The Landscape and Trends in Preventive Cardiology and its Training

HOJUNE E. CHUNG, DO; GAURAV CHOUDHARY, MD; WEN-CHIH WU, MD, MPH

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INTRODUCTION

Atherosclerotic cardiovascular disease (ASCVD) is the leading cause of death independent of gender and ethnicity in the United States (US) and is estimated to result in a staggering $273 billion economic burden annually.[1] Guideline-directed medical therapy (GDMT) in the primary and secondary prevention of ASCVD has afforded our aging population with increased survival times. Nonetheless, the epidemiology of cardiovascular disease is transitioning from ASCVD alone to include the growing prevalence of heart failure.[2] Despite advances in GDMT, the mortality from heart failure remains high.[3] The traditional model of prevention focusing on ASCVD is insufficient to meet our current needs and highlights the need for innovative training regimens within preventive cardiology.

In light of this public health priority, the opportunities to train in preventive cardiology continue to grow. Fifteen programs were first identified in 2012[4], with an additional 4 programs in 2017 for a total of 19.[5] We sought to provide an updated list of programs that also included their core focus. A total of 24 programs were identified utilizing the search methods as described by Pack et al.[4] Even with the continuous growth of cardiovascular disease, the Accreditation Council for Graduate Medical Education and American Board of Medical Specialties do not officially recognize preventive cardiology as a subspecialty. Without accreditation, preventive cardiology fellowships lack a standardized curriculum which has created heterogeneous training experiences.

It is critical that preventive cardiologists are adept in interpreting research outcomes from different disciplines that span from mental health, behavioral change, nutrition, exercise science, substance abuse, clinical pharmacology and population health, among others; and translate them into clinical practice for the benefit of their patients. Programs tend to fall into one of two dichotomies, either blending clinical and research training or solely focused on research typically in one of the disciplines of prevention such as hypertension, lipidology, atherosclerosis, subclinical atherosclerosis imaging or cardiac rehabilitation (**Table 1**).

DIVISION OF CARDIOLOGY AT BROWN ONE OF FIRST TO LAUNCH PREVENTIVE FELLOWSHIP

In 2008 the Cardiology division at the Alpert Medical School of Brown University launched one of the first preventive cardiology fellowships in the US. In collaboration and support with the Brown University's general cardiology fellowship, the preventive cardiology fellowship offers two tracks. One is a 2+2 track where the fellow is trained for 2 years in preventive cardiology and related research, and another 2 years in general cardiology. To date, 2 physicians have graduated under this track. The second track offers preventive cardiology training alone, either for 2 years of training in preparation for a future general cardiology fellowship or 1 extra year of training after the general cardiology fellowship. To date, the second track has graduated a total of 18 physicians. Some graduates have continued to serve the Rhode Island community as cardiology faculty within the Alpert Medical School.

At the inception of the fellowship the vision was to equally emphasize the clinical and research components of preventive cardiology. The core of the fellowship was structured around a robust clinical experience where the fellows rotate in general cardiology, heart failure and pulmonary hypertension clinics. As our population ages, patients are at an increased risk of cardiopulmonary co-morbidities which may lead to underdiagnosed pulmonary hypertension. The fellows are actively involved in a multi-specialty pulmonary hypertension clinic staffed by both pulmonary and cardiology. Studies have shown that these combined efforts lead to improved diagnosis and supportive care measurements in this patient population with high mortality.[6]

CARDIAC REHABILITATION TRAINING PROGRAMS

The fellows also staff one of the largest center-based cardiac rehabilitation facilities in the Northeast that is comprised of two geographically and structurally distinct programs. One follows the standard cardiovascular rehabilitation curriculum set forth by the American Association of Cardiovascular

Table 1. Cardiovascular Disease Prevention Fellowships in the United States

Program	Training Experience	Research Focus	Prerequisite
Baylor College of Medicine Houston, Texas	Clinical / Research	Lipid and Atherosclerosis	Internal Medicine
Brigham and Women's Hospital /West Roxbury Veterans Affairs Medical Center, Boston, MA	Clinical / Research	Aspirin for primary prevention, Cardiovascular genetics	Internal Medicine
Brown University / Providence Veterans Affairs Medical Center Providence, RI	Clinical / Research	Diabetes, Heart Failure, Cardiovascular Rehabilitation and Imaging	Internal Medicine
Cedars-Sinai, Los Angeles, CA	Clinical / Research	Women's Heart Disease and Health	Internal Medicine, OB/GYN, Family Medicine
Cedars-Sinai, Los Angeles, CA	Clinical / Research	Hypertension and Vascular Biology	Internal Medicine
Emory University, Atlanta, GA	Clinical / Research	Lipid, Diabetes, Nutrition, Metabolic Syndrome	Internal Medicine
Hartford Hospital, Hartford, CT	Clinical / Research	Exercise Physiology, Sports Medicine, Statin Myopathy, Cardio-oncology	Internal Medicine, Cardiology
Mayo Clinic, Rochester, MN	Clinical / Research	Pulmonary Hypertension, Heart Failure, Cardiovascular Rehabilitation	Cardiology
New York University, New York City, NY	Clinical / Research	Lipid, Diabetes, Atherosclerosis	Internal Medicine
Saint Luke's Mid America Heart Institute, Kansas City, KS	Clinical / Research	Lipid, Diabetes, Hypertension, Exercise Physiology, Atherosclerosis	Internal Medicine, Cardiology
Bronx Hospital Veterans Affairs New York City, NY	Clinical / Research	Hypertension, Metabolic Syndrome, Vascular Dementia	Internal Medicine
University of Minnesota Minneapolis, MN	Clinical / Research	Lipid, Women's Health, Biomarkers of vascular structure and function	Cardiology
UT Southwestern Dallas, Texas	Clinical / Research	Premature and familial cardiovascular disease, primary and secondary prevention	Internal Medicine
Brigham and Women's Hospital/Harvard Medical School, Boston, MA	Research	Epidemiology of Cardiovascular Disease	Non-clinical Postdoctoral Fellowship
Johns Hopkins Bloomberg School of Public Health, Baltimore, MD	Research	Epidemiology of Cardiovascular Disease	Doctoral, Non-clinical Postdoctoral Fellowship
Northwestern University Chicago, IL	Research	Epidemiology and Preventive Cardiology	Doctoral, Non-clinical postdoctoral fellowship
Oregon Health and Science University, Portland, Oregon	Research	Lipid, Atherosclerosis	Non-clinical postdoctoral Fellowship
Stanford Hospital, Stanford, CA	Research	Epidemiology of Cardiovascular Disease	Internal Medicine, Preventive Medicine, Psychiatry, Pediatrics
Texas Heart Institute Houston, Texas	Research	Atherosclerosis and Vulnerable Plaque	Non-clinical Postdoctoral Fellowship
University of California San Diego San Diego, CA	Research	Epidemiology of Cardiovascular Disease	Non-clinical Postdoctoral Fellowship
University of North Carolina Chapel Hill, NC	Research	Epidemiology of Cardiovascular Disease	Non-clinical Postdoctoral Fellowship
University of Pittsburgh Medical Center, Pittsburgh, PA	Research	Epidemiology of Cardiovascular Disease	Non-clinical Postdoctoral Fellowship
University of Wisconsin Madison, WI	Research	Atherosclerosis Imaging	Internal Medicine, Family Medicine, Cardiology
Wake Forest University Winston-Salem, NC	Research	Epidemiology of Cardiovascular Disease	Doctoral, Non-clinical Postdoctoral Fellowship

and Pulmonary Rehabilitation (AACVPR)[7], and the other executes the intensive cardiac rehabilitation curriculum from Dean Ornish Heart Disease Reversal® program.[8] The breadth of experience allows exposure to varied program structures and settings, nuanced exercise prescriptions and the physical and mental improvements made possible, which is invaluable when evaluating the natural history of cardiovascular disease.

INTRAVENOUS DIURETIC CLINIC

One unique feature of the fellowship is that each fellow is also responsible for an Intravenous Diuretic clinic. The clinic is modeled after the outpatient Oncology infusion suite for chemotherapy and tailored to the goal of administering same-day ambulatory intravenous diuretics. In this way, heart failure patients receive frequent volume assessments with the goal of averting an emergency room visit or heart failure hospitalization. The benefit of this experience is clinically meaningful for both the patient and the trainee, since hospitalizations for heart failure have a cumulative risk in mortality for these patients.[9]

PERFORMANCE AND INTERPRETATION OF STRESS TESTING

An integral part of preventive cardiology is the application of exercise physiology and stress testing towards prevention, disease detection, risk stratification or exercise prescription. Therefore, fellows receive extensive training in the performance and interpretation of stress testing, both pharmacologic and exercise, with and without imaging. Furthermore, some fellows undergo additional instruction in the quantification of coronary artery and aortic valve calcification by Computed Tomography or interpretation of cardiac MRI as part of their research. The imaging opportunities within the program continue to expand with the addition of cardiac pyrophosphate nuclear imaging to diagnosis cardiac amyloid, an increasingly common finding in the heart failure clinic.

POPULATION-BASED OUTCOMES RESEARCH

Fellows are rigorously trained in the scientific method in order to conduct population-based outcomes research. Every fellow is taught how to independently create statistical models that demonstrate which factors have relationships with exposure and outcomes of interest. Fellows routinely conduct analysis using national databases such as the Coronary Artery Risk Development in Young Adults (CARDIA), Jackson Heart Study and the registry of the AACVPR, to name a few. The goal is to nurture physicians who can critically examine the current medical literature and weigh the risks and benefits of current preventive cardiology practices to improve patient outcomes.

Lastly, the epidemiological trends of cardiovascular pathologies and preventive practices require a multidisciplinary approach. The fellows are trained in an inclusive ethos and learn to work with nursing, exercise physiologists, pharmacists, behavioral psychologists, nutritionists and substance abuse experts to provide comprehensive care. Bi-weekly multi-disciplinary research conferences are held to learn the viewpoints from different disciplines. Multidisciplinary clinical heart failure meetings occur to review all heart failure discharges, staffed by cardiology, home care nursing, home-based cardiac rehabilitation, and palliative care, to coordinate the needs and address the underlying pathophysiology of heart failure patients to prevent future hospitalizations.

CONCLUSION

As the need of our aging patient population becomes more complex, the need for a balanced clinical and research training in preventive cardiology continues to grow. Until a standardized curriculum is enacted, training programs have to evolve and adapt to the change of disease patterns and population health. As preventive cardiology programs strive to equip the modern physician with the knowledge and skills to comprehensively serve our patients with cardiovascular disease, it is necessary that the current and future preventive cardiology fellowships incorporate both clinical and research aspects in the curriculum to experience further growth and success.

References

1. Heidenreich PA, Trogdon JG, Khavjou OA, et al. Forecasting the Future of Cardiovascular Disease in the United States. Circulation 2011;123:933-44.
2. Roger VL. Epidemiology of Heart Failure. Circulation Research 2013;113:646-59.
3. Ho KK, Pinsky JL, Kannel WB, Levy D. The epidemiology of heart failure: the Framingham Study. J Am Coll Cardiol 1993;22:6a-13a.
4. Pack QR, Keteyian SJ, McBride PE. Subspecialty Training in Preventive Cardiology: The Current Status and Discoverable Fellowship Programs. Clinical Cardiology 2012;35:286-90.
5. Cardiovascular Disease Prevention Training: An Update. 2017. (Accessed August 6th, 2020, at https://www.acc.org/latest-in-cardiology/articles/2017/07/06/15/59/cardiovascular-disease-prevention-training-an-update.)
6. Jankowich M, Hebel R, Jantz J, Abbasi S, Choudhary G. Multispecialty pulmonary hypertension clinic in the VA. Pulm Circ 2017;7:758-67.
7. Guidelines for Cardiac Rehabilitation Programs: Human Kinetics, Incorporated; 2020.
8. Ornish D, Ornish A. Undo It!: How Simple Lifestyle Changes Can Reverse Most Chronic Diseases: Random House Publishing Group; 2020.
9. Setoguchi S, Stevenson LW, Schneeweiss S. Repeated hospitalizations predict mortality in the community population with heart failure. American Heart Journal 2007;154:260-6.

Authors

Hojune E. Chung, DO, Department of Internal Medicine (Section of Cardiovascular Medicine), Providence VA Medical Center, Providence, RI; Department of Internal Medicine (Section of Cardiovascular Medicine), Alpert Medical School of Brown University, Providence, RI.

Gaurav Choudhary, MD, Department of Internal Medicine (Section of Cardiovascular Medicine), Providence VA Medical Center, Providence, RI; Department of Internal Medicine (Section of Cardiovascular Medicine), Alpert Medical School of Brown University, Providence, RI.

Wen-Chih Wu, MD, MPH, Department of Internal Medicine (Section of Cardiovascular Medicine), Providence VA Medical Center, Providence, RI; Department of Internal Medicine (Section of Cardiovascular Medicine), Alpert Medical School of Brown University, Providence, RI; Medical Director, The Miriam Hospital Cardiovascular Rehabilitation Center, Providence, RI.

Conflicts of Interest

The authors have no disclosures to declare.

Correspondence

Wen-Chih Wu, MD, MPH
Chief of Cardiology, Providence VA Medical Center;
Professor of Medicine & Epidemiology
Alpert Medical School of Brown University;
Providence VA Medical Center
Research (151)
830 Chalkstone Avenue
Providence, RI 02908
401-273-7100 x16237
Fax 401-457-3357
wen-chih_wu@brown.edu