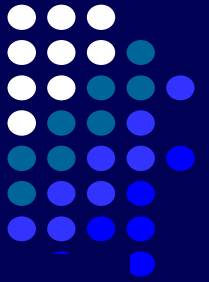


Acute Hypoxemic Respiratory Failure and ARDS in 26 Pediatric ICU in 2006 in China

Bo Sun, Xiaoguang Hu and
The Collaborative Group for Pediatric
Acute Hypoxemic Respiratory Failure

World Congress of Pediatric Critical Care
Geneva 2007-06

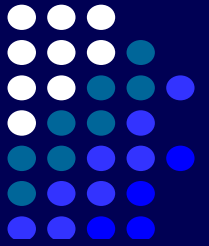
By wallcoo.com



Background

- **Pediatric acute hypoxemic respiratory failure (AHRF)** is characterized as persistent and severe hypoxemia and one of the hallmarks of ALI and ARDS
- A common reason of mortality in pediatric ICU
- High incidence, mortality and cost
- Incidence of AHRF in PICU in west 2%-4.4%; mortality 72%? 25-30%

Debrun W. Crit Care Med 1992; 20: 1223-1234.
Peters MJ. Intensive Care Med 1993; 24: 699-705.



Background

2005, Trachsel D, Toronto

- **Incidence** 2.3% (135/5677), mortality 27% (55/131)
- **Primary disease** pneumonia (50%); sepsis (46%); trauma (11%)

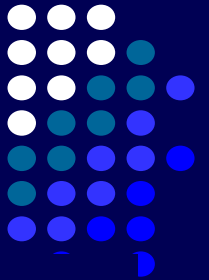
2005, multi-center pediatric ARDS study in China

- **Incidence:** 1.44%; mortality 61%
- **Limitation:** only ARDS, observational study
- **No protocol for lung protective ventilation and PICU level approximate that of west in later 80's**

Trachsel D. Am J Respir Crit Care Med 2005; 172: 206–11.

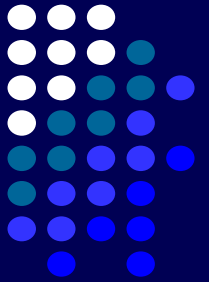
Yu W.L. Unpublished data

Objective

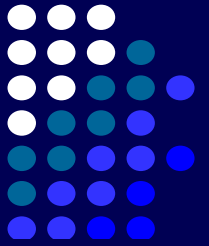


- To obtain epidemiological data of pediatric AHRF, ALI and ARDS in China
- To evaluate the influence of collaborative clinical study on incidence, mortality and cost of AHRF, ALI and ARDS in comparison to the data from 2004-2005 ARDS study
- To assess clinical cost-effectiveness of severe respiratory failure in PICU

Importance



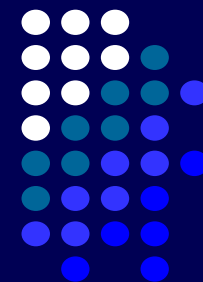
- To constitute a network-based collaborative group in PICU in China
- To have a good understanding of epidemiology of AHRF, ALI and ARDS
- To set up relevant and identical therapeutic procedure, and improve outcome and mortality
- Fundamental for interventional epidemiologic study and international collaboration



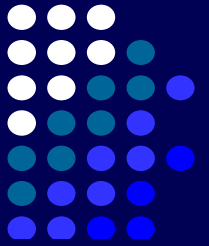
Method

- **Design:** multi-center prospective, observational clinical epidemiologic study
- **Study period:** 2005.12.1-2007.6.30
(enrollment for 12 consecutive months)
- **Patient:** 29 days= age= 15 years
- **Data collection:** demographic data, diagnosis, ventilator settings, major complication, cost, etc
- **Endpoint:** discharge, death, 28 d of entry, 48 h after weaning from ventilation, whichever occurred first.

Entry criteria of AHRF, ALI, ARDS



- **Spontaneous breathing**, hypoxemia defined by $\text{PaO}_2 = 50 \text{ mmHg}$ (or $\text{PaO}_2 / \text{FiO}_2 = 250 \text{ mmHg}$), for at least 6 consecutive hours
- **Mechanically ventilated**, requiring $\text{FiO}_2 = 30\%$, $\text{PEEP} = 2 \text{ cmH}_2\text{O}$ to achieve $\text{SpO}_2 = 90\%$ or $\text{PaO}_2 = 60 \text{ mmHg}$) for at least 6 hours
- **1994 AECC definition for ALI and ARDS**
Acute onset (7 days), $\text{P/F} < 300/200 \text{ mmHg}$
Bilateral infiltration on CXR and no cardiogenic edema

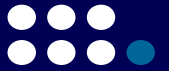


Collaborative centers

- The study was conducted at 26 PICU
- 12 of them are university affiliated; 11 from relatively developed area such as Shanghai, Beijing, Zhejiang, Guangdong, Fujian, etc.
- Other 14 are provincial children's hospital
- Each center serves population 5-10 million
- All were numbered 1-26 according to the alphabet order of the name







Collaborative centers: 26 PICU

Children's Hospital of Fudan University

Beijing Children's Hospital of Capital Medical University

Children's Hospital of Chongqing Medical University

Shanghai Children's Medical Center of Shanghai Jiaotong University

Children's Hospital of Capital Institute of Pediatrics

Peking University First Hospital

Tianjing Children's Hospital

Guangzhou Children's Hospital

Hebei Children's Hospital

Harbin Children's Hospital

Hubei Children's Hospital

Changchun Children's Hospital

Second Hospital of Hebei Medical University

Children's Hospital of Suzhou University

Dalian Children's Hospital

Chengdu Children's Hospital

Jinan Children's Hospital

Shanxi Children's Hospital

Second Hospital & Yuying Children's Hospital of Wenzhou Medical College

Shenzhen Children's Hospital

Quanzhou Children's Hospital

Second Hospital of Chinese Medical University

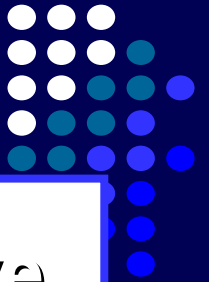
Kunming Children's Hospital

Guiyang Children's Hospital

Wuhan Children's Hospital

Jiangxi Children's Hospital





AHRF
Network
Website

Protocol execute
Supervision

Collaborative
center
investigator

Data collection
and deliver

Data analysis
Report periodically
Figure out problems
Ask for solution

Coordinating
center

2005-2006

以下所列各选项
经市委常委会研究
复旦大学尚未
上海市政协函
市委常委会审定
() 修改
市委常委会审定
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() 留待下次
() 不同意
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REF 5

1. 在 1949 年 1 月 1 日以前, 已建成的房屋, 其所有权人, 除另有规定外, 均归国家所有。
2. 在 1949 年 1 月 1 日以前, 已建成的房屋, 其所有权人, 除另有规定外, 均归国家所有。
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10. 在 1949 年 1 月 1 日以前, 已建成的房屋, 其所有权人, 除另有规定外, 均归国家所有。

姓名: _____ 填写人: _____

小潮气量通气及控制补液救治小儿持续低氧性呼吸衰竭的多中心临床研究 1025-4 17

[illegible][illegible]

用时分列整合第 1、2 号要纳入《第 3 条关于吸乳机下部的保护》。

4. 如为急性起病: ①2.5岁, 额叶沟内和侧部, 大片(5)由后方的脑组织区(脑实质)占15 mlL(或用未变形细胞)。②BaCl₂/BaCl₂为216-320 mlL, 诊断为急性肝细胞(2.5); BaCl₂/BaCl₂为20 mlL, 诊断为急性肝细胞(2.5)。

人的吸入常見腔型。

▲在九州上野站(41 周)

控制及運方案：見HR?文件A1-2)

[illegible]

PICU 危重评分表

FICU 危重评分表				
姓名	性别	住院号	出生年月	
床号	入院日期	入 FICU 日期		转院日期
项目	入 FICU 2 小时内	前 分		
1. 血压 (mmHg)				
2. HR (b/min)				
3. RR (b/min)				
4. SpO_2 (sat) (%)				
5. T (°C)				
6. PaO_2				
7. K^+				
8. Ca^{2+}				
9. 血 pH				
10. 尿 pH				
11. 尿量 (ml)				
12. 尿比重				
总分				

[illegible]

1. 杨某某 123456
 2. 李某某 789012
 3. 张某某 345678
 4. 王某某 901234
 5. 赵某某 567890
 6. 刘某某 123456
 7. 陈某某 789012
 8. 周某某 345678
 9. 吴某某 901234
 10. 郑某某 567890

1. 姓名: 孙明强 性别: 男

2. 年龄: 30 岁

3. 职业: 教师

4. 住址: 北京市朝阳区

5. 电话: 13800138000

6. 身份证号: 110101199001010001

7. 血型: O 型

8. 身高: 175 cm

9. 体重: 70 kg

10. 血压: 120/80 mmHg

11. 血糖: 5.0 mmol/L

12. 血脂: 正常

13. 肝功能: 正常

14. 肾功能: 正常

15. 心电图: 正常

16. 超声: 正常

17. 其他: 无

18. 备注: 无

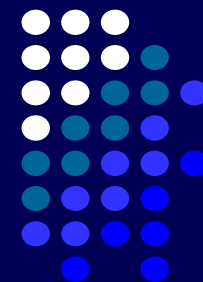
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Means of communication

- Website
(<http://www.shlung.com>)
- E-mail
- Telephone
- Fax
- Newsletter per 2 weeks
- Periodic conference



Results—General information



16921 PICU patients in 12 m

Non-critical 5316

Scores

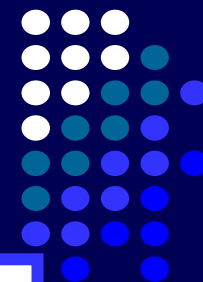
Critical patient 11605

Pediatric
9413 (81%)

Surgery
1526 (13%)

Others
666 (6%)

Results—General information



Critical patient 11605

Ventilation 2242 (19%)

Respiratory failure 2929 (25%)

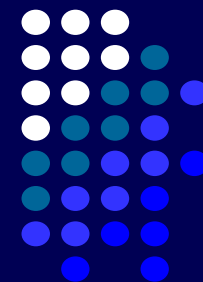
Sepsis 814 (7.0%)

Pneumonia 5390 (60.1%)

Trauma 286 (2.5%)

Death 1241
Mortality 10.7%

Results—General information



Report case 481

24 excluded

3 out of the study period

1 age < 29 d

20 not fit inclusion criteria

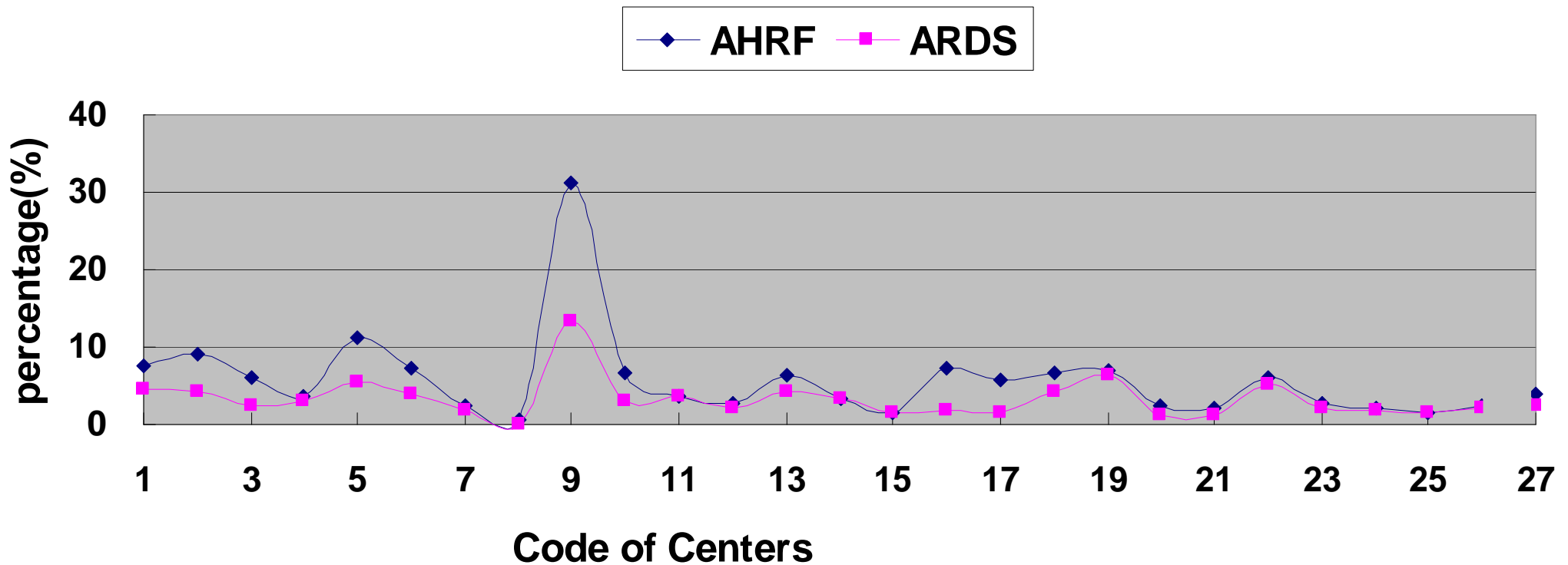
	N	%
AHRF	104	29
ALI	62	18
ARDS	291	53

457 enrolled (3.9%)

353 ALI (3.1%)

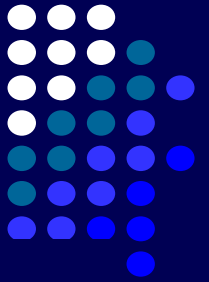
291 ARDS (2.5%)

AHRF incidence in different centers



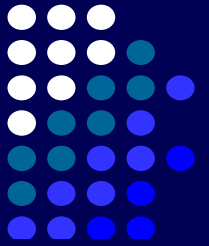
% of PICU critical patients of individual hospital
No. 27 was the mean level of all hospitals





Results—General information

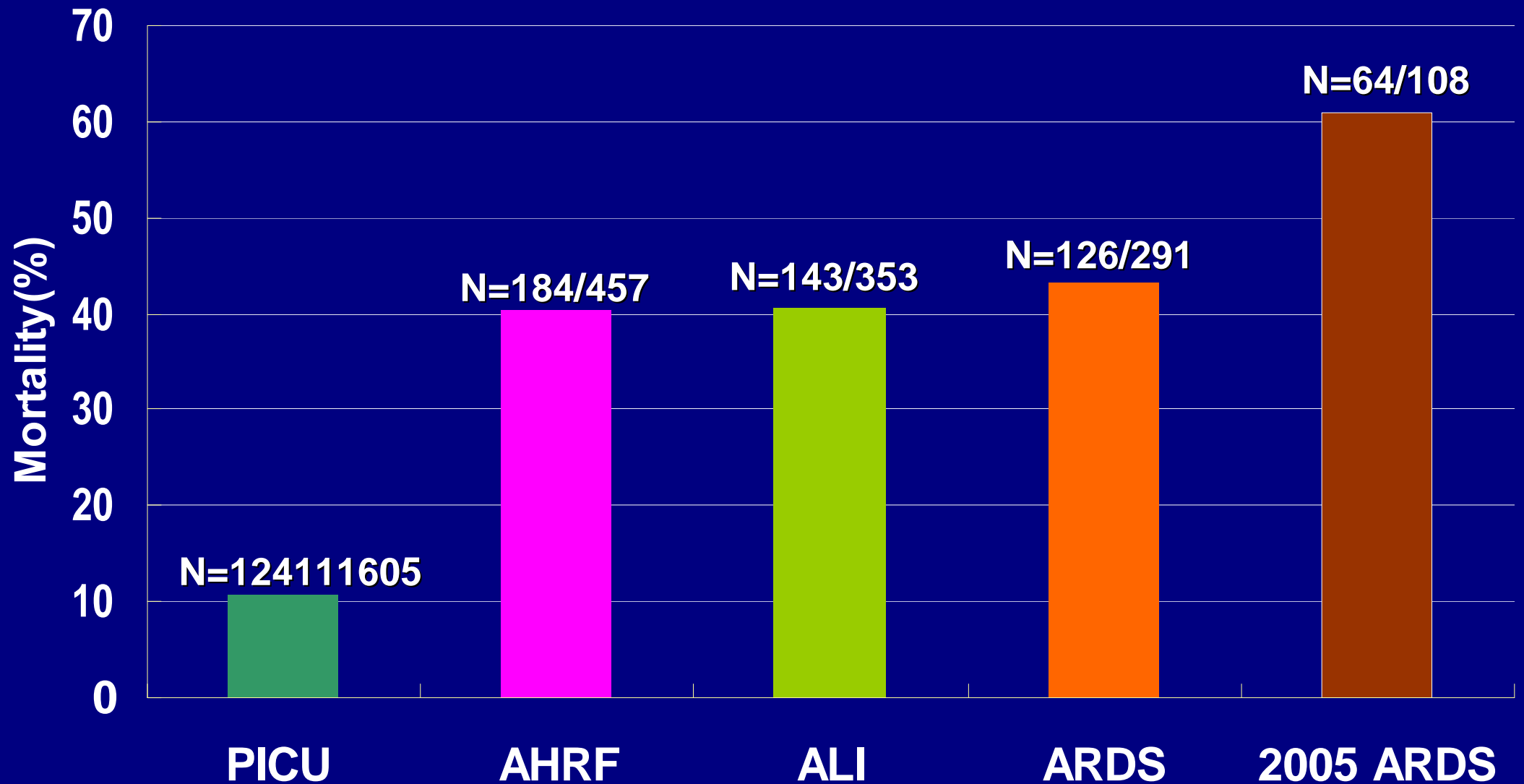
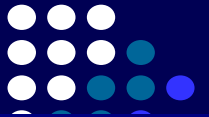
- Out of 457 AHRF, male 323 (71%)
- Median age 11 m (range 29 days-15 years), and weight 9 kg (2-77 kg)
- Median onset of AHRF 72 h (0-480 h), 95% enrolled in 384 h (6 d)
- 354 (75%) patients were mechanically ventilated at enrollment, 47 (10%) CPAP and 71 (15%) without respiratory support



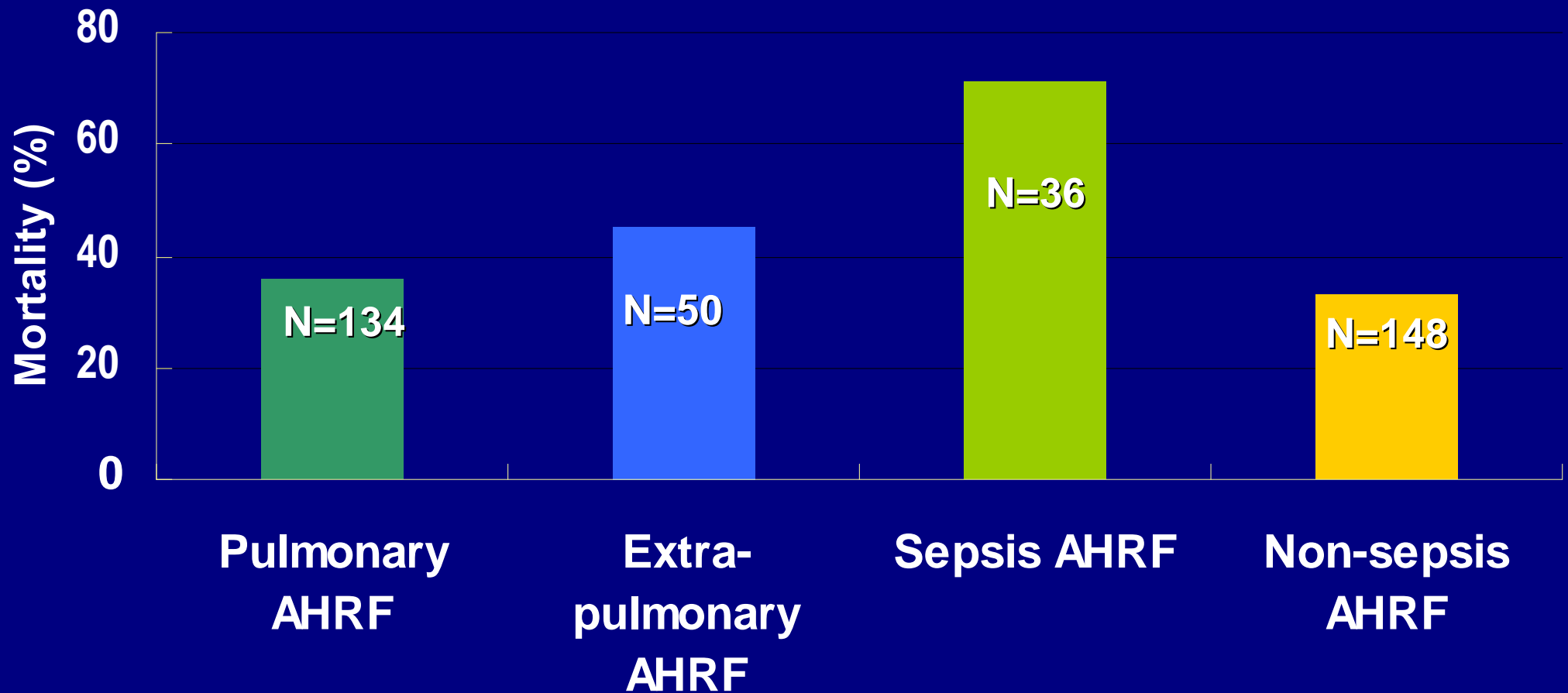
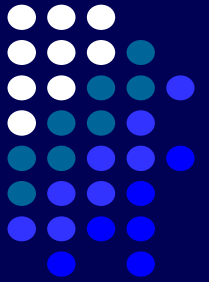
Results—Mortality

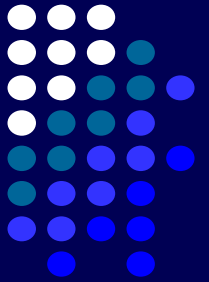
- AHRF hospital mortality was 40.3% (184/457, 95 % CI 35.7-44.8%)
- Pulmonary origin AHRF 352, 134 died (38%)
Extra-pulmonary AHRF 105, 50 died (48%, $p=0.08$)
- ARDS 43.3% (126/291, 37.6-49%), (vs. PICU 10.7%, $p<0.01$); vs. non-ARDS (34.9%, 58/166, $P>0.05$)
- Mortality was higher in patients with sepsis than those without sepsis (52% vs. 38%, $\chi^2=5.3$, $p<0.05$; OR 1.8, 95% CI 1.1-3.1)

Summary of Mortality

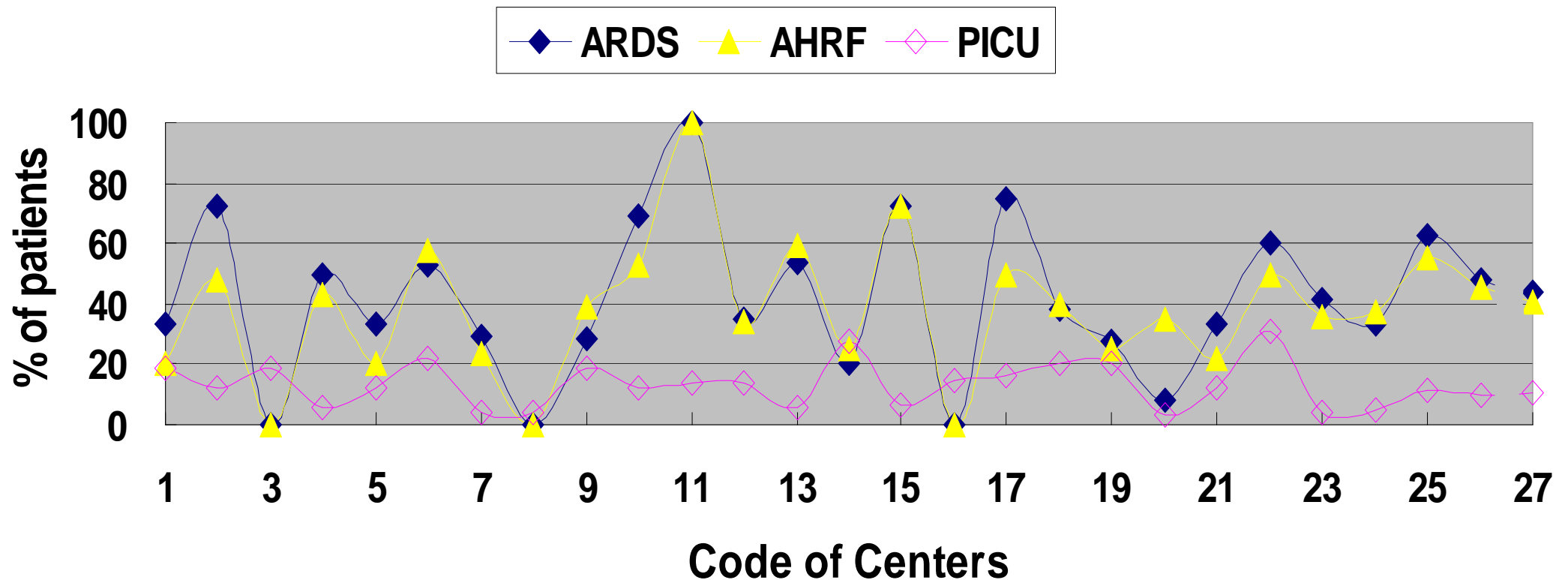


Mortality of AHRF caused by different diseases

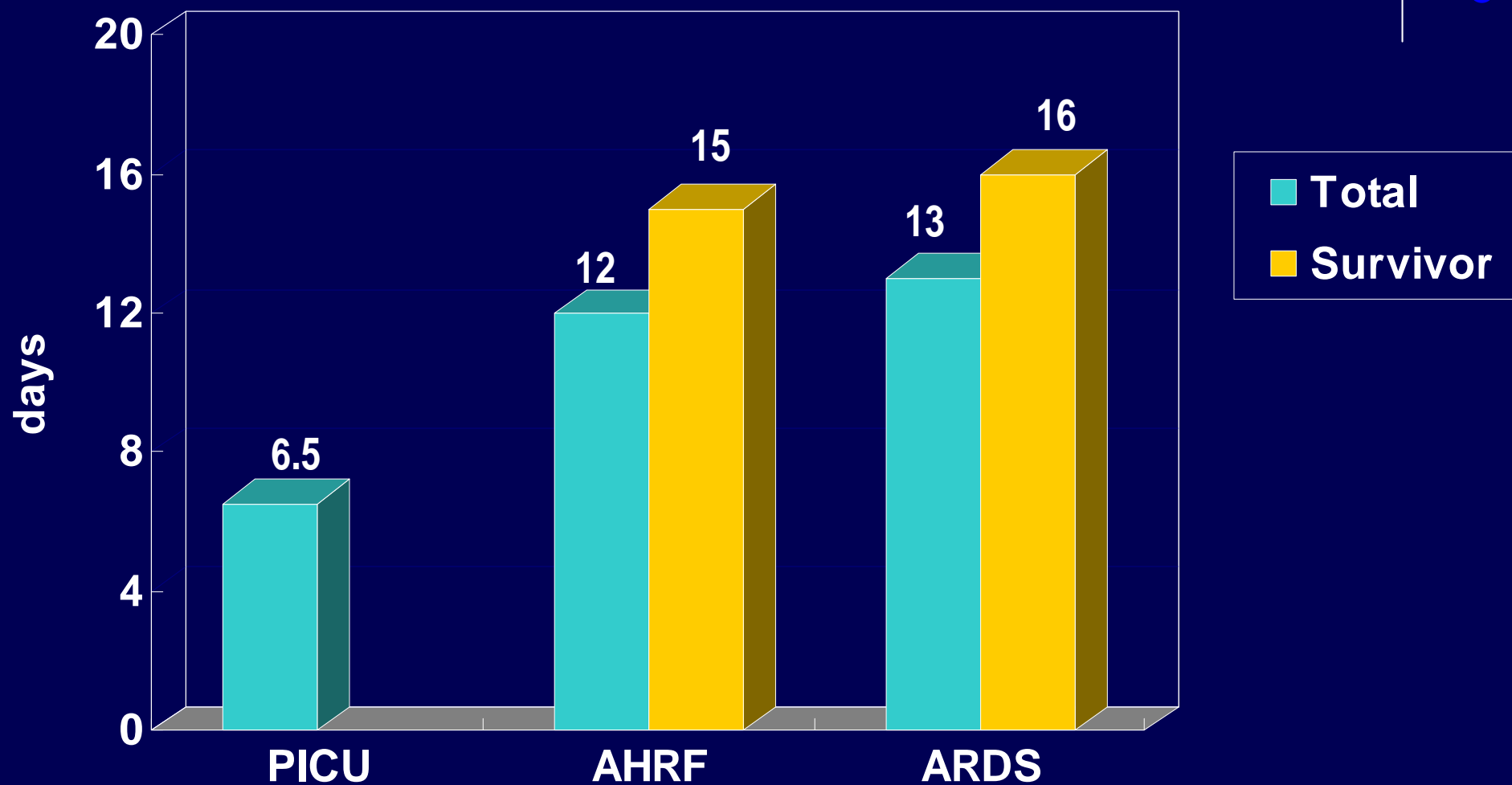
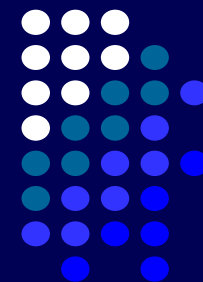


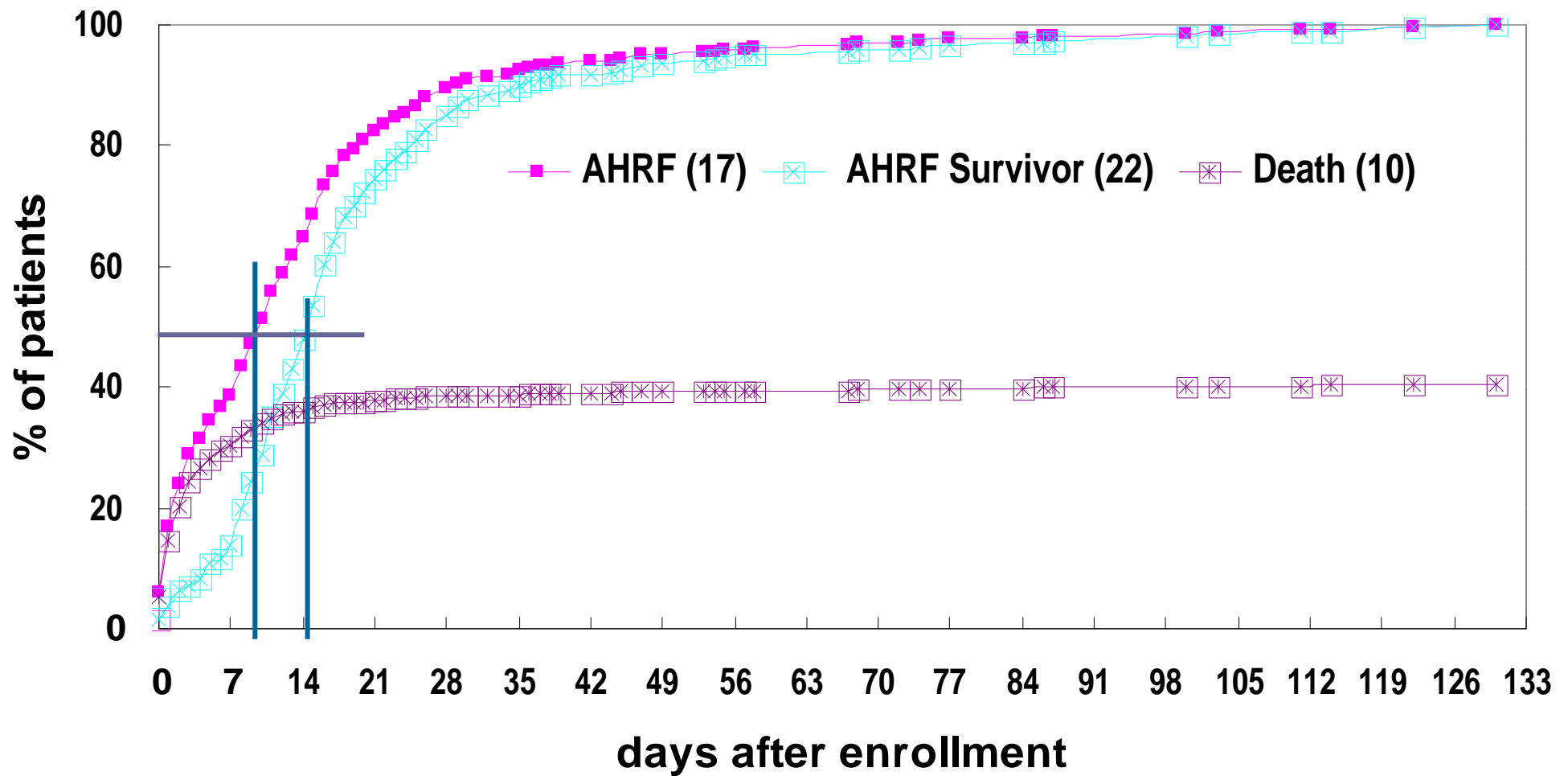


Mortality in different Centers



Results—— Mean PICU stay

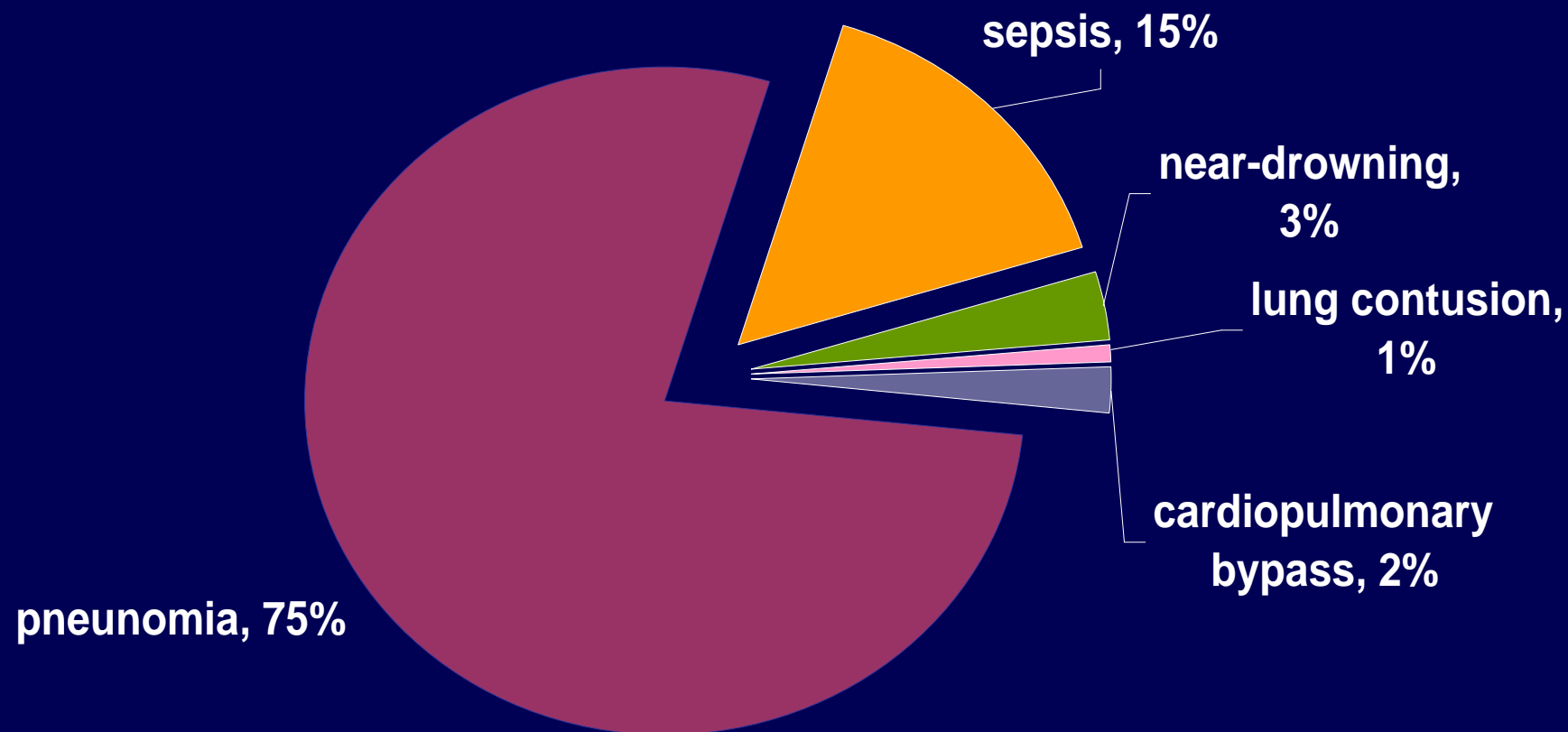




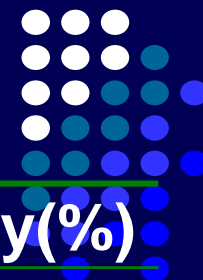
% of patients discharged home or survived to discharge or death after enrollment

Results—Primary disease

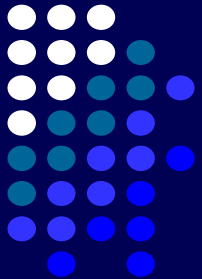
- Pulmonary 77%, extra-pulmonary 23%



Primary disease and mortality

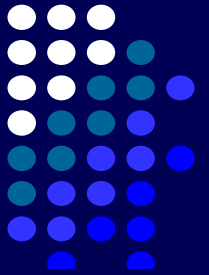


Primary	N (%)	Death (%)	Mortality(%)
Pulmonary	352 (77)	134 (73)	38
Pneumonia	343 (75)	131 (72)	38
Lung hemorrhage	3 (0.6)	3 (2)	100
Lung contusion	6 (1.3)	0 (0)	0
Extra-pulmonary	105 (23)	50 (27)	48
Sepsis	68 (15)	36 (20)	53
Near drowning	12 (3)	3 (2)	25
Pancreatitis	2	1	0
Bypass	7 (1.5)	1	33.3
Aspiration	3 (0.6)	1	44.4
Others	13 (3)	8 (4)	62
Total	457 (100)	184 (100)	40



Preexisting medical conditions

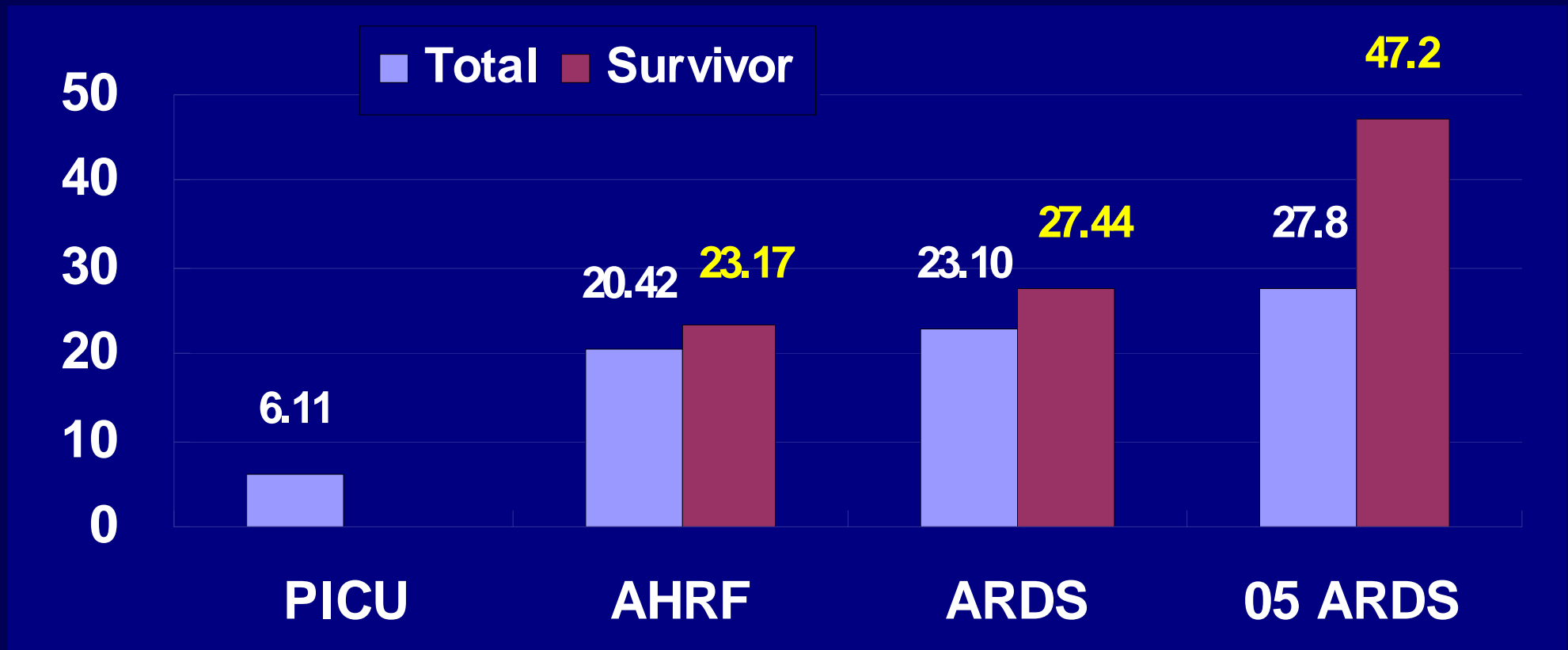
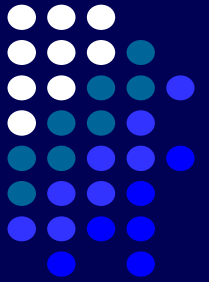
	Case(%)	Death(%)	Mortality(%)
Bronchopulmonary dysplasia	4 (0.9)	3 (1.6)	75.0
Pulmonary Hemosiderosis	5 (1.1)	2	40.0
Post-operation	22 (4.8)	10 (5.4)	45.5
Malignant disease	17 (3.7)	9 (4.9)	52.9
Aspiration of gastric contents	8 (1.8)	6 (3.3)	75
Immunosuppression	3 (0.7)	1	33.3
Others	195 (42.7)	87 (47.3)	44.6
None	203 (44.4)	66 (35.9)	32.5

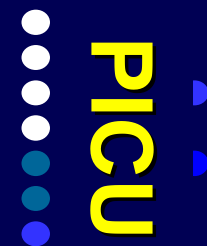


Results—— Cost in PICU

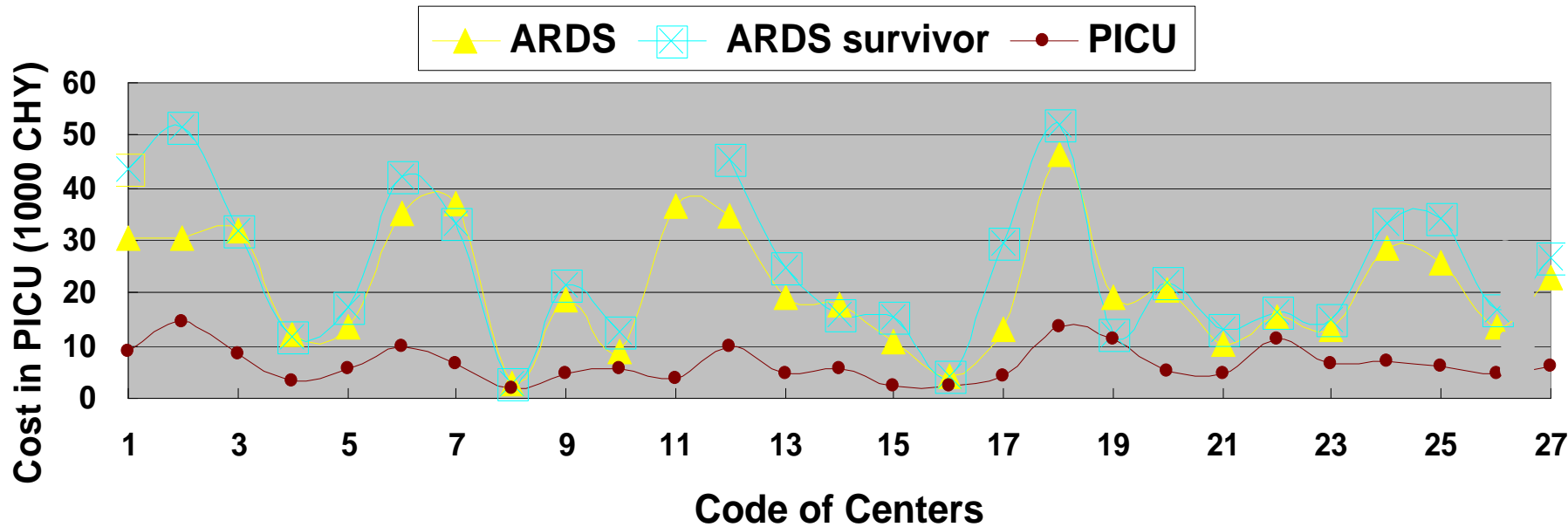
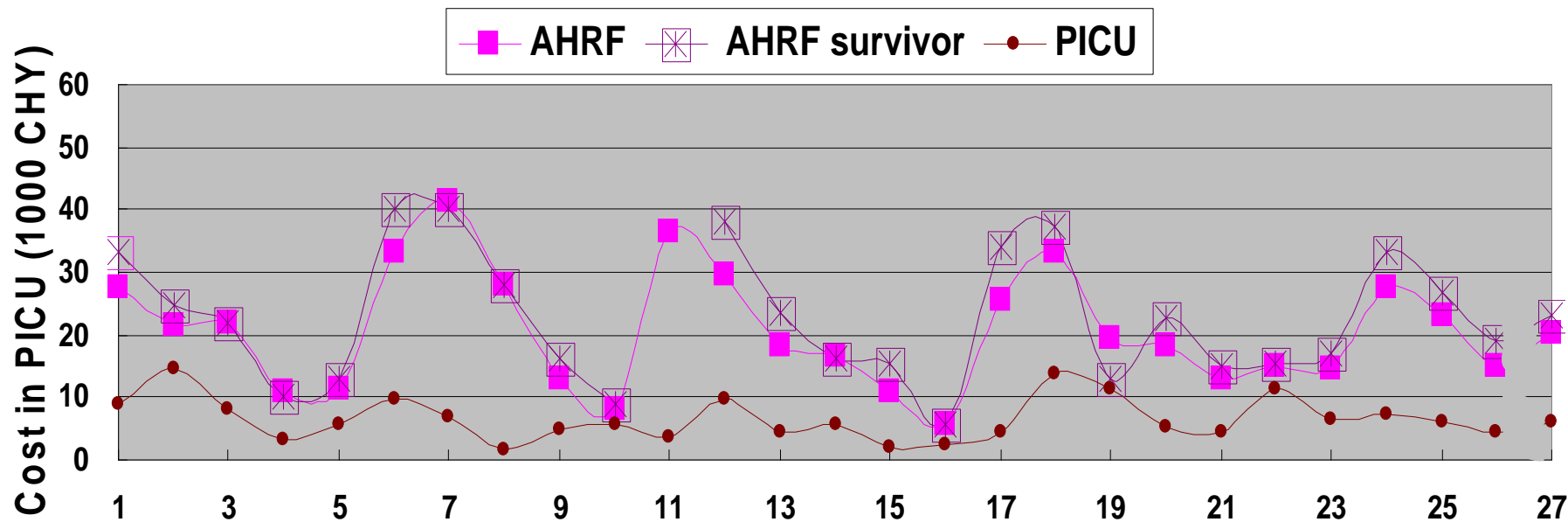
- PICU critical patients: mean cost 6113 (924/d)
- AHRF: mean cost 20,417 (1,722/d) , survivor 23,170 (1,563/d)
- ARDS: mean cost 23,100 (1,833/d), survivor 27,444 (1,638/d)
- **Unit in Yuan (CNY), 1 USD=8 CNY**

PICU cost (x1, 000 Yuan, CNY)

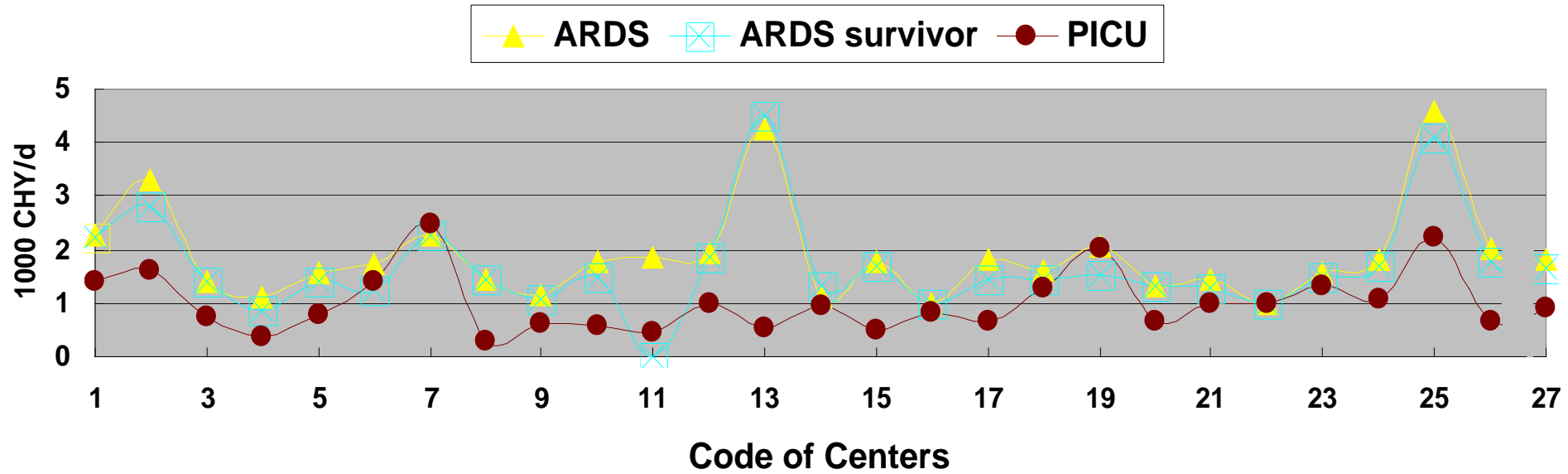
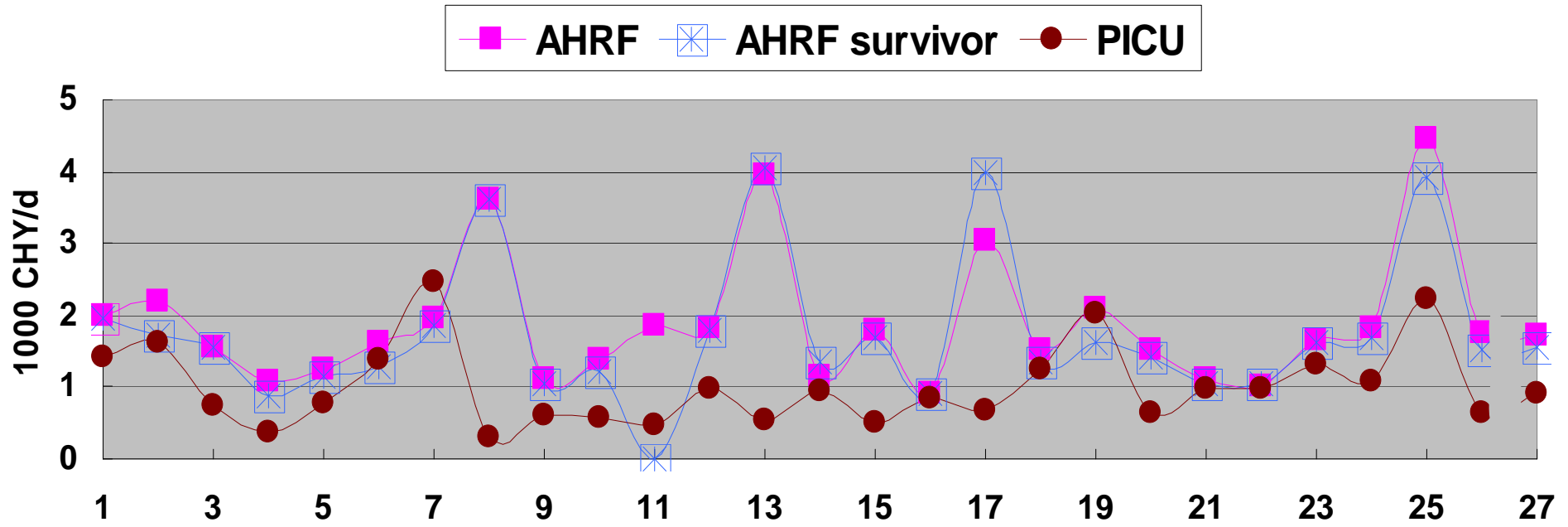


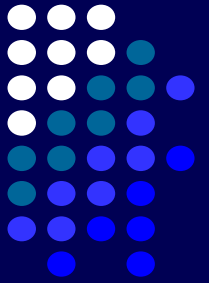


PICU cost in different Centers



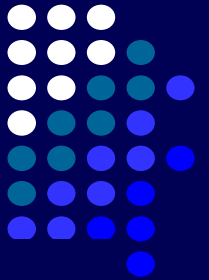
PICU cost/d in different Centers





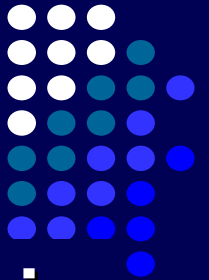
Data from different area or level

	Incidence		Mortality		Mean cost	
	AHRF	ARDS	AHRF	ARDS	AHRF	ARDS
Developed (14)	3.6%	2.4%	40%	42%	24320	24647
Undeveloped (12)	4.4%	2.2%	41%	45%	19792	17781
University (12)	3.7%	2.5%	44%	47%	24656	27049
Non-university (14)	4.2%	2.4%	36%	41%	17443	16387



Discussion

- This study is the first prospective, multicenter, observational, epidemiologic study of AHRF, ALI and ARDS in China
- Participants came from 18 provinces and 4 municipalities, covered most part of the nation except the western regions
- 11 centers from relative developed area and 12 were university affiliated
- The results of this study represent real situation of respiratory care in leading PICU in China



Discussion

- Incidence of AHRF was 3.9%, similar to those in Peters's and Trachsel's studies
- Incidences of AHRF widely varied between the 26 centers (range 0.6-31%), a control of inclusion criteria is not efficient
- The mortality of AHRF (40.3%) was higher than that in the developed countries (20-25%)
- Foundation for conducting interventional (controlled) investigation in AHRF

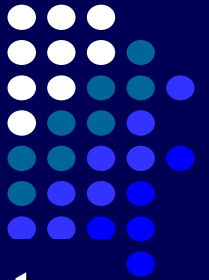
Peters MJ. Intensive Care Med 1998; 24: 699-705.
Trachsel D. Am J Respir Crit Care Med 2005; 172: 206-11.

Epidemiological data of AHRF/ARDS



Author	Pub.	Period	Case	Incidence (%)	Mortality (%)
AHRF					
Debruin	1992	86/7-90/3	100	4.4	72
Peters	1998	95/8-97/5	118	14	22
Randolph	2003	00/10-01/4	303	6	1.6
Trachsel	2005	95/6-97/4	134	2.3	27
ARDS					
Timmons	1991	87/8-90/8	44	1.5	75
Kühl	1996	92/1-93/1	112	0.7	46
Lu	2003		21	1.34	71.4
Flori	2005	96/7-00/5	221		26
Yu	2005	04/1-04/12	104	1.44	61

Pub=Publication year



Discussion

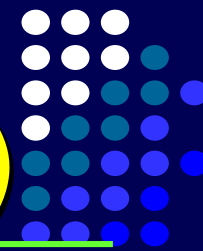
- In this study, pneumonia was the predominant primary disease (75%), followed by sepsis (15%), which differed from other studies with 30-50% and 24-46% respectively
- None of 457 AHRF had underlying diseases as bone marrow or liver transplant
- Difference in the disease severity may exist compared to the published reports

ARDSnet. N Engl J Med 2000; 342: 1301-8.

Weinert CR. Am J Respir Crit Care Med 2003; 167: 1304-9.

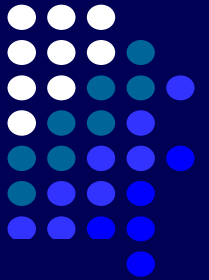
Trachsel D. Am J Respir Crit Care Med 2005; 172: 206-11.

Primary disease of AHRF/ARDS (%)



Author	Pn.	Sep.	Tra.	ND.	As.	BMT.	IS.	LT.
AHRF								
Debruin						44	60	0
Randolph	84	13	3	0	0	0	0	0
Trachsel	37	34	8	0	0	8	34	9
ARDS								
Timmons	14	16	7	18	9	0	0	0
Lu	29	0	0	0	0	0	47	0
Flori	35	13	0	9	15	0	0	0
Yu	55	23	1	0	0	0	0	0

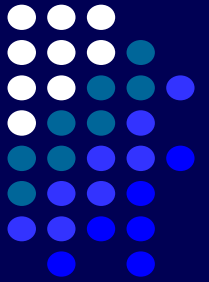
Pn=Pneumonia; Sep=Sepsis; Tra=Trauma; ND=Near drowning
 As=Aspiration; BMT=Bone marrow transplant;
 IS=Immunosuppression; LT=Liver transplant



Discussion

- 291 patients AHRF and ARDS had a higher mortality vs non-ARDS AHRF
- PICU cost was higher in centers from developed compared with underdeveloped area, but there were no difference between these two groups in mortality of AHRF and ARDS
- Reason: more give up due to economics

Regional Economic Development

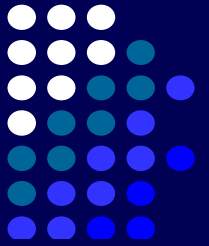


- 2004 GDP 21,239 \pm 15,001 (Median 15,000, range 8,867-54,510) Yuan (CNY)
- 2004 Urban resident income: 10,130 \pm 2,871 (Median 9,221, range 7,471-16,683) Yuan (CNY)
- 2004 average annual income: 5,645 Yuan

8 Yuan = 1 US Dollar

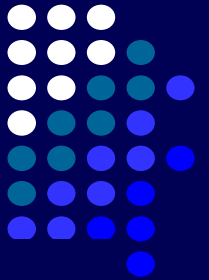
1 kg meat = 20-30 Yuan, 1 kg rice = 0.4 Yuan

1 L gasolin = 5 Yuan, 1 kwh electricity = 1 Yuan



Discussion

- Compared to non-university centers, both mortality and cost of AHRF and ARDS were higher in university centers, patient severity
- Modalities of treatments in AHRF were with considerable variation between the 26 centers, this might be one of the reasons for the wide variation of mortalities between the centers



Conclusion

- The mortality of AHRF in China was higher than that in developed countries
- There are significant difference between the hospitals in cost and treatment level
- Interventional efforts should be made to ensure facility, protocol identity, staff competence, and quality of the investigation

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**Greetings from Chinese Pediatric Society Pediatric
Critical Care Assembly**

**Chinese Collaborative Study Group for Pediatric
Respiratory Failure**