10-Year Heart Failure Outcomes From Nurse-Driven Clinics in Rural Sub-Saharan Africa

Lauren A. Eberly, MD, a Emmanuel Rusingiza, MD, h Paul H. Park, MD, MSc, c,d Gideon Ngoga, BS, RN, a Symaque Dusabeyezu, RN, f FrancisMutabazi, BCM, f Cyprien Gahamanyi, RN, f Evariste Ntaganda, MD, MPH, f Gene F. Kwan, MD, MPH, c,d,e Gene Bukhman, MD, PhD c,d,e

ABSTRACT

Nurse-led delivery care models have the potential to address the significant burden of heart failure in sub-Saharan Africa. Starting in 2006, the Rwandan Ministry of Health, supported by Inshuti Mu Buzima (Partners In Health–Rwanda), decentralized heart failure diagnosis and care delivery in the context of advanced nurse-led integrated noncommunicable clinics at rural district hospitals. Here, the authors describe the first medium-term survival outcomes from the district level in rural sub-Saharan Africa based on their 10-year experience providing care in rural Rwanda. Kaplan-Meier methods were used to determine median time to event for: 1) composite event of known death from any cause, lost to follow-up, or transfer to estimate worst-case mortality; and 2) known death only. Five-year event-free rates were 41.7% for the composite outcome and 64.3% for known death. While death rates are encouraging, efforts to reduce loss to follow-up are needed. (J Am Coll Cardiol 2019;73:977-80) © 2019 by the American College of Cardiology Foundation.

Echocardiographic evaluation and longitudinal care of patients with heart failure is largely unavailable in rural areas of low-income sub-Saharan Africa. Traditional cardiologist-centered care delivery models for heart failure in rural sub-Saharan Africa lack feasibility. Alternatively, nurse-led programs have the potential to be effective and scalable (1,2). Understanding the outcomes of such strategies is critical for wider acceptability.

Beginning in 2006, the Rwandan Ministry of Health, supported by Inshuti Mu Buzima (Partners In Health–Rwanda), decentralized heart failure diagnosis and care delivery in the context of advanced nurse-led integrated noncommunicable (NCD) clinics at 3 rural district hospitals (2). Here, we describe the first medium-term survival outcomes from the district-level in rural sub-Saharan Africa based on our 10-year experience providing care in rural Rwanda.

METHODS

Between 2006 and 2011, nurses at 3 rural district hospital advanced NCD clinics were trained in focused point-of-care echocardiography and heart failure management algorithms that included diuretic agents, angiotensin-converting enzyme inhibitors, cardiac beta-blockers, and warfarin when indicated (2,3). Patients were sent to clinic after hospital...
AABBREVIATIONS AND ACRONYMS

LTFU = lost to follow-up
NCD = noncommunicable disease

discharge or referred from lower-level facilities. A visiting cardiologist supervised the clinics on a monthly basis and attempted to perform independent history, physical examination, and confirmatory echocardiography on newly enrolled patients within a 6-month period.

Between September 2017 and October 2017, we performed a manual chart review on all patients newly enrolled over a period of 11 years (2006 to 2017) with a cardiologist-confirmed heart failure diagnosis in 3 district-level NCD clinics in rural Rwanda. These clinics were the only source of specialized heart failure care for a combined catchment area of close to 1 million people, with an estimated prevalence of moderate or severe heart failure of 0.1% (1,000 people) in Global Burden of Disease study models (4,5).

Adult patients were defined as age ≥18 years. Patients not seen in clinic within 6 months were considered lost to follow-up (LTFU). Outreach attempts had been made for these patients with assistance from community health workers who notified clinic staff of patient deaths and date of death if known. Transferred patients included those transferred to other referral centers or district hospitals. Patients who had sufficient resolution of their disease state and no longer required further clinical follow-up exited from care. We determined time to all-cause mortality. Time-to-event for patients LTFU was determined from date of initial visit to date of last visit or date of last known contact.

Kaplan-Meier methods were used to determine median time to event (months) from intake. Patients were stratified by age and diagnostic category, as well as time period of diagnosis (2006 to 2011 vs. 2012 to 2017) to evaluate for improvement in outcomes over time. Given high LTFU in this region for heart failure patients and difficulty in ascertaining death for patients LTFU or transferred, 2 analyses were performed with event of interest as: 1) composite event of known death from any cause, LTFU, or transfer to estimate worst-case mortality; and 2) known death only with patients who were LTFU or transferred censored at last clinic visit or last available contact (6). Otherwise, patients without the event of interest were censored at the period of interest.

All data were analyzed using SAS software, version 9.4 (SAS Institute Inc., Cary, North Carolina). Ethical approval was obtained by the Rwanda National Ethics Committee and Institutional Review Board of Brigham and Women’s Hospital.

RESULTS

Since November 2006, 719 of referred patients were enrolled with a cardiologist-confirmed heart failure diagnosis. The majority of adults (72%) were female, lived in dirt-floor housing (82%), and were farmers (78%) (5). The median age of adult patients was 42 years. Nearly 40% of adults presented with New York Heart Association functional class III to IV. Among adults, cardiomyopathy (39.7%) and rheumatic heart disease (26.8%) were most common. Median follow-up of adult patients was 27.6 months (interquartile range: 8.4 to 60.7 months). A total of 193 adult patients (42.8%) were alive and retained in care at data extraction. Over the 10-year period, 133 (29.5%) of adult patients had documented deaths, 108 (23.9%) were LTFU, 12 (2.7%) were transferred, and 5 (1.1%) exited care.

Pediatric patients comprised 36% of the cohort, of whom the majority were female (62%) and lived in dirt-flooring housing (86%). Of pediatric patients, congenital heart disease (52.4%) and rheumatic heart disease (35.9%) were most prevalent. Median follow-up was 13.5 months (interquartile range: 2.8 to 40.4 months). Of pediatric patients, 110 (44.3%) were alive and retained in care at data extraction. A total of 49 (19.4%) had documented deaths, 83 (33.5%) were LTFU, 2 (0.8%) were transferred, and 2 (0.8%) exited care.

Median time-to-event and 5-year event rates by diagnostic and age category are demonstrated in Table 1. The 5-year mortality rate was 38.8% in the first 5-year period after clinic establishment (2006 to 2011) and was 27.1% in the second time period (2012 to 2017) (p = 0.15).

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Median Time to Event and 5-Year Event Rates by Age and Diagnostic Category</th>
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<tbody>
<tr>
<td></td>
<td><strong>Composite</strong> &lt;br&gt; (95% CI)</td>
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<tr>
<td>Entire cohort</td>
<td>37.9 (32.6-45.4) &lt;br&gt; N/A (90.8-N/A)</td>
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<tr>
<td>Age category</td>
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<tr>
<td>Adult</td>
<td>44.4 (36.4-55.4) &lt;br&gt; N/A (80.0-N/A)</td>
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<tr>
<td>Pediatric</td>
<td>28.7 (21.9-40.5) &lt;br&gt; N/A (N/A-N/A)</td>
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<tr>
<td>Heart failure category</td>
<td></td>
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<tr>
<td>CMP</td>
<td>50.3 (41.2-64.9) &lt;br&gt; N/A (84.0-N/A)</td>
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<tr>
<td>RHD</td>
<td>70.3 (42.3-N/A) &lt;br&gt; N/A (82.4-N/A)</td>
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<tr>
<td>HTN-HD</td>
<td>25.8 (17.3-36.4) &lt;br&gt; N/A (55.8-N/A)</td>
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<tr>
<td>Congenital</td>
<td>24.7 (12.2-35.9) &lt;br&gt; N/A (N/A-N/A)</td>
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<tr>
<td>Isolated RHF</td>
<td>22.9 (11.4-45.6) &lt;br&gt; N/A (82.4-N/A)</td>
</tr>
</tbody>
</table>

Diagnostic criteria for each category have been previously described (7). No stress testing or coronary angiography was available. *Composite of death, lost to follow-up, or transfer as estimate of worst-case mortality.

CI = confidence interval; CMP = cardiomyopathy (moderate-severely depressed left ventricular systolic function/ejection fraction ≤40% without regional variation suggestive of coronary disease); HTN-HD = hypertensive heart disease; N/A = not available/unable to be calculated due to too few events or size of the risk set; RHD = rheumatic heart disease (including mitral stenosis and other rheumatic valvular disease); RHF = right heart failure; SE = standard error.
**DISCUSSION**

To our knowledge, this is the first survival analysis reported from a large heart failure cohort managed by nurses at rural district hospitals in low-income sub-Saharan Africa (Central Illustration). Also, it is the largest single-country heart failure survival analysis from the region.

The 6-month and 1-year composite event-free outcomes of our cohort were 80.1% and 72.3% compared with survival rates of 82% (6 month) and 66.7% (1 year) from recent previous studies of African heart failure patients (6,7). However, comparisons are limited by inability to risk-adjust, and notable differences in our cohort: the median age of our impoverished, rural African cohort was younger than previous African registries and demonstrated persistence of a substantial burden of rheumatic heart disease and nonischemic cardiomyopathies (5-7).

Limitations of this study include the relatively high LTFU (29%). Very ill patients could be unable to travel to clinic, and there are likely unaccounted deaths among those LTFU because many have limited telephone contact. Conversely, in this population, health care ends up being relatively low in priority while achieving daily needs such as work; patients who are relatively well may not return (6). We are further limited by the lack of a control group and data regarding heart failure hospitalizations.

There have been several decades of efforts in sub-Saharan Africa to deliver integrated and decentralized chronic management for common NCDs such as hypertension, type 2 diabetes, and asthma (8). Our strategy, however, represents the first example to our knowledge of chronic care integration and decentralization for more severe and complex chronic conditions such as heart failure (2). Nurse-led models for heart failure care delivery can allow economically
and socially vulnerable patients with advanced cardiovascular disease to be identified quickly, start on guideline-directed therapy before seeing a specialist, and gain access to cardiac surgery when appropriate (1,2). The 10-year death rates are encouraging, but loss-to-follow-up needs to be significantly reduced. This approach has been scaled nationally in Rwanda, and it is being adapted in other countries in the region. Efforts to better track patients and limit loss to follow-up, along with ongoing monitoring and evaluation, will be important as this program is implemented at a larger scale.

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ADDRESS FOR CORRESPONDENCE: Dr. Gene Bukhman, Department of Global Health and Social Medicine, Harvard Medical School, 641 Huntington Avenue, Boston, Massachusetts 02115. E-mail: gene.bukhman@hms.harvard.edu. Twitter: @gbukhman.

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