Cardiac Rehabilitation for Hypertension Assessment and Control: Report From the International Council of Cardiovascular Prevention and Rehabilitation

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The burden of cardiovascular diseases (CVDs) has been steadily rising over the past decades, with an over 40% increase globally.1 Efforts in primary and secondary prevention of CVD and its associated risk factors are required to mitigate this epidemic. One of the chief risk factors contributing to the CVD burden is hypertension, as it is a significant contributor to CVD-related morbidity and mortality. Specifically, hypertension is estimated to cause 7.5 million deaths, which is approximately 12.8% of total mortality, making it one of the top 10 leading causes for death across the world.2,3 Moreover, hypertension accounts for nearly 57 million disability-adjusted life years or 3.7% of total disability-adjusted life years.2

Given this high rate of morbidity, secondary prevention to control hypertension is tantamount. Cardiac rehabilitation (CR) is a comprehensive model of care for the secondary prevention and control of CVD, including blood pressure (BP) assessment and delivery of interventions for hypertension management. The International Council of Cardiovascular Prevention and Rehabilitation (ICCPR) is concerned with promoting greater delivery of CR, which, in turn, will promote greater assessment and control of BP.

The ICCPR has recently partnered formally with the World Hypertension League (WHL). Consequently, the WHL has official representation on the ICCPR council and actively contributes to our primary initiatives. ICCPR is collaborating on WHL’s recent dietary salt initiative and has official representation on the expert committee to develop a call to action.4 Outline herein are the aims of the ICCPR, a description of CR in a global context, and ICCPR’s current efforts, with a particular focus on hypertension management.

INTERNATIONAL COUNCIL OF CARDIOVASCULAR PREVENTION AND REHABILITATION

The ICCPR (http://globalcardiacrehab.com) was formed in 2011 by a group of CR experts from leading CR associations internationally to fill the gap in communication between such associations and unite in efforts to “promote cardiovascular disease prevention and cardiac rehabilitation for all.” The ICCPR is composed of elected representatives from the board of directors of CR-associated organizations from across the world. The associations of the 24 current members are shown in the Figure. The ICCPR is an official member of the World Heart Federation.

As outlined in our inaugural Charter,5 among our main goals are to: (1) promote CR as an essential, not optional, service; and (2) support countries to establish and augment programs of CR, adapted to local needs and conditions. The ICCPR council meets quarterly via web conference to work towards these aims. The ICCPR is led by an Executive Board, on which the senior author serves.

CARDIAC REHABILITATION

CR is defined by the World Health Organization (WHO) as “the sum of activities required to influence favourably the underlying cause of the disease, as well as the best possible physical, mental and social conditions, so that they may, by their own efforts preserve or resume when lost, as normal a place as possible in the community.”6 The “core components” of CR are commonly agreed upon by the member associations of ICCPR and include individualized programs of cardio-protective pharmacologic therapies in conjunction with health behavior and education interventions of physical activity and exercise, nutrition, psychological health, and smoking cessation.7 These components are generally delivered by an interprofessional team over a series of months, which is of particular benefit for monitoring BP. Again, one of the main elements is BP assessment and monitoring, as well multifactorial, evidence-based intervention to achieve control.

Among patients with CVD, participation in CR is associated with reduced rates of all-cause mortality and cardiac mortality by 13% to 26% and 20% to 36%, respectively.7 An observational study of 601,099 US Medicare beneficiaries enrolled in CR found a reduction in 5-year all-cause mortality rates by 21% to 34%.8 A recent Cochrane overview of six CR Cochrane reviews concluded that compared with usual care alone, the addition of CR participation was related to significantly reduced hospital re-admissions, even in low-risk patients following myocardial infarction or percutaneous intervention or among those with heart failure.9
Meta-analyses have also demonstrated that CR participation is associated with reductions in BP. With comprehensive CR, systolic BP was significantly reduced by 3 mm Hg to 7 mm Hg\textsuperscript{10,11} while diastolic BP was significantly reduced by 2 mm Hg.\textsuperscript{11} While much of this evidence comes from high-income countries, the benefits of CR in low- and middle-income countries has also been established.\textsuperscript{7}

THE ROLE OF CR IN IDENTIFYING, MONITORING, AND CONTROLLING HYPERTENSION

As outlined above, a core element of CR focuses on evaluation, intervention, and monitoring of BP. Table I displays hypertension-specific excerpts from guidelines/position statements/quality indicators from the leading CR associations globally.\textsuperscript{12–17} As shown, achieving BP targets by program discharge is a key outcome of CR among the majority of Society publications.

A cornerstone of hypertension management is lifestyle changes, namely diet, exercise, and smoking cessation, which are promoted in CR. Indeed, this has been reiterated in recent hypertension guidelines.\textsuperscript{18} In particular, exercise training has been a key intervention to mitigate the burden of hypertension and its comorbidities.\textsuperscript{19} Exercise prescription recommendations from leading associations with corresponding BP reductions are summarized in Table II.

A core component of CR also relates to medical management. As such, pharmacotherapy is reviewed at the initial assessment to ensure that patients are taking the guideline-recommended therapies for hypertension control, and that they are titrated and tolerated such that targets are achieved. CR education and counseling focuses on medication actions, side effects, and the importance of adherence.

UTILIZATION OF CR GLOBALLY

Despite the high quality and quantity of evidence supporting guideline recommendations for CR referral from leading professional organizations (eg, American Heart Association and the American College of Cardiology Foundation),\textsuperscript{20} CR utilization rates are incredibly low globally.\textsuperscript{21} CR is available in only 38.8% countries worldwide: 68.0% of high-income, 28.2% of middle-income, and 8.3% of low-income countries. The number of CR programs per inhabitant (referred to as CR density) is a crude estimate of the number of patients who might have access to CR in each country.\textsuperscript{22} Based on national and regional surveys in high-income
countries, CR density ranges from one program per 100,000 to one program per 300,000 inhabitants.\textsuperscript{23-25} In middle-income countries, CR density ranges from 0.9 to 6.4 million inhabitants per program.\textsuperscript{23}

Given data demonstrating the cost-effectiveness of CR,\textsuperscript{26} clearly there is a need to augment delivery of CR to ensure greater patient access and, subsequently, greater hypertension management. Given the low cost to deliver CR, this model of care will be useful in low-resource settings to increase the reach of hypertension interventions.

**ICCPR’S CURRENT EFFORTS TOWARD CVD CONTROL AND CR ADVOCACY**

ICCPR is currently focused on two initiatives to increase the provision of CR globally. The first is a consensus statement on a CR delivery model for low-resource settings. Leaders with WHL served as key members of

<table>
<thead>
<tr>
<th>TABLE I. Hypertension as a Core Component of CR</th>
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<tbody>
<tr>
<td>Association (Year)</td>
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<tr>
<td>AHA/AACVPR (2007)\textsuperscript{12}</td>
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<td>BACPR (2012)\textsuperscript{14}</td>
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<td>EACPR (2014)\textsuperscript{15}</td>
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<td>ACRA (2014)\textsuperscript{16}</td>
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<td>CACPR quality indicators (2014)\textsuperscript{17}</td>
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Abbreviations: AACVPR, American Association of Cardiovascular and Pulmonary Rehabilitation; ACC, American College of Cardiology; ACRA, Australian Cardiovascular Health and Rehabilitation Association; AHA, American Heart Association; BACPR, British Association of Cardiovascular Prevention and Rehabilitation; BP, blood pressure; CACPR, Canadian Association of Cardiovascular Prevention and Rehabilitation; CKD, chronic kidney disease; CR, cardiac rehabilitation; DM, diabetes mellitus; EACPR, European Association of Cardiovascular Prevention and Rehabilitation; HF, heart failure.
**TABLE II. Exercise Prescription Guidelines, Scientific Statements, and Recommendations for the Prevention, Treatment, and Control of Hypertension Made by Leading Professional Committees and Organizations**

<table>
<thead>
<tr>
<th>Professional Committee/Organization</th>
<th>JNC 8&lt;sup&gt;a&lt;/sup&gt; and AHA/ACC Lifestyle Work Group&lt;sup&gt;29&lt;/sup&gt;</th>
<th>JNC 7&lt;sup&gt;30&lt;/sup&gt;</th>
<th>AHA&lt;sup&gt;31&lt;/sup&gt;</th>
<th>ACSM&lt;sup&gt;32&lt;/sup&gt;</th>
<th>ESH/ESC&lt;sup&gt;33&lt;/sup&gt;</th>
<th>CHEP&lt;sup&gt;34&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The FITT of the Ex Rx</strong></td>
<td><strong>Frequency (how often?)</strong></td>
<td>3-4 sessions per wk</td>
<td>Most days of the week</td>
<td>Most, preferably all, days of the week</td>
<td>5-7 d/wk</td>
<td>4-7 d/wk in addition to habitual daily activity</td>
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<td></td>
<td><strong>Intensity (how hard?)</strong></td>
<td>Moderate to vigorous&lt;sup&gt;b&lt;/sup&gt;</td>
<td>None specified</td>
<td>Moderate</td>
<td>Moderate&lt;sup&gt;d&lt;/sup&gt;</td>
<td>Moderate&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td><strong>Time (how long?)</strong></td>
<td>40 min per session</td>
<td>≥30 min/d</td>
<td>150 min/wk</td>
<td>30-60 min continuous or accumulated in bouts</td>
<td>≥30 min/d</td>
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<td></td>
<td><strong>Type (what kind?)</strong></td>
<td>Aerobic</td>
<td>Aerobic</td>
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<td>Aerobic</td>
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<td></td>
<td><strong>Evidence rating</strong></td>
<td>“Evidence Statement”</td>
<td>Class I level of evidence A&lt;sup&gt;e&lt;/sup&gt;</td>
<td>Evidence category A,&lt;sup&gt;f,g&lt;/sup&gt;</td>
<td>Class I level of evidence A-B&lt;sup&gt;j&lt;/sup&gt;</td>
<td>Grade D&lt;sup&gt;i&lt;/sup&gt;</td>
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<td></td>
<td><strong>Adjuvant</strong></td>
<td>Dynamic RT</td>
<td>Dynamic RT 2-3 d/wk</td>
<td>Moderate 60%-80% of VO&lt;sub&gt;2&lt;/sub&gt;&lt;sub&gt;reserve&lt;/sub&gt;</td>
<td>1-RM, 8-12 repetitions</td>
<td>Dynamic RT 2-3 d/wk</td>
</tr>
<tr>
<td></td>
<td><strong>Evidence rating</strong></td>
<td>Class III level of evidence B&lt;sup&gt;k&lt;/sup&gt;</td>
<td>Evidence category B&lt;sup&gt;l&lt;/sup&gt;</td>
<td>2-3 overall; 5-7 among patients with hypertension</td>
<td>Evidence category B&lt;sup&gt;l&lt;/sup&gt;</td>
<td>Grade D&lt;sup&gt;i&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td><strong>BP reduction, mm Hg</strong></td>
<td>1-5</td>
<td>4-9</td>
<td>5-7 among patients with hypertension</td>
<td>2-3 overall; 5-7 among patients with hypertension</td>
<td>5-7 overall; 2 overall; 7 overall</td>
</tr>
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<td></td>
<td><strong>Review methodology</strong></td>
<td>Meta-analyses and systematic reviews of RCTs or controlled clinical trials from 2001 to 2011</td>
<td>Nonsystematic literature review including a range of study types. Recommendations made by consensus</td>
<td>An initial search that identified a meta-analysis or review within the past 6 y; a second systematic review from 2006 to 2011 followed</td>
<td>Systematic literature review including a range of study types. Recommendations made by consensus</td>
<td>Extensive literature review of RCTs and meta-analyses of RCTs as highest priority; other data were considered if appropriate scientific caliber</td>
</tr>
</tbody>
</table>

Abbreviations: ACC, American College of Cardiology; ACSM, American College of Sports Medicine; CHEP, Canadian Hypertension Education Program; ESH, European Society of Hypertension; JNC 8, Eighth Joint National Committee; JNC 7, Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure; RCTs, randomized controlled trials; 1-RM, one repetition maximum; RT, resistance training.

<sup>a</sup>Organizations listed above. <sup>b</sup>Moderate intensity is defined as 40% to <60% oxygen uptake reserve (VO<sub>2</sub><sub>reserve</sub>) or an intensity that causes noticeable increases in heart rate and breathing; vigorous or high intensity ≥60% VO<sub>2</sub><sub>reserve</sub> or an intensity that causes substantial increases in heart rate and breathing.

<sup>c</sup>The National Heart, Lung, and Blood Institute (NHLBI)<sup>35</sup> rating system grades the strength of the evidence (Evidence Statement) and the strength of the recommendation(s) (Evidence Recommendation); adapted from the US Preventive Services Task Force.<sup>35</sup>

<sup>d</sup>The Lifestyle Work Group rated the Evidence Statement for aerobic exercise to lower blood pressure (BP) as “high”; the Evidence Recommendation for the exercise prescription (Ex Rx) or Frequency, Intensity, Time, and Type of the exercise prescription (FITT) to lower BP was rated grade B<sup>f</sup> or “moderate”; corresponding to class IIa level of evidence A.<sup>e</sup>

<sup>e</sup>Classification of recommendations and level of evidence per American Heart Association (AHA) guideline criteria.<sup>31,36,37</sup>

<sup>f</sup>NHLBI grading of evidence.<sup>38</sup>

<sup>g</sup>The strength of evidence was rated: evidence category B<sup>f</sup> for the immediate effects of aerobic exercise or postexercise hypotension; evidence category A<sup>e</sup> for aerobic exercise to lower BP; evidence category B<sup>f</sup> for the recommended aerobic Ex Rx<sup>e</sup> or FITT to lower BP.<sup>38</sup>

<sup>h</sup>European Society of Cardiology (ESC) recommendations.<sup>33</sup>

<sup>i</sup>Canadian Hypertension Education Program (CHEP) graded recommendations by the underlying evidence<sup>14</sup> using grade A (strongest evidence, based on high-quality studies) to grade D (weakest evidence, based on low-power imprecise studies or expert opinion alone).

<sup>j</sup>CHEP assigned grade D to “higher intensity exercise is not more effective.”

<sup>k</sup>The strength of evidence was rated evidence category C<sup>f</sup> for the immediate effects of dynamic resistance exercise or postexercise hypotension.

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the primary writing panel for this initiative. Following a literature review, low-cost approaches to delivering the core components of CR were proposed. Recommendations for each component were developed using a modified Grading of Recommendations Assessment, Development and Evaluation (GRADE approach), or consensus where evidence was not available. An algorithm to tailor the program based on the type of healthcare provider available for delivery (ie, community healthcare worker, allied health professional, or physician/equivalent) was also developed to facilitate implementation. We are currently working toward academic dissemination of this work, and then, as offered by WHL leadership, we hope to distill the recommendations for clinical and policy application through the website http://www.worldhypertensionleague.org/, among other venues.

The second initiative is a practical guide to support CR reimbursement advocacy. The economic impact of CVD and the corresponding benefits of CR and its cost-effectiveness are summarized. This provides the case for CR reimbursement. Second, the results of the ICCPR survey on CR reimbursement policies by government and insurance companies are summarized, which show that government reimbursement is low and many patients pay out-of-pocket. Finally, a multifaceted approach to CR advocacy is forwarded. Indeed, the WHL has demonstrated leadership in its advocacy work and has been highly supportive of our efforts in this regard.

In conclusion, the ICCPR is delighted to partner with WHL in our efforts to increase hypertension management in CVD patients globally. We hope to continue with our fruitful partnership, as CR is an important model of care for hypertension management.

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Disclosures: None.

Conflicts of interest: None.

References


