The pediatric index of mortality 3 score to predict mortality in a pediatric intensive care unit in Palembang, South Sumatera, Indonesia.pdf

by Irsan Saleh

Submission date: 11-Dec-2019 01:35PM (UTC+0700)
Submission ID: 1232149714
File name: intensive_care_unit_in_Palembang,_South_Sumatera,_Indonesia.pdf (311K)
Word count: 4524
Character count: 21241

Paediatrica Indonesiana

p-ISSN 0030-9311; e-ISSN 2338-476X; Vol.57, No.3(2017). p. 164-70; doi: http://dx.doi.org/10.14238/pi57.3.2017.164-70

Original Article

The pediatric index of mortality 3 score to predict mortality in a pediatric intensive care unit in Palembang, South Sumatera, Indonesia

Destiana Sera Puspita Sari, Indra Saputra, Silvia Triratna, Mgs. Irsan Saleh

Abstract

Background For critically ill patients in the pediatric intensive care unit (PICU), a scoring system is helpful for assessing the severity of morbidity and predicting the risk of mortality. The *Pediatric Index of Mortality* (PIM) 3 score consists of ten easy simple variables, so that the probability of death can be assessed prior to undergoing advanced therapies. The PIM 3 score in inexpensive and comprised of routine laboratory variables performed in PICU patients. In Indonesia, studies to validate the PIM 3 score have been limited.

Objective To evaluate the PIM 3 score for predicting the probability of death in the PICU, Dr. Mohammad Hoesin Hospital (MHH), Palembang.

Methods A prospective, cohort study was performed in the PICU, MHH, Palembang, from February to April 2016. The PIM 3 score was calculated within 2 hours of patients admission to the PICU by an android calculator application. PIM3 score and mortality were analyzed by Mann-Whitney test; calibration was performed by Hosmer-Lameshow goodness of fit test, discrimination was done by receiver operating characteristic (ROC) curve analysis; and standardized mortality ratio (SMR) was calculated.

Results During the study period there were 81 PICU patients, 69 children were included, ranging in age from 1,5 to 187 months. The overall mortality rate was 40,58%. The most common illnesses in our subjects were malignancy (17,4%), post non-thoracic surgery (14,5%), dengue shock syndrome (14,5%), respiratory disease (13%), and neurological disease (11,6%). Subjects' PIM3 scores ranged from 1,02% to 58,84%, with means of 26,08% in non-survivors and 13,05% in survivors. The SMR was 2,24, indicating that death was underpredicted. The AUC of 0,771 (95% CI of 0,651 to 0,891) indicated that the PIM3 score had good discrimination.

Conclusion In Mohammad Hoesin Hospital, Palembang, South Sumatera, the PIM 3 can be used to predict mortality in PICU patients, but the score should be multiplied by a factor of 2.24. This recalibration is needed due to the presumed lower standard of care at this hospital compared to that of the originating PIM 3 institutions in developed countries. **[Paediatr Indones. 2017;57:164-70; doi: http://dx.doi.org/10.14238/pi57.3.2017.164-70].**

Keywords: *PIM3 score; probability of mortality; PICU MHH Palembang*

The hospital pediatric intensive care unit (PICU) has special staff and equipment to care for critically-ill or injured children aged 0 to 18 years (except neonates) in order to identify primary disease process and to support patients at risk for organ dysfunction.[1] PICU patients often have unclear prognoses and mortality rates may be dependent on PICU staff and procedures. A scoring system for illness severity is useful for objectively predicting the outcomes and prognoses of PICU patients.[2-8]

From the Department of Child Health, Sriwijaya University Medical School/Dr. Mohammad Hoesin Hospital, Palembang, South Sumatera, Indonesia.

Reprint request to: Destiana Sera Puspita Sari, Sriwijaya University Medical School/Dr. Mohammad Hoesin Hospital. Jl. Jenderal Sudirman KM. 3,5 Palembang, South Sumatera, Indonesia. E-mail: destiana.sera@yahoo.co.id.

Since 1980, there are various scoring systems have been used, such as the *Pediatric Risk of Mortality* (PRISM), *Pediatric Logistic Organ Dysfunction* (PELOD), and *Pediatric Index of Mortality* (PIM) tests. The newest version are PRISM III, PELOD 2, and PIM 3, respectively.[9-13] The first version of PIM was developed at 1997 in Australia and the United Kingdom. The second model, PIM 2, was developed using data collected from 13 PICU in 1997 and 1999 in Australia, New Zealand, and the United K ingdom.[14-15] The newest iteration, PIM 3, was developed in 2010-2011 by Straney *et al.* Discrimination of PIM3 was 0.88, compared to as high as 0.90 in PIM 2. The PIM 3 mortality risk was 3,9% in Scotland and England, and 2.9% in Australia and New Zealand. The difference may have been due to individual PICU performance or facilities, as well as the health status of the population.[13]

The PIM 3 scoring system has some advantages compared to other scoring systems. The PIM 3 consists of 10 simple variables which are easy to assess, can predict mortality before patients receive advanced therapy, are from routin PICU examinations, and are not prohibitively expensive to be used in a developing country.[14] In Indonesia, the PIM 3 model has yet to be validated, so we do not know if mortality predictions by PIM 3 in Indonesia are similar to those in developed countries. The objective of this study was to evaluate the utility of PIM 3 as a mortality predictor in the PICU, Mohammad Hoesin Hospital (MHH), Palembang, South Sumatera.

Methods

We conducted a prospective, cohort study in our PICU from February to April 2016. Inclusion criteria were critically ill PICU patients with reliable laboratory findings corresponding to the PIM 3 score variables, and whose parents provided informed consent. Patients who stayed in the PICU for less than 1 hours were excluded.

Collected data at admission included age, sex, weight, length, nutritional status, diagnosis, and PIM 3 variables such as systolic blood pressure and pupillary reaction to bright light. Our variables assessed were partial oxygen tension (PaO2) and FiO2 at the same time of PaO2 if oxygen was given by endotracheal tube, non-invasive ventilation, or headbox; base excess in arterial blood gas analysis, type of mechanical ventilation at any time during the first hour of PICU admission, elective admission to PICU, recovery from surgery or a procedure was the main reason for ICU admission, presence of low-risk diagnosis, high-risk diagnosis, or very high-risk diagnosis. Definitions of these variables and the scoring method were according to PIM 3 developers' guidelines.[13]

Scores were calculated using PIM 3 calculator application from *Australian and New Zealand Intensive Care Society* (AZNICS).[16] Data was entered into Microsoft Excel 2007 and analyzed using *SPSS version 16.0* software. We analyzed for an association between PIM 3 score and mortality. The performance of PIM3 score was assessed by calibration and discrimination. Calibration evaluated PIM 3 at different risks of mortality, and was assessed by Hosmer–Lemeshow table. Standardised mortality ratio (SMR) was calculated to mean probability of death and the ratio of observed to expected death rates. Discrimination evaluated how well PIM distinguished between patients who survived and died, and was assessed using the area under the curve from the ROC plot. The study was approved by the Ethics Committee of the Sriwijaya University Medical School.

Results

Over the study period, 81 patients were admitted to the PICU, but data were collected from only 69 subjects who qualified based on inclusion criteria. Of these 69 subjects, 28 (40.58%) died. Subjects' median age was 89 months, with the highest mortality in the 60-119 month group (45.83%). The majority of subjects were boys (59.4%). About a half (43.5%) of the children had good nutritional status, while non-survivors had malnutrition and undernutrition (50%). The most common underlying disease for PICU admission was malignancy (17.4%), but the mayor cause were central nervous system and burns (8/8 and 1/1, respectively. Demographic features and clinical course of subjects related to outcome are provided in **Table 1**.

Subjects' PIM 3 scores ranged from 1.02% to 58.84%, with mean and median scores of 18.34% and 13.05%, respectively. Most subjects were in the 5-20% score interval. No subjects had scores of less than

Table 1. Characteristics of patients related to outcome

Characteristics	All patients (N=69)	Non-survivors (n=28)	Survivors (n=41)
Gender, n(%)			
Male	41 (59.4)	15	26 (63.4)
Female	28 (40.6)	13	15 (53.6)
Age group, n(%)			
< 12 months	10 (14.5)	4	6 (14.6)
12-59 months	24 (34.8)	9	15 (36.6)
60-119 months	24 (34.8)	11	13 (31.7)
> 120 months	11 (15.9)	4	7 (17)
Nutritional status, n(%)			
Malnutrition	4 (5.8)	2	2 (4.9)
Undernutrition	22 (31.9)	11	11 (26.8)
Good nutrition	30 (43.5)	8	22 (53.6)
Overweight	4 (5.8)	3	1 (2.4)
Obesity	9 (13.0)	4	5 (12.2)
Diagnosis, n(%)			
Malignancy	12 (17.4)	7	5 (12.2)
Post-surgical procedure besides thoracic surgery	10 (14.5)	1	9 (21.9)
Dengue shock syndrome	10 (14.5)	5	5 (12.2)
Respiratory system	9 (13.0)	2	7 (17)
Central nervous system	8 (11.6)	8	0
Cardiogenic shock/CHF/arrythmia	6 (8.7)	3	3 (7.3)
Endocrine-metabolic	4 (5.8)	1	3 (7.30
Post-thoracic surgery	4 (5.8)	0	4 (9.7)
Sepsis/septic shock	2 (2.9)	0	2 (4.9)
Snake bite	2 (2.9)	0	2 (4.9)
Emergency hypertension	1 (1.4)	0	1 (2.4)
Burns	1 (1.4)	1	0

Table 2. Distribution of PIM 3 scores related to outcomes

PIM 3 score interval by group, n(%)	All patients (N=69)	Outcomes	
		Non-survivors (n=28	Survivors (n=41)
1-5%	12 (17.4)	3	9 (22)
5-20%	36 (52.2)	11	25 (61)
20-30%	8 (11.6)	4	4 (9.7)
>30%	13 (18.8)	10	3 (7.3)

Table 3. PIM3 score related to outcome

Outcome	N	Median PIM 3 score (range), %
Non-survivors	28	21.4 (2.7-58.8)
Survivors	41	11.4 (1.0-53.9)

1%. Higher PIM 3 score indicated higher probability of mortality. The PIM 3 score intervals and subject outcome are shown in **Table 2**.

Mean and median PIM 3 scores in non-survivors were 26.1% and median 21.4%, respectively. For survivors, mean and median of PIM 3 scores were 13.1% and 11.4%, respectively (**Table 3**). Mann-Whitney test revealed that median PIM 3 score in non survivors were significantly higher compared to the value in survivors (P=0.0001).

Table 4 shows the SMR calibration of the PIM 3 model based on four PIM 3 score intervals of 1-5%, 5-20%, 20-30%, and >30%. The overall SMR was 2.24. The expected mortality rate based on PIM 3 score was 18.1%, less than the actual percentage observed (40.5%).

The PIM 3 score was divided in quartiles of risk, by range interval of 14.45. The SMRs in each quartiles of risk group were >1, which meant mortality was underpredicted. The AUC curve analysis showed a good discriminatory ability of the PIM 3 score in 44.38-58.84% interval group to distinguish between survivors and non-survivors (AUC>70%) (**Table 5**).

Table 6 shows that SMRs in overall demographic and clinical course group were >1, except for predicting mortality in the subgroups of post-surgical procedure other than thoracic surgery, others illnesses (snake bite, diabeticum ketoasidosis, and post thoracic surgery), and respiratory system.

Table 4. Observed and expected of mortality based on PIM 3 score intervals by group

PIM 3 interval by group	Mean PIM 3 (%)	N	Non-survivors		Survivors		Chi-square value of Hosmer Lemeshow Goodness of fit	SMR
			Observed, n	Expected, n(%)	Observed, n	Expected, n(%)		
1-5%	3.3	12	3	0.4 (3.3)	9 (75)	11.6 (96.7)	16.9	7.5
5-20%	12.11	36	11	4.4 (11.43)	25 (69.4)	31.6 (87.7)	9.9	2.5
20-30%	23-34	8	4	1.8 (22.5)	4 (50.0)	6.2 (77.5)	2.69	2.22
>30%	45.14	13	10	5.87 (45.15)	3 (23.08)	7.13 (54.8)	2.9	1.70
Total		69	28 (40.6)	12.47 (18.06)	41 (59.4)	56.53 (81.9)	19.34	2.24

SMR=standardized mortality ratio

Table 5. Calibration of PIM 3 score based on quartiles of risk

Quartiles of risk (%)	Mean PIM 3 score	Total, n(%) (N=69)	Non-survivors (n=28)		Survivors (n=41)		SMR	AUC (95% CI)
			Observed, n	Expected, n(%)	Observed, n(%)	Expected, n(%)		
1-15.45	9.21	44 (63.77)	11	4.05 (0.09)	33 (75)	39.95 (90.8)	2.7	0.715 (0.585 to 0.845)
15.46-29.91	22.76	12 (17.4)	7	2.73 (22.7)	5 (41.67)	9.27(77.25)	2.56	0.613 (0.435 to 0.791)
29.92-44.37	37.78	8 (10.14)	5	2.27 (37.8)	2 (33.3)	3.73 (62.2)	1.76	0.648 (0.417 to 0.878)
44.38-58.84	51.44	6 (8.69)	5	3.08 (51.3)	1 (16.67)	2.92 (48.67)	1.62	0.751 (0.578 to 0.924)

Table 6. Performance of PIM3 score related to age, nutritional status, and primary diagnosis

Variables	Mean PIM 3 score	n	Non-survivors (n=28)		Survivors (n=41)		Chi-square Hosmer Lemeshow Goodness of fit	SMR
			Observed, n(%)	Expected, n(%)	Observed, n(%)	Expected, n(%)		
Age group, n(%)								
< 12 months	27.53	10	4	2.75 (27.5)	6 (60)	7.25 (72.5)	0.57	1.25
12-59 months	16.85	24	9	4.04 (16.8)	15 (62.5)	19.9 (83.2)	6.08	2.23
60-119 months	19.45	24	11	4.7 (19.45)	13 (54.2)	19.3 (80.4)	8.44	2.34
> 120 months	10.78	11	4	1.2 (10.78)	7 (63.3)	9.8 (89)	6.53	3.33
Nutritional status, n(%)								
Malnutrition	27.42	4	2	1.09 (27.4)	2 (50)	2.91 (72.7)	0.76	1.83
Undernutrition	18.92	22	11	4.16 (18.9)	11 (50)	17.8 (81)	11.25	2.64
Good nutrition	16.86	30	8	5.06 (16.86)	22 (73.3)	24.9 (83.1)	1.7	1.58
Overweight	17.74	4	3	0.7 (17.8)	1 (25)	3.3 (82.5)	7.56	4.3
Obesity	18.04	9	4	1.62 (18)	5 (55.56)	7.38 (82)	3.5	2.47
Diagnosis, n(%)								
Malignancy	18.75	12	7	2.25 (18.75)	5 (41.7)	9.75 (81.2)	10.03	3.11
Post-surgical procedure besides thoracic surgery	15.88	10	1	1.59 (15.9)	9 (90)	8.41 (84.1)	0.21	0.63
Dengue shock syndrome	22.57	13	6	2.93 (22.6)	7 (53.8)	10 (76.9)	3.22	2.04
Respiratory system	24.25	9	2	2.18 (24.2)	7 (77.8)	6.82 (75.8)	0.01	0.92
Central nervous system	17.77	8	8	1.42 (17.7)	0	6.58 (82.2)	30.49	5.64
Cardiology	15.77	6	3	0.95 (15.8)	3 (50)	5.05 (84.2)	4.43	3.16
Others*	11.50	11	1	1.26 (11.5)	10 (80)	9.74 (88.5)	0.05	0.79

*Others: snake bite, diabetic ketoacidosis, post-thoracic surgery

Table 7 and **Figure 1** show the area under the curve of PIM 3 score ROC analysis. The AUC of the PIM 3 score was 0.771 (95% CI 0.67 to 0.75), and the AUC of the PIM 3 quartiles of risk was >0.7 (0.715). An AUC of 70-80% is considered to be accurate for predicting death and survival.

Discussion

Our study investigated 69 PICU patients at MHH, Palembang, South Sumatera, during a-3 months period, in order to evaluate the performance of PIM 3, in terms of calibration and discrimination ability

Table 7. Discrimination of PIM 3 and PIM 3 quartiles of risk as related to death

Variables	AUC	SE	95%CI
PIM 3 score	0.771	0.061	0.651 to 0.891
PIM 3 quartiles of risk	0.715	0.003	0.585 to 0.845

compare to those observed in developed countries. The prevalence of mortality in our PICU was 40.58%, similar to that of Honna *et al* (45.7%).[17] The prevalence of PICU mortality was also similar to that from India in 2011 (46.2%),[18] but higher than in Pakistan in 2006 (28.7%),[19] Iran in 2008 (15%),[20] and Egypt in 2013 (8.5%).[21]

The PIM 3 model uses score variables to get a percentage of mortality probability. Overall, in the originating studies, the PIM 3 mortality risk were 3.9% in Scotland and United Kingdom and 2.9% in Australia and New Zealand. Validation of the PIM3 model has never been done in a developing country, but validation of the second iteration of PIM (PIM 2) was done in in Iran, Pakistan, India, and Africa.[14,19-21]

We found that PIM 3 scores in non-survivors ranged from 2.73% to 58.84% with a mean of 26.08%. For survivors, mean PIM 3 score was 11.38%, ranging from 1.02-53.9%. Most subjects (52.17%) were in the 5-20% range. Higher PIM 3 score means higher mortality probability. Of those with PIM 3 scores >30% score, 76.9 died, while 23.1% survived. Mann-Whitney test revealed a statistically significant difference in PIM 3 score between non-survivors and survivors (P=0.0001). This mortality probability was much higher than documented rates at others PICUs where validation of ordinary prognostic scores had been undertaken. As such, the standard of care in our PICU may be worse then PICUs in developed countries. The following factors may influence PICU performance: differences of clinical characteristics, demographic population, health status, human sources (nurse to patient ratio, human exhaustion factor, subjective factors in evaluating PIM 3 score, the doctor's ability in treat and make accurate and timely decisions related to clinical condition, as well as nursing skill in getting arterial blood specimens), and validity of the laboratory for measuring based excess.[22] Mohammad Hoesin Hospital, Palembang, as a teaching hospital, placed senior of pediatric residents as doctors on duty in the emergency room

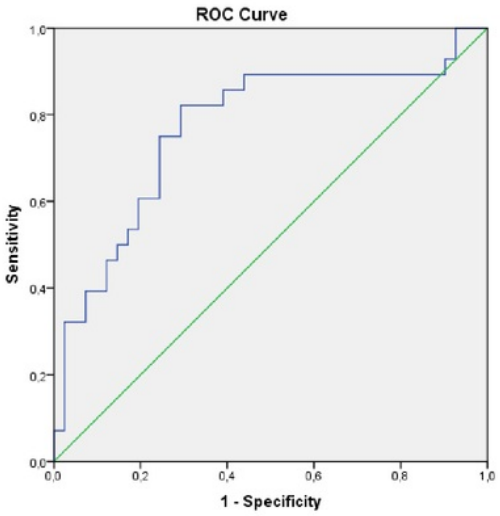

Figure 1. ROC Curve Analysis for PIM3 Scores

and PICU under pediatric intensivist supervision. The skill of these doctors could subjectively influenced the measures of PIM 3's variables, such as the size of pupillary reaction to bright light, the decision to gave mechanical ventilation before the first hour in PICU, and skill in setting mechanical ventilation support and FiO2 for patients. These factors could influence the final PIM 3 score, even though we have trained aur staff in clear operational procedures to standardize evaluations in an effort to minimize bias. Nevertheless, some subjects were stabilized in a tertiary hospital or private clinic prior to referral to MHH, which may also have influenced the PIM 3 score variables.

The calibration of the PIM3 model using SMR was calculated by dividing the number of observed deaths by the number of expected deaths. Chi-square statistical analysis was performed with the formula: $\Sigma(O-E)2/E$, in which is O=observed and E=expected, for survivors and non-survivors in each interval group. Then we used Hosmer and Lemeshow test for goodness-of-fit based on the four PIM3 score interval group of 1-5%, 5-20%, 20-30%, and >30%. The SMRs for all interval was >1, ranging from 1.7-2.2, except for the 1-5% group which had SMR 7.5, indicating that the actual mortality was 7.5 times higher than expected in the 1-5% interval group. Multiple factors may have influenced these results, such as poor referral system, delayed initial therapy,

or complications which could have changed outcome, such as hospital-acquired infection, malnutrition caused by hospitalization, or ventilator-associated pneumonia. The ability of PIM 3 to predict mortality was 18.07%, which was less than the actual observed mortality of 40.5%. The overall SMR was 2.24, which meant that the PIM 3 model underpredicted deaths in our facility. As such, the mortality probability was 2.24 times higher in MHH compared to the original PIM 3 score. Other studies in developing countries like India, Pakistan, and Egypt reported SMRs from PIM 2 scores of 3.3, 1.57, and 1.92, respectively.[19,21] On the other hand, a Japanese study reported PIM 2 SMR <1 (0.77), which meant the score had overpredicted mortality.[23]

The discrimination was evaluated by AUC. Discrimination is considered to be very good for ROC >0.9, good for 0.80–0.90, and fair for 0.70–0.80. The AUC was calculated as 0.771 (95%CI 0.651 to 0.951), lower than AUC in the original places where PIM 3 score was undertaken. However, AUCs were found in developed countries as follows: Australia 0.91, New Zealand 0.90-0.93, United Kingdom 0.85, and Scotland 0.84-0.86.14 Studies of PIM2 in developing countries in Africa showed good discrimination with AUC values of 0.841 (95%CI 0.78 to 0.90),[24] Pakistan 0.81 (95%CI 0.75 to 0.87), and Iran 0.795 (95%CI 0.715 to 0.875).[20]

In conclusion, PIM 3 score has quite good calibration in our set-up. The PIM 3 score can be used in PICU, MHH, Palembang by correcting for the expected probability of death by multiplying the original PIM 3 score by 2.24. This calibration needs to be done due to the presumed lower standard of care at MHH compared to the standards in the originating PIM 3 institutions. The standard of care may be influenced by multiple factors, such as clinical characteristics, demographic population, health status, human resources, medical equipment, good laboratory, and more.

Conflict of Interest

None declared.

References

1. Frankel, Lorry R; DiCarlo, Joseph V. Pediatric intensive care. In Bernstein, Daniel; Shelov, Steven P. Pediatrics for medical students. 2nd ed. Philadelphia: Lippincott Williams & Wilkins; 2003. p. 541. ISBN 978-0-7817-2941-3.
2. Knaus WA, Draper EA, Wagner DP, Zimmerman JE. Prognosis in acute organ-system failure. Ann. Surg. 1985;202;6:685-93.
3. Proulx F, Joyal JS, Mariscalco MM, Leteurtre S, Leclerc F, Lacroix J. The pediatric multiple organ dysfunction syndrome. Pediatr Crit Care Med. 2009;10:12-22. doi: 10.1097/PCC.0b013e31819370a9.
4. Tantalean JA, Leon RJ, Santos AA, Sanchez E. Multiple organ dysfunction syndrome in children. Pediatr Crit Care Med. 2003;4:181-5.
5. Pollack M. Prediction of outcome. In: Fuhrman BO, Zimmerman JJ, editors. Pediatric critical care. 2nd ed. St Louis: Mosby; 1998; pp. 152-61.
6. Tarnow-Mordi WO, Hau C, Warden A, Shearer A.J. Hospital mortality in relation to staff workload: a 4-year study in an adult intensive-care unit. Lancet. 2000;356:185-9.
7. Hartman ME, Cheitetz IM. Pediatric emergencies and resuscitation. In: Behrman RE, Kliegman RM, Jenson HB, editors. Nelson textbook of pediatrics. 19th ed. Philadelphia: Saunders; 2011. p. 279-296.
8. Eghbalkhah A, Salamati P, Sotoudeh K, Khashayar P. Evaluation and comparison of admission and discharge criteria in admitted patients of pediatric intensive care unit of Bahrami Children's Hospital with the criteria of American Academy of Pediatrics. Iran J Pediatr. 2006;16:399-406.
9. Slater A. Monitoring outcome in paediatric intensive care. Paediatr Anaesth. 2004;14:113-6.
10. Pollack MM, Ruttimann UE, Getson PR. Pediatric risk of mortality (PRISM) score. Crit Care Med. 1988;16:1110-6.
11. Pulido-Barba P, Porras-Ramirez B, Vazquez de Lara-Cisneros LG. The validity of the index of pediatric mortality risk (PRISM) in a pediatric intensive care unit. Bol Med Hosp Infant Mex. 1993;50:861-4.
12. Shann F, Pearson G, Slater A, Wilkinson K. Paediatric index of mortality (PIM): a mortality prediction model for children in intensive care. Intensive Care Med. 1997;23:201-7.
13. Straney L, Clements A, Parslow RC, Pearson G, Shann F, Alexander J, *et al*. Paediatric index of mortality 3: an updated model for predicting mortality in pediatric intensive care. Pediatr Crit Care Med. 2013;14:673-81.
14. Eulmesekian PG, Perez A, Minces PG, Ferrero H. Validation of pediatric index of mortality 2 (PIM2) in a single pediatric

intensive care unit of Argentina. Pediatr Crit Care Med. 2007;8:54-7.

15. Slater A, Shann F, Pearson G, Paediatric Index of Mortality (PIM) Study Group. PIM 2: a revised version of the Paediatric Index of Mortality. Intensive Care Med. 2003;29:278-85.
16. Australian and New Zealand Intensive Care Society (ANZICS) [homepage on the internet]. Carlton South: The Association; ©2014 [cited 2016 May 15]. PIM3 calculator. Available from: http://www.anzics.com.au/_layouts/15/WopiFrame.aspx?sourcedoc=%7B92B9A3CA-C2AC-4CC5-9FB9-1BD16058E777%7D&file=PIM3%20Calculator.xlsx&action=default&DefaultItemOpen=1.
17. Honna L, Triratna S, Triwani T, Theodorus T. Use of pediatric logistic organ dysfunction in determuning prognosis among pediatric intensive care unit patients. Pediatr. Indones. 2010;50:347-50.
18. Gandi J, Sangareddi S, Varadarajan P, Suresh S. Pediatric index of mortality 2 score as an outcome predictor in pediatric intensive care unit in India. Indian J Crit Care Med. 2013;17:288-91.
19. Qureshi AU, Ali AS, Ahmad TM. Comparison of three prognostic scores (PRISM, PELOD, and PIM 2) at pediatric intensive care unit under Pakistani circumstances. J Ayub Med Coll Abbottabad. 2007;19:49-53.
20. Salamati P, Talaee S, Eghbalkhah A, Chaman R, Mokhtari Z, Azarshahin M. Validation of pediatric index of mortality-2 scoring system in a single pediatric intensive care unit in Iran. Iran J Pediatr. 2012;22:481-6.
21. Youssef MR, Mosleh H, Labib JR. Assessment of the performance of the pediatric index of mortality 2 (PIM2) among Egyptian pediatric patients admitted to the intensive care. Egyptian Pediatric Association Gazette. 2014;62:65-71.
22. Zimmerman JE. Measuring intensive care unit performance: a way to move forward. Crit Care Med. 2002;30:2149–50.
23. Imamura T, Nakagawa, Goldman RD, Fujiwara T. Validation of pediatric index of mortality 2 in a single pediatric intensive care unit in Japan. Intensive Care Med. 2012;38:649-54.
24. Solomon LJ, Morrow BM, Argent AC. Paediatric index of mortality scores: an evaluation of function in the paediatric intensive care unit of the Red Cross War Memorial Children's Hospital. S Afr J Crit Care. 2014;30:9-13.

The pediatric index of mortality 3 score to predict mortality in a pediatric intensive care unit in Palembang, South Sumatera, Indonesia.pdf

ORIGINALITY REPORT

18%	15%	8%	5%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

MATCH ALL SOURCES (ONLY SELECTED SOURCE PRINTED)

12%

★ www.paediatricaindonesiana.org

Internet Source

Exclude quotes	On	Exclude matches	< 1%
Exclude bibliography	On		