

# Integrated emergency department and general intensive care unit management on health outcomes

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The emergency department (ED) should reliably provide the required medical treatment to patients who are in an emergency or are critically ill. However, the ED faced two challenges in China. There were no limitations to the medical resources that could be accessed by ED patients, and health care providers could not deny patients. Thus, the ED was overcrowded, making it difficult to distinguish critically ill patients from those requiring non-emergency treatment.

On the other hand, critically ill patients require a team-based approach to care to ensure they receive sequential and consistent treatments. However, emergency physicians were only responsible for patients on their shifts. Previous theoretical and applied research<sup>[1,2]</sup> has demonstrated that critically ill patients greatly benefit when the management of the ED and intensive care unit (ICU) effectively integrates advanced theories and techniques of critical care medicine in emergent stages of the disease. Therefore, based on the actual clinical situation of our hospital and the implementation of innovative behavioral strategies, we innovatively integrated the management of the ED and general ICU. The purpose of this study was to evaluate the effect of integrating ED and general ICU management on emergency medical care.

A five-level adult emergency triage standard was developed based on the “Emergency classification guidelines”<sup>[3]</sup> issued by the National Health Commission of the People’s Republic of China. These guidelines are a combination of 10 objective quantitative indicators (*ie*, body temperature, systolic blood pressure, pulse rate, mean arterial pressure, shock index, respiration rate, peripheral oxygen saturation, peripheral blood glucose, state of consciousness, and pain score), and 48 and 25 common complaints or symptoms seen in priority general patients and trauma patients, respectively. In addition, computer-aided patient

triage software<sup>[4]</sup> was developed to identify patients in need of emergency care. Emergency patients were triaged according to disease severity and were classified as level I (fatal, red), level II (critical, orange), level III (emergency, yellow), level IV (not urgent, green), and level V (non-emergency, blue). Critically ill patients were defined as those with unstable vital signs which were classified as level I and need to be treated immediately. The changes in the medical treatment process before and after the integrated management are shown in Figure 1.

The primary outcomes were ED length of stay, cardiopulmonary resuscitation success rate, the resuscitation success rate in emergency and critical patients, time to emergency electrocardiogram (ECG) examination in patients with acute ST-segment elevation myocardial infarction (MI), time to antiplatelet drug administration, the rate of goal time compliance, and treatment success rate. Secondary outcomes were the average daily number of critically ill patients, the number of hospitalizations, the number of central venous catheterization cases and the average daily cost, and the outcomes of patients with acute ST-segment elevation MI. Time to emergency ECG examination was defined as the time from ED entry to completion of the ECG examination. Time to antiplatelet drug administration was defined as the time from ED entry to the administration of oral antiplatelet drugs.

As shown in Supplementary Digital Content, Table 1, <http://links.lww.com/CM9/A782> the resuscitation rate of critically ill patients increased from 73.58% (401 in 545) to 85.32% (1244 in 1458) due to the improvement in the management model. The percentage of patients requiring resuscitation was higher in the observational group than that in the control group: 6.60% (1458 in 22,017) *vs.* 5.40% (545 in 10,008). The ED length of stay decreased due to a rapid transferring of patients to the general ICU or

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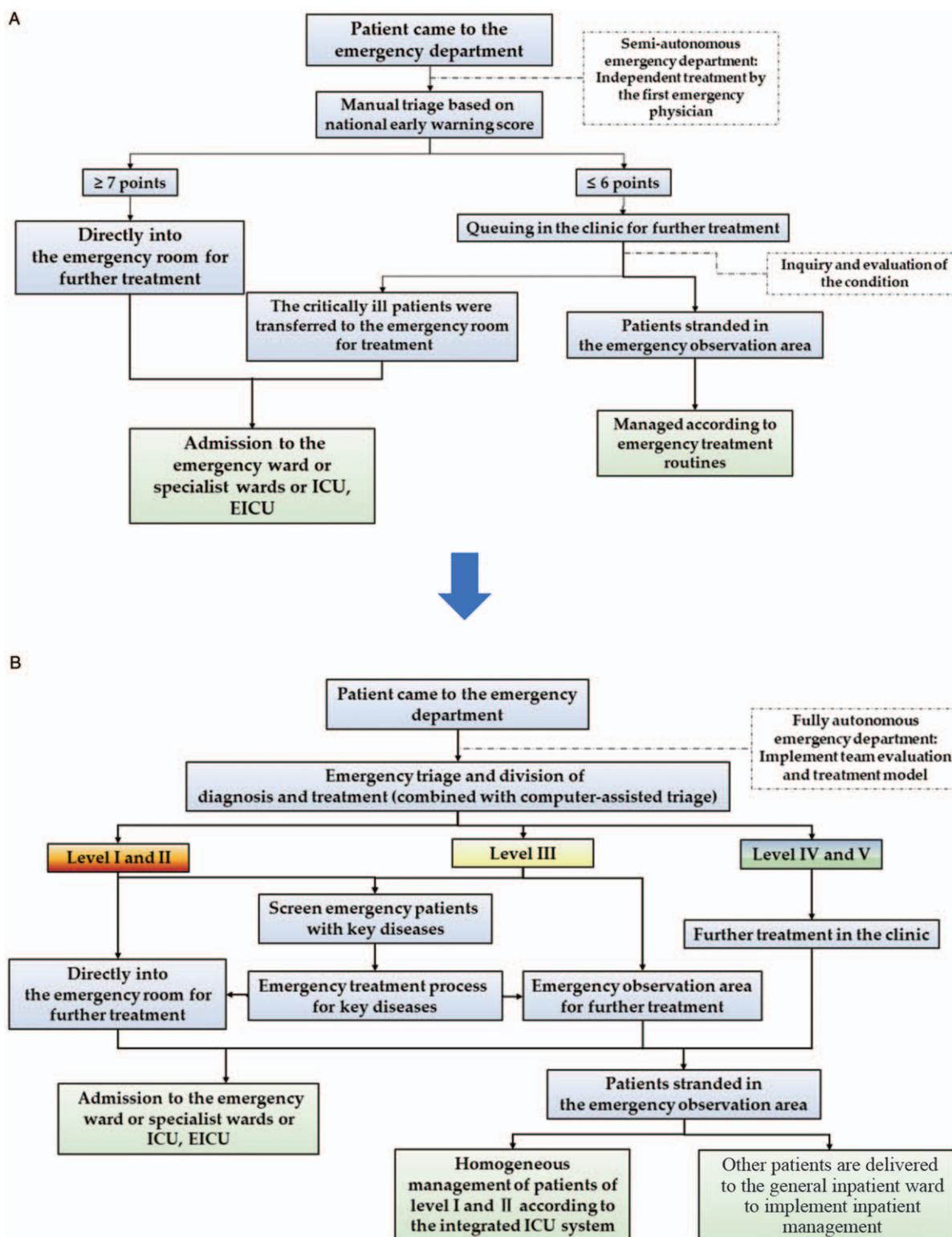
DOI:  
10.1097/CM9.0000000000001794

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Chinese Medical Journal 2021;134(21)

Received: 28-05-2021 Edited by: Peng Lyu



**Figure 1:** Emergency patient management process before and after integrative management. (A) Before, (B) After. ICU: Intensive care unit, EICU: Emergency intensive care unit.

specialty wards. The percentage of general ICU admissions increased sixfold to 0.48% (105 in 22,017) after the implementation of the integrated management model. Access for patients with key diseases was unimpeded in the observation group, the wait time was significantly shortened, and the medical quality of the treatment process

and the total successful rescue rate were significantly improved by effectively standardizing emergency medical staffs' clinical decision-making in the observation group. The successful rescue rate of acute trauma patients and acute respiratory failure patients was significantly improved (data not shown). Among the MI patients with

acute ST-segment elevation, the times to ECG examination and administration of antiplatelet drugs were significantly reduced. The average door-to-balloon (DTB) time and the rate of reaching the standard of the DTB time were comparable.

Critically ill patients received decisive treatments sooner. Thus, the success rate of cardiopulmonary resuscitation and return of spontaneous circulation (ROSC) increased significantly, similar to that reported previously.<sup>[2]</sup> This progress is the result of several factors, including yearly training of staff in first aid and critical care medicine, and standardized rescue treatment. By developing reliable triage tools, standardizing care procedures for emergency patients, and conserving medical resources for critically ill patients, critically ill patients' wait times were significantly shortened. This truly reflects the "emergency" of the ED. The rescue team shares some responsibilities with the Rapid Response team<sup>[4]</sup> in critical care medicine and can effectively respond to all kinds of emergencies. In a previous study,<sup>[5]</sup> emergency treatment and medical safety were improved by formulating standardized clinical management guidelines based on the best available evidence. Therefore, we created standardized emergency care procedures for key diseases, which significantly improved the successful rescue rate of acute trauma, acute respiratory failure, and acute ST-segment elevation MI patients, and the DTB time met the DTB Alliance requirements.<sup>[6]</sup> However, our rate of emergency percutaneous coronary intervention (PCI) was lower than that reported in a previous study,<sup>[7]</sup> which may be due to the lack of adequate healthcare human resources needed to implement an emergent PCI. Overall, the standardized care procedures for key diseases effectively simplified the intermediate link and effectively shortened the treatment duration. This ensured the continuity and standardization of treatment and provided quick, efficient, and safe medical services.

Through triaging, most critically ill patients can be screened, and treatment priority can be fairly determined. However, some emergency patients are not well informed about their condition or are dishonest and misreport their main symptoms or complaints, leading to over-triage or under-triage. Undoubtedly, standardized training can help improve the comprehensive first aid skills of emergency physicians. Unfortunately, not every emergency physician is willing to engage in this continued education outside of work. The learning process is long and boring and may dissuade physicians from completing the training. Ensuring this training is completed requires the active coordination of the management department as well as policies, job qualifications, and income distributions that promote emergency physicians to actively engage in learning. In addition, the implementation of the intervention also requires emergency patients to be compliant with reasonable requests from medical staff. Some patients may be reluctant to cooperate for various reasons, which may lead

to inadequate intervention. This can be circumvented through continuous health education that is coordinated by the management department.

### Acknowledgement

The authors are grateful to Prof. Lei Shen of Tongji University affiliated Shanghai Pulmonary Hospital, Department of Thoracic Surgery for her valuable advice on statistical analysis and manuscript. We also thank Prof. Yiming Lu of JiaoTong University-affiliated Ruijin Hospital, Emergency Department for his suggestions in study design.

### Funding

This paper was supported by the Special Project of Shanghai Municipal Economic and Information Technology Commission (No. 201601028), the Key Medical Project of Science and Technology Support Plan of Shanghai Science and Technology Commission (No. 16411954400), and the General Project of Shanghai Municipal Health and Family Planning Commission (No. 201640181).

### Conflicts of interest

None.

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**How to cite this article:** Mao S, Ge Z, Zhao H, Wang Y, Cao J, Xia Z. Integrated emergency department and general intensive care unit management on health outcomes. *Chin Med J* 2021;134:2553–2555. doi: 10.1097/CM9.0000000000001794