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# In-Hospital Trauma Mortality Has Decreased in Japan Possibly Due to Trauma Education

Kenichi Hondo, MD, Atsushi Shiraishi, MD, PhD, Satoshi Fujie, MD, Daizoh Saitoh, MD, PhD, Yasuhiro Otomo, MD, PhD

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**BACKGROUND:** The Japan Advanced Trauma Evaluation and Care (JATEC) education program was introduced in 2002. To examine its effect on the survival of trauma patients, we investigated changes in trauma mortality in Japan in the years after JATEC was introduced.

**STUDY DESIGN:** We included patients registered in the Japan Trauma Databank (JTDB) from 2004 to 2011 with clear in-hospital mortality and sufficient data to estimate the Trauma Injury Severity Score (TRISS). Patients were grouped into the early (2004–2006), transition (2007–2008), and late (2009–2011) cohorts. We performed logistic regression analyses after adjusting for TRISS to estimate risk of death in the transition and late cohorts compared with the early cohort. Stratified logistic regression analyses showed which characteristics contributed to the changes in mortality.

**RESULTS:** Of 94,664 patients registered in the JTDB, 47,095 were selected. Adjusted mortality was significantly lower in the late cohort (odds ratio = 0.68; 95% CI, 0.61–0.76) than in the early cohort (reference). Stratification analyses demonstrated significant interactions in patients with or without any chest or abdominal surgery (odds ratio = 0.83 vs 0.68;  $p < 0.001$  in the late cohort) and in patients with TRISS probability of survival  $< 0.5$  or  $\geq 0.5$  (odds ratio = 0.71 vs 0.67 for TRISS probability of survival  $\geq 0.5$ ;  $p < 0.001$  in the late cohort).

**CONCLUSIONS:** Since 2007, mortality has decreased in patients with mild trauma injury; however, mortality was significantly worse for severely injured patients or patients requiring surgical procedures. These findings suggest that definitive trauma care in Japan should be strengthened. (*J Am Coll Surg* 2013;217:850–857. © 2013 by the American College of Surgeons)

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The combination of unintentional injuries and suicide accounts for >88,000 deaths annually in Japan and was the leading cause of death in the younger population ranging from 5 to 44 years old.<sup>1</sup> Although this is a large public health problem in a highly developed country, trauma care in Japan in the early 2000s was not satisfactory; a national survey reported in 2002 that death might have been prevented in approximately 38% of patients with trauma who arrived at the hospital with any vital signs.<sup>2</sup> In addition, there was large regional and institutional variability in the quality of trauma care in Japan,

with more cases of preventable trauma death in relatively smaller trauma centers rather than in high-volume trauma centers.<sup>3</sup>

In 1980, the American College of Surgeons Committee on Trauma established an educational program for initial trauma care, the ATLS program.<sup>4</sup> The original aims of ATLS were to train those who do not manage trauma on a regular basis, such as rural general practitioners, in the initial management of severely injured patients.<sup>5</sup> To date, this program has been introduced into >30 countries.<sup>5</sup> Several improvements have been reported in the quality of trauma care<sup>6</sup> and in mortality rates.<sup>7,8</sup> Studies from several countries have indicated that ATLS providers contribute to improvements in trauma care.<sup>9–17</sup> The Japanese Association for Acute Medicine intended to introduce ATLS into Japan. However, the Japan chapter of the American College of Surgeons, which is a subsidiary organization of the Japan Surgical Society and the sole organization that the American College of Surgeons can approve as a host organization, showed little interest in introducing ATLS to Japan.<sup>18</sup>

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Received March 29, 2013; Revised May 29, 2013; Accepted May 29, 2013. From the Medical Hospital of Tokyo Medical and Dental University, Shock, Trauma and Emergency Medical Center, Tokyo (Hondo, Shiraishi, Fujie, Otomo); and National Defence Medical College, Division of Traumatology, Research Institute, Tokorozawa, Japan (Saitoh). Correspondence address: Atsushi Shiraishi, MD, PhD, Medical Hospital of Tokyo Medical and Dental University, Shock, Trauma and Emergency Medical Center, 1-5-45 Yushima, Bunkyo-ku, Tokyo, 113-8519 Japan. email: [siris.accm@tmd.ac.jp](mailto:siris.accm@tmd.ac.jp)

**Abbreviations and Acronyms**

AIS	= Abbreviated Injury Scale
ATOM	= Advanced Trauma Operative Management
ED	= emergency department
ISS	= Injury Severity Score
JATEC	= Japan Advanced Trauma Evaluation and Care
JTDB	= Japan Trauma Databank
OR	= odds ratio
TRISS	= Trauma Injury Severity Score

To help eliminate preventable deaths from trauma and to improve trauma care in Japan, in 2002 the Joint Committee of the Japanese Association for the Surgery of Trauma and Japanese Association for Acute Medicine corporately developed a standardized trauma care protocol, named the Japan Advanced Trauma Evaluation and Care (JATEC).<sup>3,19</sup> The JATEC is a 2-day off-the-job training course in initial trauma management that consists of a primary survey (ie, physiological, ABCDE approach) and a secondary survey (ie, history taking and anatomical, systemic approach) and as such it is similar to ATLS.<sup>20</sup> However, the precise methods of JATEC differ from those of ATLS and are more suitable for Japanese emergency medical situations in accordance with the European Course on Trauma Care, which was expanded by the European Surgical Association.<sup>21,22</sup>

Our study objective was to assess the effect of the educational program by examining clinical outcomes of trauma care in Japan 10 years after JATEC was first introduced.

**METHODS****Study design**

This study was a retrospective observational study based on a nationwide trauma registry in Japan. We estimated changes in trauma mortality from 2004 to 2011 as a surrogate indicator for assessing the effects of the trauma education programs that began in 2002.

**Data source**

The data for the study were obtained from the Japan Trauma Databank (JTDB), which was established in 2003 by the Trauma Registry Committee of the Japanese Association for the Surgery of Trauma and the Committee for Clinical Care Evaluation of the Japanese Association for Acute Medicine.<sup>23</sup> The aim of JTDB is to improve the quality of trauma care by collecting and analyzing patients' demographic data, including attributable data and injury characteristics, using information from emergency medical services. These data include vital signs at initial medical examination, pre-existing medical

conditions, medical examinations, treatments, trauma diagnosis as represented with the Abbreviated Injury Scale (AIS), and outcomes. At the end of 2011, 169 medical centers in all 47 prefectures in Japan participated in JTDB.<sup>23</sup> In most cases, physicians of the participating institutions who had been trained in AIS coding registered the data from individual patients via the internet. We used the JTDB 2012 dataset, which included information from 2004 to 2011.<sup>23</sup>

**Selection criteria**

We selected all patients with complete data sets from which we could estimate the Trauma Injury Severity Score (TRISS), injuries for which AIS scores ranged from 3 to 5 in any region, and specified dates of hospitalization in study hospitals. We excluded patients with unsurvivable injuries, defined as an AIS score of 6 in any region, or who had out-of-hospital cardiac arrest; these patients were not expected to survive when they arrived at the emergency department (ED), and there was not generally an intention to treat them.

We adopted the TRISS method to estimate trauma mortality for several reasons. The first reason was that adjusting score of severity, coupled with initial vital signs, is ideal because the targets of improvement in trauma care education are patients with unstable vital signs in the early phase. The second reason was that goodness-of-fit and diagnostic accuracy of the models with TRISS were more predictable than with ISS for the overall cohort (Appendix 1 and 2, online only).

**Comparison of differences in trauma care across time periods**

In 2008, the number of physicians in Japan was 295,049.<sup>24</sup> The number of physicians who received JATEC training increased by about 1,000 every year after 2004, so that 2,618 by 2006, 4,364 by 2008, and 7,561 physicians had been trained by 2011.<sup>19,24</sup> JTDB started registering patients in 2004 and had accumulated data on 94,664 patients by 2011.<sup>23</sup> We divided the patients from 8 years of JTDB registration into 3 cohorts: the early cohort (those registered in JTDB from 2004 to 2006), the transition cohort (2007 to 2008), and the late cohort (2009 to 2011). We analyzed the changes in trauma outcomes during these periods as a surrogate indicator of the effect of trauma care education on mortality.

**Outcomes**

We defined the study outcomes as in-hospital death from any cause.

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