:833–838.
- Pitman BM, Chew S, Wong CX, et al. Prevalence and risk factors for atrial fibrillation in a semi-rural sub-Saharan African population: The hEart of ethiopia: Focus on Atrial Fibrillation (TEFF-AF) Study. *Heart Rhythm O2* 2022;3:839–846.
- Prasitlumkum N, Navaravong L, Desai A, et al. Sex differences on outcomes of catheter ablation of ventricular tachycardia in patients with structural heart disease: A real-world systematic review and meta-analysis. *Heart Rhythm O2* 2022;3:847–856.
- Mehta NK, Allam S, Mazimba S, Karim S. Racial, ethnic, and socioeconomic disparities in out-of-hospital cardiac arrest within the United States: Now is the time for change. *Heart Rhythm O2* 2022;3:864–867.
- Turek R, Toussaint E, Shedd O. Utilization of smartphone application to resolve right-sided phrenic nerve stimulation for a pacemaker patient remotely located in rural farmland of Haiti. *Heart Rhythm O2* 2022;3:864–867.
- Varma N, Kondo Y, Park S, et al. Utilization of remote monitoring among patients receiving cardiac resynchronization therapy and comparison between Asia and the Americas. *Heart Rhythm O2* 2022;3:868–870.
- Srivatsa UN, Varyani R, Kini P, et al. Knowledge exchange—Working together across the globe. *Heart Rhythm O2* 2022;3:871–873.
- Sanhueza S, Vergara I, Bittner A, et al. Cardiogenic shock due to arrhythmia-induced cardiomyopathy and its recovery after radiofrequency ablation under extracorporeal membrane oxygenation support. *Heart Rhythm O2* 2022;3:874–878.