

## International Collaboration With Dedicated Local Implementation Improves Survival From Out-of-Hospital Cardiac Arrest

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Sudden out-of-hospital cardiac arrest (OHCA) remains a leading cause of death worldwide. However, several resuscitation councils, through multipronged evidence-based approaches, are making significant strides in addressing this deadly problem, with emphasis on early bystander cardiopulmonary resuscitation (CPR) and automated external defibrillator use, CPR quality, and meticulous postresuscitation care. In this issue of *JAHA*, Hara and colleagues<sup>1</sup> document improvement in survival from OHCA in a large cohort of 241 990 adults between 2007 and 2013. Improvement was associated with Japan's participation in the evidence evaluation process of the International Liaison Committee on Resuscitation (ILCOR) and implementation of the International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations (CoSTR) and Japan CPR guidelines.

ILCOR was conceived in 1992 when a panel of international resuscitation experts at the fifth American Heart Association conference on CPR and emergency cardiovascular care (ECC) called for the formation of a permanent infrastructure to develop common CPR guidelines and to improve ECC worldwide.<sup>2</sup> That same year, the first international consensus recommendations<sup>3,4</sup> were developed for uniform reporting for OHCA; this enabled resuscitation programs to benchmark their outcomes using a common template. In 1993, ILCOR was formally established as a resuscitation "council of councils." The objectives of ILCOR are to provide a forum for discussion and analysis of resuscitation research and techniques; to disseminate information about resuscitation training and education; to provide

a mechanism for collecting, reviewing, and sharing scientific data; and to produce international consensus statements summarizing resuscitation evidence and, when possible, making treatment recommendations.<sup>5</sup> The first ILCOR consensus recommendations for CPR and ECC were published in 1997.<sup>6</sup> In 2000, 2005, 2010, and 2015, ILCOR sponsored international evidence evaluation processes with simultaneous publication of the CoSTR in *Circulation* and *Resuscitation* in 2005,<sup>7,8</sup> 2010<sup>9,10</sup> and 2015.<sup>11,12</sup>

The Resuscitation Council of Asia (RCA) was established in 2005 with founding members from the Japan Resuscitation Council, the Korean Association of Cardiopulmonary Resuscitation, the National Resuscitation Council of Singapore, and the National Resuscitation Council of Taiwan. That year, the RCA participated as an observer in the meetings involved in developing the 2005 ILCOR CoSTR statements.<sup>7,8</sup> The RCA became a member council of ILCOR in 2006 and has participated in all ILCOR meetings and consensus statements since then.

The international CPR and ECC consensus statements developed by ILCOR provide the foundation for each resuscitation council to develop evidence-based guidelines that are appropriate for the local (council) healthcare delivery system and training network and that can be implemented in a cost-effective manner. The increase in survival from OHCA documented by Hara and colleagues<sup>1</sup> reflects a substantial nationwide commitment by resuscitation experts and the Japan Ministry of Health, Labor, and Welfare. Key elements of this resuscitation system include the establishment of the mandatory All-Japan Utstein Registry managed through the Fire and Disaster Management Agency of Japan,<sup>13</sup> protocols for dispatcher CPR instruction, systematic and strategic training in CPR and automated external defibrillator use mandated in schools and required for obtaining a driver's license, and nationwide establishment of public access CPR and defibrillation programs.<sup>14</sup> This commitment also incorporates a process of continuous quality improvement.<sup>15</sup>

Hara and colleagues<sup>1</sup> identified their study cohort from the All-Japan Registry that now contains information from >1 million OHCA events. The study compared outcome of OHCA in 2 periods: the ILCOR 2005 period (when resuscitation was consistent with the recommendations in the 2005 ILCOR

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CoSTR<sup>7,8</sup> and the 2006 Japan guidelines) and the ILCOR 2010 period (when resuscitation was consistent with the recommendations of the 2010 ILCOR CoSTR<sup>9,10</sup> and the 2010 Japan guidelines). Because penetration of new resuscitation recommendations into resuscitation practice requires time, the authors compared outcomes of those patients resuscitated during 3 maturation years in each period: the first full year following publication of each new CoSTR plus guidelines publication (ie, 2007 versus 2011), the second year after publication (ie, 2008 versus 2012), and third year after publication (2009 versus 2013). They also compared outcomes according to the initial rhythm and the bystander present at the time of arrest (emergency medical services versus citizen bystanders [family member, passerby, or colleague]). Neurologically favorable 1-month survival improved after the 2010 ILCOR CoSTR for all rhythms and for all bystander categories and in each maturation year, with the largest improvements among those with OHCA witnessed by citizen bystanders and those with a shockable rhythm.

Hara and colleagues<sup>1</sup> attributed the recent improvement in survival to the emphasis on the importance of high-quality CPR in the 2010 ILCOR CoSTR and Japan CPR guidelines, including the change in recommended CPR sequence from airway–breathing–circulation to compressions–airway–breathing and the emphasis on compressions of adequate rate and depth with adequate recoil and minimal interruptions. They also noted the substantial effort in Japan to increase the quality of CPR education and public access defibrillation programs. Clearly, significant countrywide effort was expended to improve resuscitation outcomes and to establish resuscitation programs with processes of continuous quality improvement. Although survival is improving, the authors note that overall survival is still low, and they identified areas in which further improvement is needed.

An intriguing finding of Hara and colleagues<sup>1</sup> is that nearly all outcomes in the years following ILCOR 2010 were significantly better among those victims of OHCA who received CPR with ventilation compared with those who received compression-only CPR. This finding is inconsistent with previous published literature, including the most recent ILCOR systematic review.<sup>16</sup> The authors hypothesize that those bystanders who were able to provide CPR with ventilation may have been better trained than those who provided compression-only CPR.

The authors acknowledge several weaknesses of their study. There were many possible confounders, including several changes in bystander CPR education and the addition of dispatcher protocols for bystander CPR instruction, and many potential changes in postcardiac arrest care that may have improved survival in the later years.

The review of Hara and colleagues<sup>1</sup> illustrates the increase in cardiac arrest survival that can result from evidence-based resuscitation recommendations, improved resuscitation

practice and a process of continuous quality improvement. ILCOR has worked to reduce delay between the publication of new evidence and the generation of new ILCOR and resuscitation council recommendations. Through 2015, the ILCOR evidence review process relied on volunteer resuscitation experts to perform systematic reviews to answer key questions that were prioritized by ILCOR task forces. The resulting ILCOR systematic reviews were then debated by the ILCOR task forces, and the resulting CoSTR statements were “batched” and published every 5 years, with simultaneous or near-simultaneous updated council guidelines. The most recent (2015) ILCOR systematic evidence reviews applied the GRADE guideline development tool, completed under the supervision of an international member of the GRADE working group and an evidence evaluation expert.<sup>17</sup>

In 2016, to facilitate more rapid application of new resuscitation evidence to the ILCOR CoSTR, council guidelines, and the practice of resuscitation, ILCOR devised a continuous evidence evaluation process to support near-continuous reviews of resuscitation evidence. A fundamental change introduced in this process is the engagement of knowledge synthesis units—KSUs—that have information scientists and compensated systematic reviewers perform the systematic reviews, with the advice and assistance of content experts from the ILCOR task forces. The KSUs will address resuscitation questions that are large and complicated or several questions that can be grouped and addressed through sensitivity or subgroup analyses. In addition, contracted individual resuscitation experts will undertake systematic reviews that typically involve single questions.

The systematic reviews performed by the KSUs will be clustered into domains to enable a single search strategy to identify and analyze evidence to answer multiple questions that cut across task forces. The first ILCOR systematic review undertaken by a KSU, for example, incorporated several questions related to the effectiveness of different compression:ventilation ratios and involved both the basic life support and pediatric task forces.<sup>16</sup> Examples of domains include education; defibrillation, drugs and fluids, CPR, airway and ventilation, screening and diagnosis, emergency care, and postarrest care. Topics that are grouped by search strategy into these domains will facilitate repeated searches and generation of automatic alerts when new relevant papers are published. All systematic reviews and meta-analyses will use GRADE methodology.

The systematic reviews will include a summary of the science and knowledge gaps but will not include treatment recommendations—the relevant ILCOR task forces will formulate treatment recommendations and add statements about the values and preferences that influenced treatment recommendations. The task force CoSTRs will be published on the ILCOR website (<http://www.ilcor.org>). Annual summaries

of the new CoSTRs will likely be published in *Circulation* and *Resuscitation*, and each ILCOR council will create or modify council guidelines as needed.

An important feature of the new ILCOR continuous evidence evaluation is an enhanced public consultation process. This will involve posting documents for public comment on the ILCOR website. The postings will occur after several stages: formulation of a new resuscitation question, prioritization of questions, and drafting of a CoSTR. Public comments will be considered by the relevant task force and modifications made as needed.

Hara and colleagues<sup>1</sup> have documented improved OHCA survival associated with implementation of international evidence-based recommendations and council guidelines. Maximizing survival requires strengthening each link in the chain of survival including bystander recognition and immediate high-quality CPR with dispatcher instruction, public access defibrillation and emergency medical services, and ultimately expert post-cardiac arrest care. This goal will be achieved through continued international collaboration, measurement of outcomes, and continuous quality improvement.

## Disclosures

Mary Fran Hazinski has received significant compensation within the past 12 months from the American Heart Association (Emergency Cardiovascular Care) as a senior science editor for resuscitation science statements and training materials. In that capacity, she also served as the editor of the AHA Guidelines for CPR and ECC (and guidelines updates) and as coeditor of the international CoSTR statements. Jerry Nolan receives significant compensation from Elsevier as the editor of *Resuscitation*. He also serves as the coeditor of the international CoSTR statements.

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