

Personalised/ Precision Medicine

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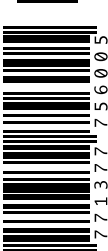
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Intensive Care in China

Medicine in mainland China has progressed rapidly during the past 20 years along with rapid economic development. Although the number of ICU beds, doctors and nurses has increased, postgraduate professional education is still lacking. This article gives an overview of the history and current state of intensive care in China.

Critical care was recognised as a medical speciality in China less than 10 years ago. However, the development of intensive care began in the 1980s when the first intensive care unit (ICU) with a single bed was opened in 1982 at Peking Union Medical College Hospital, which opened the first department of critical care medicine in 1984 with a seven-bed ICU, chaired by Professor Dechang Chen, who is recognised as the father of critical care in China (Qiu et al. 2001; Wang and Ma 2006). Figure 1 is a timeline of the main developments.

Intensive Care Infrastructure

A 1989 Ministry of Health regulation that made it mandatory for hospitals to have an ICU in order to be accredited as a tertiary hospital led to rapid growth (Qiu et al. 2001; Wang and Ma 2006). Currently there is no census information on the number of intensive care beds in China. An estimate from 2010 put the number of beds as approximately 51,891 or 1.8% of hospital beds, corresponding to 3.91 ICU beds per 100,000 population (Du et al. 2010). The estimated number of ICU physicians is between 33,210 and 49,815 and ICU nurses between 71,091 and 104,820 (Du et al. 2010). Hospital and ICU provision varies greatly across the country. Figures 2-4 and Table 1 show hospital bed and healthcare staff provision in Beijing and across China compared to other countries.

Professional Societies

Before intensive care medicine was recognised as a specialty, the speciality societies involved in critical care (surgery, anaesthesiology, emergency medicine and pulmonology) had critical care sections (Du et al. 2010).

There are now three professional societies for critical care, which collaborate closely. The Chinese Society of Critical Care Medicine (CSCCM) was established in 1997, and has

roughly 700 members. It promotes critical care medicine, and liaises with government bodies, and with international critical care societies, including the World Federation of Societies

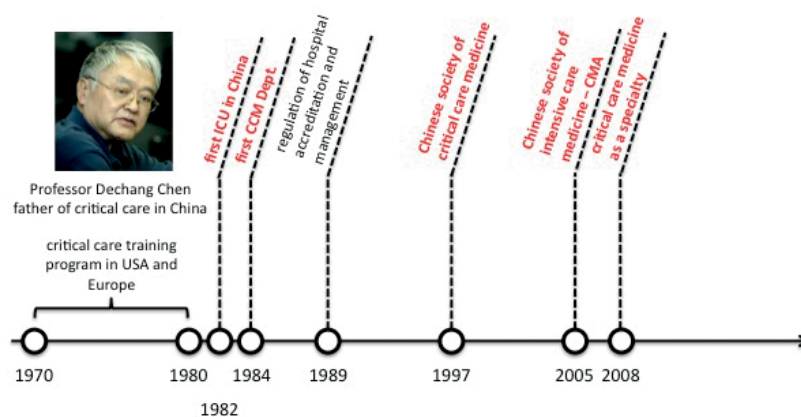


Figure 1. Development of Intensive Care Medicine in China

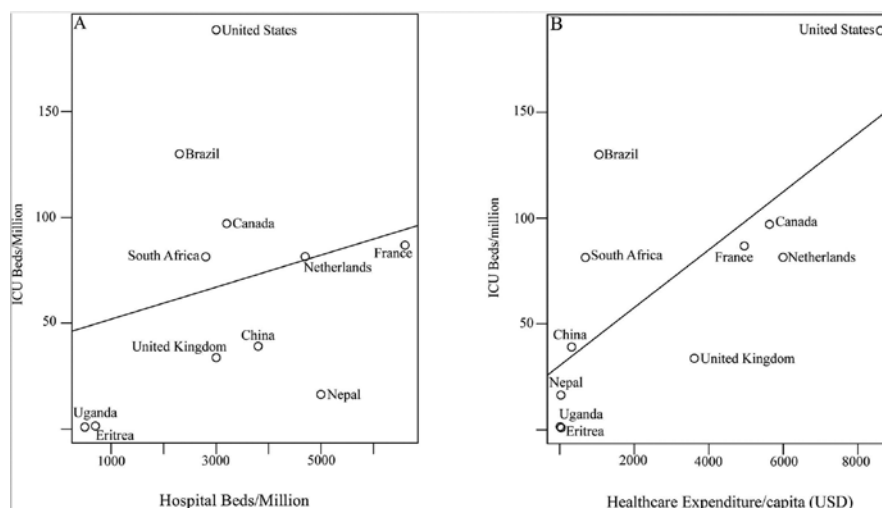


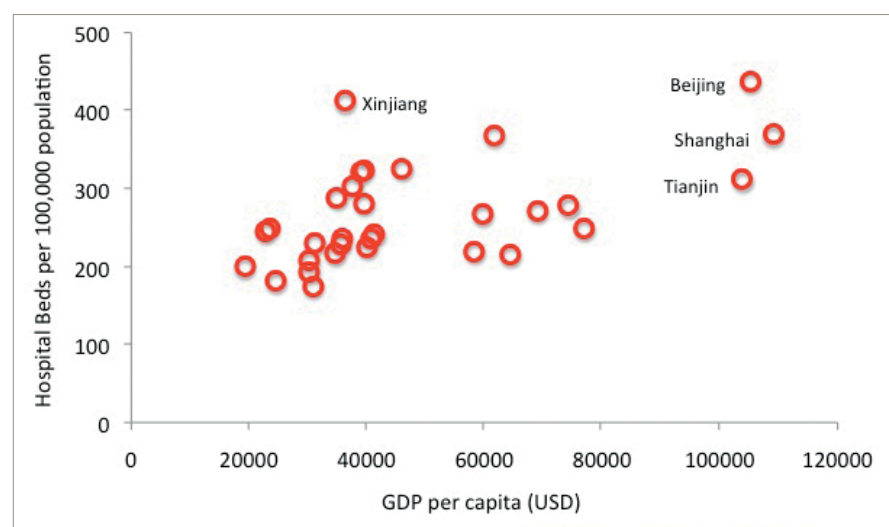
Figure 2. Comparison of the relationship between ICU beds and hospital beds (panel a), and between ICU beds and national healthcare expenditure per capita (panel b) in low versus selected high-income countries.

Source: Murthy et al. (2015) Reproduced under CC BY 4.0 (creativecommons.org/licenses/by/4.0/)

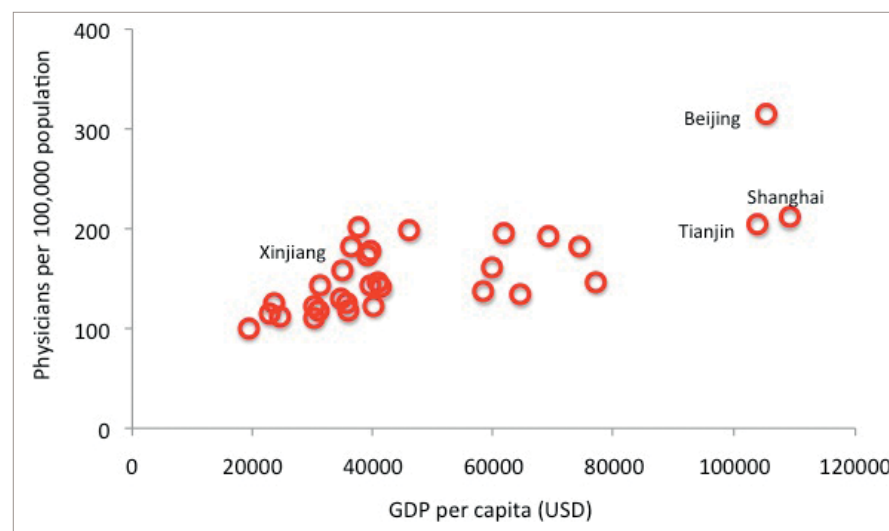
Table 1. Critical Care Resources in Beijing, 2014

Population	21,516,000 (incl. 8,187,000 immigrants)
Hospitals	672
Hospital beds	109,789
ICU beds	2,878 (2.6%) (in 192 ICUs)
Physicians	89,590
ICU physicians	1,365 (1.5%)
RNs	106,167
ICU nurses	4,818 (4.5%)

Sources: bjstats.gov.cn/tjsj/tjgb/ndgb/201511/t20151124_327764.html [Accessed: 6 February 2017]; <http://xxzx.bjchfp.gov.cn/tonjixinxi/weishengtongjijianbian/2014nianjianbian/qsywswzyqk.html> [Accessed: 6 February 2017]

**Figure 3.** Geographic Variation in Health Resources (Hospital Beds per 100,000 population)

Source: National Bureau of Statistics of China. China Statistical Yearbook 2014. [Accessed: 1 March 2015] Available from stats.gov.cn/tjsj/ndsj/2014/indexch.htm

**Figure 4.** Geographic Variation in Health Resources (Physicians per 100,000 population)

Source: National Bureau of Statistics of China. China Statistical Yearbook 2014. [Accessed: 1 March 2015] Available from stats.gov.cn/tjsj/ndsj/2014/indexch.htm

of Intensive and Critical Care Medicine, the Asia Pacific Association of Critical Medicine and the Global Sepsis Alliance. It organises a national conference every year. The last conference in 2016 was attended by more than 3000 delegates. The Chinese Society of Intensive Care Medicine was established under the umbrella of the Chinese Medical Association in 2005. The CSICM has developed clinical practice guidelines on sepsis management, mechanical ventilation and nutritional support. The professional certification of intensivists is undertaken by the Chinese Association of Critical Care Physicians (CACCP), which was founded in 2009 and is affiliated to the China Medical Doctors Association.

Education and Training

Pathways to the intensive care medicine specialty follow 3-4 years of fellowship training in internal medicine, anaesthesia, emergency medicine or general surgery (Du et al. 2010). The recognition of critical care medicine as a specialty in 2009 was in part a recognition of intensivists' response to health-care pandemics and emergencies, such as SARS and the Wenchuan earthquake in 2008 (Du et al. 2010). As yet, there is no formal accredited training programme in intensive care medicine. A pulmonary and critical care medicine fellowship training programme has been established by a collaboration between the Chinese Thoracic Society and the American College of Chest Physicians (Qiao et al. 2016), as one of four pilot subspecialties to be recognised by the government. It is hoped that a multidisciplinary approach to subspecialty training will be adopted going forward (Du and Weng 2014). To that end the China Critical Care Clinical Trials Group (CCCCTG) and the Task Force of Core Competencies in Intensive and Critical Care Medicine Training in China have developed a list of 129 core competencies which will assist in developing training programmes (Hu et al. 2016).

The professional societies provide continuing medical education and training. The Chinese Society of Critical Care Medicine provides the Basic Assessment and Support in Intensive Care (BASIC) course, Improve Proficiency in Ventilation (IMPROVE), Fundamental Critical Care Support and Fundamental Disaster Management courses. The Chinese Society of Intensive Care

Medicine offers the Chinese Critical Care Certificate Course. Other educational programmes are offered with international partners: for example, the Multiprofessional Critical Care Review Course (MCCRC) with the Society of Critical Care Medicine.

China Critical Care Clinical Trials Group

The China Critical Care Clinical Trials Group (CCCCTG) was established in 2009. The group includes 25 tertiary hospitals (21 of which are teaching hospitals) in 21 provinces. The hospitals include 19 general, 4 surgical and 2 medical ICUs (Tables 2-4). The group has completed 12 studies, with 3 ongoing and 2 in the planning. It has 15 papers and 1 book chapter published. It also participates in InFACT, the International Forum for Acute Care Trialists, and in the International Severe Acute Respiratory and Emerging Infection Consortium (ISARIC).

One of the first studies published by the CCCCTG was an analysis of the adult patient population that stayed in any of 22 participating ICUs for ≥ 24 hours from July 1 to August 31, 2009 (Figures 5-6) (Du et al. 2013).

Critical Care Research

Chinese researchers are increasingly publishing in the 7 major critical care journals (Ma and Du 2013). While the number of articles in critical care journals is increasing (Li et al. 2010), average citations fell in the years up to 2008 (Li et al. 2010). Several obstacles to critical care research still exist in China (Ma and Du 2013):

- **Lack of training in clinical research:** this results in poor study design, inadequate description of the methods, suboptimal reporting of the results, and getting carried away in the discussion
- **Inadequate resources:** inadequate funding, unavailability of research nurses and/or biostatisticians
- **Language barrier:** poor writing, not following the manuscript preparation instructions

China is increasingly participating in international studies (Table 6). Registration of clinical trials is increasing (from 1,945 registered in 2013 (Ma and Du 2013) to 9,058 for mainland China and 1,298 for Hong Kong

Table 2. Participating ICU information in 2009

	Total	Mean \pm SD	Median (IQR)	Range
ICU beds	499	22.0 \pm 14.3 (1.2 \pm 0.5%)	18 (12 to 28)	8 to 76
ICU physicians	317	13.2 \pm 10.6	12 (8 to 13)	6 to 60
ICU nurses	1,010	42.1 \pm 32.1	33 (26 to 45)	15 to 175
Admissions	25,872	1,078 \pm 945	791 (438 to 1,293)	81 to 3,907
Mechanical ventilation	16,091	700 \pm 660 (66.8 \pm 24.4%)	434 (271 to 886)	27 to 2,605
CRRT	2,848	124 \pm 161 (13.3 \pm 12.4%)	55 (37 to 119)	0 to 580
Death	2,863	119 \pm 111 (14.4 \pm 11.7%)	92 (45 to 145)	8 to 462

Table 3. Critical Care Resource: 2009 to 2014

	2009	2010	2011	2012	2013	2014
ICU beds	527 22.0 \pm 14.3 8-76	736 30.7 \pm 29.9 6-130	800 33.3 \pm 33.6 8-152	892 37.2 \pm 35.3 8-152	764 30.6 \pm 28.1 8-152	826 33.0 \pm 31.6 8-172
ICU physicians	317 13.2 \pm 10.6 6-60	293 13.3 \pm 4.7 4-24	381 15.9 \pm 7.7 4-44	418 17.4 \pm 8.7 3-48	418.5 16.7 \pm 6.9 2.5-28	444 17.8 \pm 7.4 6-31
ICU nurses	1,010 42.1 \pm 32.1 15-175	1,585 68.9 \pm 61.8 20-296	1,778 77.3 \pm 77.0 22-380	2,061 89.6 \pm 94.6 22-436	1,885 75.4 \pm 69.5 16-382	2,042 81.7 \pm 77.3 25-428

Table 4. Patients in Participating ICUs: 2007 to 2014

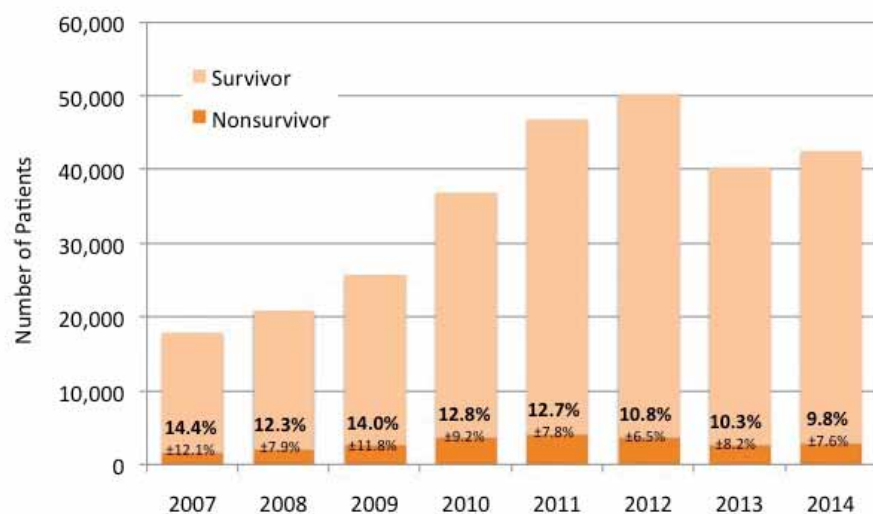
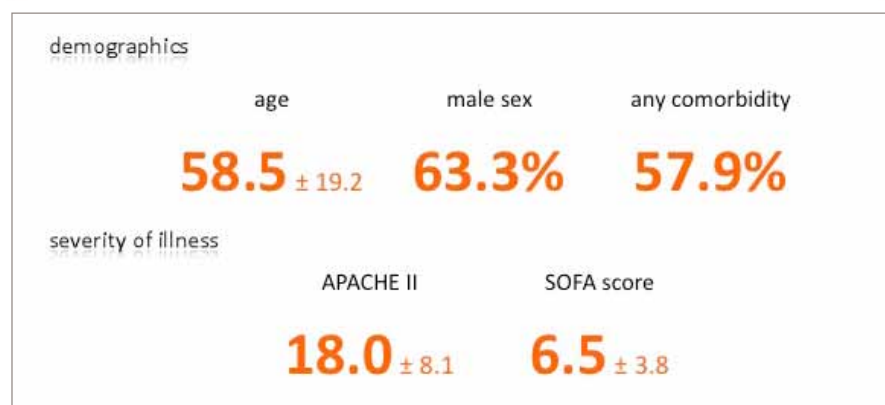
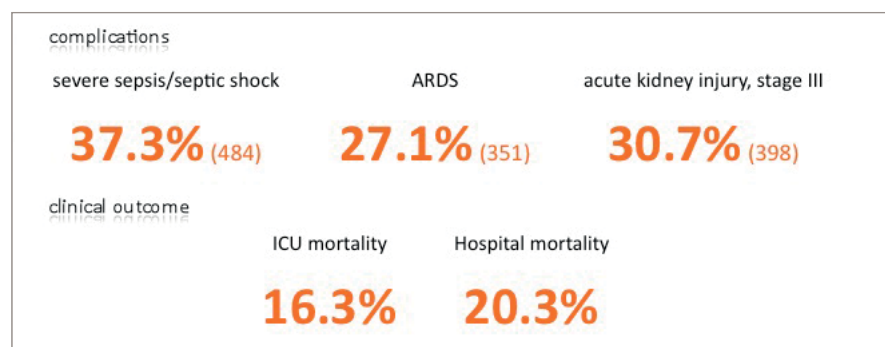


Table 5. Patients in Participating ICUs: 2007 to 2014

	2007	2008	2009	2010	2011	2012	2013	2014
Ventilation	10,685 65.9±22.6%	12,649 66.5±23.5%	16,090 66.8±24.4%	21,366 59.8±24.4%	28,873 61.2±25.0%	28,087 55.8±26.1%	28,285 66.2±23.2%	29,818 66.9±23.5%
PiCCO	124 5.2±8.9%	183 1.5±3.2%	526 2.8±4.8%	288 1.5±2.2%	588 3.1±5.5%	849 3.7±5.7%	733 2.9±3.6%	822 3.4±4.3%
PAC	139 5.8±6.9%	95 1.0±1.7%	93 0.8±1.7%	87 0.8±2.0%	109 0.8±2.0%	98 0.7±1.9%	41 0.3±1.0%	71 0.5±2.1%
CRRT	1,364 12.2±12.3%	1,820 12.2±10.8%	2,848 13.3±12.4%	2,793 10.3±7.7%	3,755 10.3±7.7%	4,482 11.8±8.3%	3,480 11.1±7.6%	4,185 12.6±8.8%

**Figure 5.****Figure 6.****Table 6.** International Collaborations

Study	No. ICUs All	No. Pts All	No. ICUs China	No. Pts China
BEST Kidney (2000-2001)	54	1,738	2 (3.7)	77 (4.4)
EPIC II (2007)	1,265	13,796	13 (1.0)	
SAFE-TRIPS (2007)	391	1,955	57 (14.6)	503 (25.7)
Nutritional Support Survey (2007)	158	2,946	21 (13.3)	370 (12.6)
EUROBACT (2009)	162	1,156	10 (6.2)	59 (5.1)
MOSAICS (2009)	150	1,285	40 (26.7)	189 (9.1)
3rd Mechanical Ventilation Survey (2010)	927	4,151	43 (4.6)	571 (13.8)
ICON Study (2012)	730	10,069	?	?

registered at clinicaltrials.gov at the time of writing (clinicaltrials.gov/ct2/search/map/click?map.x=597&map.y=169), of which 3369 were open. The National Natural Science Foundation of China (NSFC) began accepting grant applications for critical care research in 2010.

Conclusion

Clinical practice is similar to western countries, but critical care resources are at the lower end. Professional training/accreditation and more participation in research is needed. ■

Conflict of Interest

Bin Du declares that he has no conflict of interest.

Directory

Chinese Society of Critical Care Medicine
csccm.org/cn

Statistics	
Total population (2015)	1,400,000,000
Gross national income per capita (PPP international \$, 2013)	11
Life expectancy at birth m/f (years, 2015)	75/78
Probability of dying between 15 and 60 years m/f (per 1 000 population, 2013)	103/76
Total expenditure on health per capita (Intl \$, 2014)	731
Total expenditure on health as % of GDP (2014)	5.5

Source: World Health Organization who.int/countries/lka/en
Statistics are for 2013

For full references, please email editorial@icumanagement.org or visit <https://iii.hm/8x4>