

# Prevalence of Acute Renal Failure in the Intensive Care Unit of the CHU la Référence Nationale in Ndjamen

Hamat Ibrahim<sup>1\*</sup>, Charfadine Senoussi Abdelkerim<sup>1</sup>, Yakoub Hissein Ali<sup>1</sup>, Bonté Adjougoult Koboy<sup>2</sup>, Djibril Youssouf<sup>1</sup>, Haoua Youssouf Seid<sup>1</sup>, Nassima Hissein<sup>1</sup>, Djibrine Mahamat Djibrine<sup>1</sup>, Zahra Eltigani Ahmed<sup>1</sup>

<sup>1</sup>Nephrology and Haemodialysis Department of CHU la Référence Nationale (CHU-RN), N'Djamena, Tchad

<sup>2</sup>Polyvalent Intensive Care Units of CHU la Référence Nationale (CHU-RN), N'Djamena, Tchad

Email: \*doctahmat@yahoo.fr

**How to cite this paper:** Ibrahim, H., Senoussi Abdelkerim, C., Hissein Ali, Y., Adjougoult Koboy, B., Youssouf, D., Youssouf Seid, H., Hissein, N., Mahamat Djibrine, D. and Eltigani Ahmed, Z. (2025) Prevalence of Acute Renal Failure in the Intensive Care Unit of the CHU la Référence Nationale in Ndjamen. *Open Journal of Nephrology*, 15, 82-89.

<https://doi.org/10.4236/ojneph.2025.151008>

**Received:** January 8, 2025

**Accepted:** March 9, 2025

**Published:** March 12, 2025

Copyright © 2025 by author(s) and Scientific Research Publishing Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

## Abstract

**Introduction:** Acute renal failure (ARF) is a frequent clinico-biological syndrome in the intensive care unit. The aim of our study was to determine the prevalence of ARF in the general intensive care unit. **Patients and Method:** This was a cross-sectional study conducted over a period of 08 months in the intensive care unit of the CHU la Référence Nationale (CHU-RN) in N'Djamena. All patients presenting with ARF on admission were included. The clinical, biological and morphological characteristics of IR were studied. Data were analyzed using SPSS version 18.0 (Statistique Package for Social Sciences 18.0). **Results:** We recorded 206 ICU admissions, including 52 cases of acute renal failure, giving a prevalence of 25.2%. AKI accounted for 92.3%. The mean age of patients was  $47 \pm 17.1$  years [19 - 86 years]. The sex ratio was 1.5. Functional signs were dominated by oligoanuria (84.6%) and disturbed consciousness (78.8%). Mean creatinemia was 125.2 mg/L [28.6 - 588.3 mg/L], mean uremia 2.3 g/L [0.7 - 6.0 g/L]. Ultrasonography was normal in 23.1%, showed dilation of the excretory tract on a single kidney in 1.9%, and stigmata of chronicity in 5.8%. According to the KDIGO classification of AKI, we found stage 3 in 53.9%. ARF was organic in 67.8%. Infectious causes accounted for 44.2%. Multivisceral failure syndrome was associated with ARF in 69.2%. Management was based on rehydration (82.7%), antibiotic therapy (53.8%), transfusion (42.3%), extrarenal purification (9.6%) and obstruction removal (3.8%). The outcome was favorable in 15.4% of cases, with recovery of renal function, and unfavorable in 84.6%, with 76.9% of deaths. The leading causes of death were multivisceral failure syndrome and AKI ( $p = 0.036$ ). ICU stay was 4.4 days. **Conclusion:** Our study highlights the high mortality of ARF due

to the multiplicity of causes, and calls for urgent measures to reduce its prevalence.

## Keywords

Acute Renal Failure, Resuscitation, CHU-RN, Chad

## 1. Introduction

Acute renal failure (ARF) corresponds to a sudden reduction in the kidneys' ability to purify uremic toxins and regulate the body's electrolyte balance. It is manifested by a rise in plasma urea and creatinine concentrations and/or a reduction in urine volume [1]. The incidence of ARF in the ICU reported in the literature varies according to the definitions chosen [2]. More than 50% of patients hospitalized in intensive care develop AKI, and more than 10% of them require extrarenal renal replacement therapy (ERT) during their hospitalization [1] [2]. KDIGO's three-stage definition correlates the intensity of AKI with ICU mortality [3] [4]. This classification necessitates close monitoring of plasma creatinine and diuresis, and therefore better diagnosis. In the ICU, ARF is most often multifactorial, secondary to hypovolemia and sepsis inducing renal hypoperfusion and acute tubular necrosis [5] [6]. Prevention is essentially based on identifying patients at risk, avoiding nephrotoxic factors and maintaining renal perfusion by controlling patients' blood volume and renal perfusion pressure [7]. In Chad, a developing country where the health system is under construction, with only 5 nephrologists for around 18 million inhabitants, epidemiological data on ARF in the ICU are non-existent. The aim of our study was to determine the prevalence of ARF in polyvalent intensive care units.

## 2. Patients and Method

This was a cross-sectional, descriptive and analytical study conducted over a period of eight (08) months (July 1 to December 31, 2021) in the intensive care unit of the Centre Hospitalier Universitaire la référence nationale (CHU RN) in N'Djamena (Chad). Patients were recruited consecutively. Patients aged 18 and over with ARF on admission or during hospitalization in the intensive care unit were included. Data were collected from patient records using a pre-established questionnaire including clinical, para-clinical, therapeutic and evolutionary variables.

**Table 1.** Definition of acute renal failure according to the KDIGO consensus.

	Plasma creatinine	Diuresis
Stage 1	Increase of 26.5 mmol/L over baseline creatinine in 48 hours OR increase in plasma creatinine from 1.5 to 1.9 times baseline creatinine in 7 days	<0.5 ml/kg/h over 6 to 12 hours
Stage 2	2- to 2.9-fold increase over reference creatinine in 7 days	<0.5 ml/kg/h ≥12 hours

**Continued**

Stage 3	3-fold increase over reference creatinine in 7 days OR Plasma creatinine > 354 mmol/L OR Initiation of renal replacement therapy	<0.3 ml/kg/h $\geq$ 24 hours OR Anuria $\geq$ 12 hours
---------	--	--

ARF was defined according to the KDIGO 2021 criteria (**Table 1**).

Anuria is defined by diuresis < 100 ml in 12 hours, oliguria by diuresis < 0.3 ml/kg/h, diuresis is preserved when it is  $\geq$ 0.5 ml/kg/h [8]. Multi-visceral failure syndrome was defined by the TRAN score (**Table 2**).

**Table 2.** Visceral failure definitions, according to [8].

1. Cardiovascular failure
  - Mean arterial pressure  $\leq$  50 mmHg
  - vascular filling or vasoactive drugs to maintain systolic blood pressure > 100 mmHg
  - Heart rate  $\leq$  50 b/min<sup>-1</sup>
  - Ventricular tachycardia or ventricular fibrillation or cardiac arrest or myocardial infarction
2. Respiratory failure
  - Respiratory rate  $\leq$  5 or  $\geq$  49 c/min<sup>-1</sup>
  - Mechanical ventilation for at least 3 days or with IOF 2 > 0.4 or PEEP > 5 cm H<sub>2</sub>O
3. Renal failure (in patients without chronic renal failure)
  - Creatinine  $\geq$  280  $\mu$ mol/L<sup>-1</sup> (3.5 mg/dL)
  - Extra-renal purification
4. Neurological failure
  - Glasgow score  $\leq$  6 (in the absence of sedation)
5. Hematological failure
  - Hematocrit  $\leq$  20%
  - Leukocytosis  $\leq$  300/mm<sup>3</sup>
  - Platelets  $\leq$  50,000/mm<sup>3</sup>
  - DIC
6. Liver failure
  - Clinical jaundice or total bilirubin  $\geq$  51  $\mu$ mol/L<sup>-1</sup> (3 mg/dL<sup>-1</sup>)
  - SGPT >  $\times$ 2
  - Hepatic encephalopathy
7. Gastrointestinal failure
  - Acute bleeding ulcer (requiring more than 2 blood units/24 h)
  - Acute hemorrhagic pancreatitis, acute acalculous cholecystitis, necrotizing enterocolitis, digestive perforation

Data were collected and analyzed using Excel 2010 and SPSS version 18.0 (Statistique Package for Social Sciences 18.0). Results were given in terms of frequency and percentage for qualitative variables, and by calculating means with their standard deviation for quantitative variables. Analytical studies were carried out using cross-tabulations. Means with standard deviations and percentages were compared using the Student's t-test and the Chi-square test, according to their conditions of applicability, with a significance threshold if "p" < 0.05.

Ethical Considerations: we obtained research authorization from the admin-

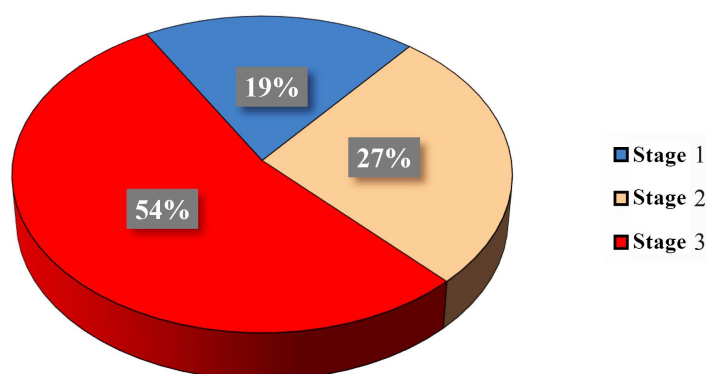
istration of the Centre Hospitalier et Universitaire; the informed consent of the patients or their parents; and the data were kept strictly confidential.

### 3. Results

During the study period, we identified 206 patients admitted to the general intensive care unit at RN University Hospital, 52 of whom had presented with ARF, giving a prevalence of 25.2%. The mean age was  $47 \pm 17.1$  years [19 - 86 years]. The 19 - 39 age group followed by the 40 - 59 age group accounted for 38.5% and 36.5% respectively, with a sex ratio of 1.5. The departments from which patients came were the reception and emergency department (67.3%), nephrology (19.2%), internal medicine (15.4%) and surgery (3.8%). Terrain was dominated by hypertension (28.8%), diabetes (23.1%) and chronic renal failure (11.5%). The main reason for admission to intensive care was altered consciousness (42.3%), followed by sepsis (26.9%) and hemodynamic instability (17.3%). Community-acquired ARF accounted for 92.3% and hospital-acquired ARF for 7.7%. Functional signs were dominated by oligoanuria at 84.6% and impaired consciousness at 78.8%, with a mean Glasgow score of  $9.2 \pm 2.7$  [5]-[15] (**Table 3**).

**Table 3.** Clinical characteristics.

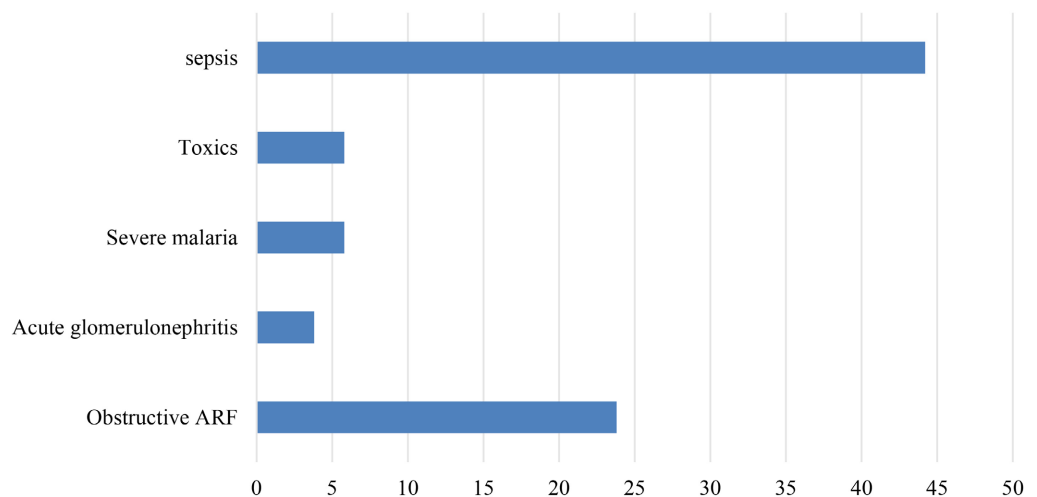
Clinical features	Percentage (%)
Oliguria	71.2
Anuria	13.5
Consciousness disturbance	78.8
Tachycardia	65.4
Hypotension	40.4
Dehydration	28.8
IMO	25.0
Fever	17.3
Pulmonary condensation syndrome	17.3
Ascites	9.6



**Figure 1.** Stage of AKI according to KDIGO.

Mean creatinemia was 125.2 mg/L [28.6 - 588.3 mg/L], mean blood urea 2.3 g/L [0.7 - 6.0 g/L]. KDIGO stage 3 ARF accounted for 53.9% of cases (**Figure 1**). The blood count revealed anemia in 65.4% of patients, with a mean hemoglobin of 9.6 g/dl [3.4 - 16.6 g/dl]. Mean CRP was 99.4 mg/l [0.55 - 530 mg/l]. Ultrasound was normal in 23.1% (n = 12), and showed dilatation of the excretory tract on a single kidney in one patient (1.9%), and stigmata of chronicity in three patients (5.8%).

ARF was functional in 28.4% of patients, obstructive in 3.8% and organic in 67.8%. ARF related to a septic mechanism was found in 44.2% of cases (**Figure 2**), with a statistically significant correlation ( $p = 0.030$ ) between the causes and the KDIGO stage of ARF. Sixty-nine percent (69.2%) of patients had at least one multivisceral failure associated with ARF. Hematological failure predominated (42.3%), followed by cardiac (19.2%) and respiratory (19.2%) failure. Management of ARF patients was based on rehydration (82.7%), antibiotic therapy (53.8%), transfusion (42.3%), and obstruction removal in two patients (3.8%). Five patients (9.6%) required extrarenal purification.



**Figure 2.** Causes of AKI.

Progression was marked by complete recovery of renal function in 15.4% (n = 8) of patients. Four patients progressed to chronic renal failure. Forty patients (76.9%) died. Most deaths were related to multivisceral failure syndrome and the KDIGO stage of AKI, with statistical significance ( $p = 0.036$ ). The average length of stay of patients in intensive care was 4.4 days [1 - 48 days/dl].

#### 4. Discussion

The incidence of ARF in the ICU varies according to the type of admission and diagnostic criteria. In our study, the frequency of ARF in the ICU was 25.2%. In Morocco, it was 13.4% [9]. In Europe, the incidence is 30% [8]. These results confirm the findings of the literature, according to which the incidence of ARF in intensive care varies between 3% and 30% [10] [11]. In our series, males accounted for 55.8%, with a mean age of  $47 \pm 17.1$  years [19 - 86 years]. In Morocco, Kerzaz

R *et al.* reported an average age of 44.69 years ( $\pm 19.70$  years) [12]. In the West, it occurs between 60 and 80 years of age, with maximum frequency in the population aged over 75 [13].

The main reason for admission to intensive care was altered consciousness (42.3%), and the majority of patients (84.6%) presented with oligoanuria, with disturbed consciousness found in 78.8% of patients. Kerzaz R *et al.*, in Morocco, reported oligoanuria and disturbed consciousness in 92% and 60% of their series respectively [12]. This may be attributable to uraemic encephalopathy, but may also be part of multivisceral failure, probably linked to a pre-existing chronic pathology [14]. In our series, risk factors accounted for 57.7% of cases, including hypertension (28.8%), diabetes (23.1%) and CKD (11.5%). In Mali, 61.60% of patients were exposed to one or more risk factors [15], whereas in Burkina Faso, Coulibaly G *et al.* found 35.8% of cases [16].

AKI was community-acquired in 92.3% of cases, and of organic origin in 67.8% of patients. The same finding has been reported by Brivet FG and Guerin C *et al.*, where AKI is most often seen on admission [10] [17]. Several mechanisms could explain the occurrence of AKI in the hospital setting, such as volume depletion, arterial hypotension, sepsis, use of vasopressors, exposure to nephrotoxic “substances”, and also the additive interaction of multiple risk factors and associated conditions [18]. Sepsis is by far the most frequent mechanism of ARF in the intensive care setting, with incidence ranging from 32.7% to 75.9% depending on the series [12] [19]. In our study, sepsis accounted for 44.2% of organic causes. Studies have shown that sepsis and renal hypoperfusion preceded the onset of acute renal failure in 70% of cases, while 72% of intensive care patients in renal failure presented with sepsis [10] [19]. Their presence calls for vigilance in optimizing blood volume and limiting any additional nephrotoxicity [6].

Therapeutically, vascular filling with crystalloids was the most commonly used treatment for hemodynamic failure (82.7%), and antibiotic therapy in 53.8% of cases. The incidence of ARF requiring extra-renal replacement therapy (ERT) in the ICU varies from one series to another. In our series, EER was indicated in 20 patients (38.46%), but only five (9.61%) patients had received EER, involving an average of two hemodialysis sessions lasting 2 hours per session. In the study by Cruz DN and Imane A, the incidence was 30% and 33.3% respectively [9] [20]. On the other hand, 4% and 6% depending on the series [3] [21]. This could be explained by the absence of consensus criteria for the indication of EER and the type of department recruitment. In our study, most patients requiring EER were unable to benefit from it for various reasons: the unavailability of dialysis machines in the ICU, the distance between the two departments posed logistical and packaging problems for patients with hemodynamic instability, and above all the absence of direct coordination between departments for absolute nephrological emergencies.

We recorded 40 deaths (76.9%), the causes of death being related to multivisceral failure syndrome and ARF ( $p = 0.036$ ). This result is in line with mortality

data for ARF reported in the intensive care setting, which varies between 56% and 79% [17]. The high proportion of mortality in our series could be explained essentially by the delay in admission of patients to the ICU, the severity of the initial clinical picture, notably multivisceral failure due to septic states, which are poor prognostic factors [22]. At the end of the stay, 15.4% (n = 8) patients had fully recovered their renal function. Four patients (7.7%) had progressed to chronic renal failure. The average length of stay for patients in intensive care in our cohort was 4.4 days [1 - 48 days].

## 5. Conclusion

Despite technological advances and a better therapeutic approach, our study highlights the high mortality of AKI due to the multiplicity of causes and imposes urgent measures to reduce its prevalence.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

## References

- [1] Aniort, J., Deteix, P., Souweine, B., *et al.* (2019) Epidémiologie de l'insuffisance rénale aiguë. *Néphrologie & Thérapeutique*, **15**, 63-69.
- [2] Hoste, E.A.J., Bagshaw, S.M., Bellomo, R., Cely, C.M., Colman, R., Cruz, D.N., *et al.* (2015) Epidemiology of Acute Kidney Injury in Critically Ill Patients: The Multinational AKI-EPI Study. *Intensive Care Medicine*, **41**, 1411-1423. <https://doi.org/10.1007/s00134-015-3934-7>
- [3] Uchino, S. (2005) Acute Renal Failure in Critically Ill Patients: A Multinational, Multicenter Study. *Journal of the American Medical Association*, **294**, 813-818. <https://doi.org/10.1001/jama.294.7.813>
- [4] Ostermann, M. and Chang, R. (2008) Correlation between the AKI Classification and Outcome. *Critical Care*, **12**, Article No. R144. <https://doi.org/10.1186/cc7123>
- [5] The Kidney Disease Improving Global Outcomes (KDIGO) Working Group (2012) KDIGO Clinical Practice Guideline for Acute Kidney Injury. *Kidney International*, **2**, 1-138.
- [6] Klouche, K., Sandapa, D., Barrau, H. and Jonquet, O. (2010) Insuffisance rénale aiguë en réanimation—Prévention et traitement. *Réanimation*, **20**, 552-559. <https://doi.org/10.1007/s13546-010-0030-4>
- [7] Valette, X., Terzi, N. and du Cheyron, D. (2010) Quelle définition pour l'insuffisance rénale aiguë en réanimation? *Réanimation*, **19**, 431-440. <https://doi.org/10.1016/j.reaurg.2010.04.006>
- [8] Gaudry, S., Zucman, N. and Dreyfuss, D. (2015) Critères de début et d'arrêt de l'épuration extrarénale en réanimation. *Réanimation*, **24**, 400-405. <https://doi.org/10.1007/s13546-015-1028-8>
- [9] Imane, A.O. (2017) Prise en charge de l'insuffisance rénale aiguë en milieu de réanimation à l'hôpital militaire Avicenne de Marrakech. Université Gadi Ayyad.
- [10] Brivet, F.G., Kleinknecht, D.J., Loirat, P. and Landais, P.J.M. (1996) Acute Renal Failure in Intensive Care Units—Causes, Outcome, and Prognostic Factors of Hospital

- Mortality. *Critical Care Medicine*, **24**, 192-198.  
<https://doi.org/10.1097/00003246-199602000-00003>
- [11] Groeneveld, A.B.J., Tran, D.D., van der Meulen, J., Nauta, J.J.P. and Thijs, L. (1991) Acute Renal Failure in the Medical Intensive Care Unit: Predisposing, Complicating Factors and Outcome. *Nephron*, **59**, 602-610. <https://doi.org/10.1159/000186651>
- [12] Kerzaz, R. (2017) Insuffisance rénale aiguë en réanimation et périopératoire: Serie prospective de 42 cas. Université Sidi Mohammed Ben Abdellah.
- [13] Borni-Duval, C., Krummel, T., Bazin, D. and Hannedouche, T. (2011) Épidémiologie et pronostic de l'insuffisance rénale aiguë aux soins intensifs de néphrologie. *Néphrologie & Thérapeutique*, **7**, 298-299. <https://doi.org/10.1016/j.nephro.2011.07.083>
- [14] Mehta, R.L., Bouchard, J., Soroko, S.B., Ikizler, T.A., Paganini, E.P., Chertow, G.M., et al. (2010) Sepsis as a Cause and Consequence of Acute Kidney Injury: Program to Improve Care in Acute Renal Disease. *Intensive Care Medicine*, **37**, 241-248. <https://doi.org/10.1007/s00134-010-2089-9>
- [15] Lamine, T. (2014) Insuffisance rénale aiguë en réanimation: Facteurs étiologiques et pronostiques. Université des sciences, des techniques et des technologies de Bamako. <https://www.bibliosante.ml/handle/123456789/5136>
- [16] Coulibaly, G., Lengani, H.Y.A., Sondo, K.A., Konvolbo, H.P., Diendéré, É.A., Nitiéma, I.J., et al. (2020) Épidémiologie de l'insuffisance rénale aiguë au cours de la dengue dans la ville de Ouagadougou. *Néphrologie & Thérapeutique*, **16**, 27-32. <https://doi.org/10.1016/j.nephro.2019.04.002>
- [17] Guerin, C., Girard, R., Selli, J., Perdrix, J. And Ayzac, L. (2000) Initial versus Delayed Acute Renal Failure in the Intensive Care Unit. *American Journal of Respiratory and Critical Care Medicine*, **161**, 872-879. <https://doi.org/10.1164/ajrccm.161.3.9809066>
- [18] Payen, D. and Berton, C. (2005) Insuffisance rénale aiguë: Épidémiologie, incidence et facteurs de risque. *Annales Françaises d'Anesthésie et de Réanimation*, **24**, 134-139. <https://doi.org/10.1016/j.annfar.2004.11.017>
- [19] Benouaz, S., Toudert, K., Batouche, D.D., Benouaz, N.A., Meghraoui, H. and Mentouri, Z. (2017) Profil épidémiologique et facteurs pronostiques de l'insuffisance rénale aiguë en réanimation. *Néphrologie & Thérapeutique*, **13**, 401. <https://doi.org/10.1016/j.nephro.2017.08.313>
- [20] Cruz, D.N., Bolgan, I., Perazella, M.A., Bonello, M., de Cal, M., Corradi, V., et al. (2007) North East Italian Prospective Hospital Renal Outcome Survey on Acute Kidney Injury (NEiPHROS-AKI). *Clinical Journal of the American Society of Nephrology*, **2**, 418-425. <https://doi.org/10.2215/cjn.03361006>
- [21] Metnitz, P.G.H., Krenn, C.G., Steltzer, H., Lang, T., Ploder, J., Lenz, K., et al. (2002) Effect of Acute Renal Failure Requiring Renal Replacement Therapy on Outcome in Critically Ill Patients. *Critical Care Medicine*, **30**, 2051-2058. <https://doi.org/10.1097/00003246-200209000-00016>
- [22] Bagshaw, S.M., George, C. and Bellomo, R. (2007) Changes in the Incidence and Outcome for Early Acute Kidney Injury in a Cohort of Australian Intensive Care Units. *Critical Care*, **11**, R68. <https://doi.org/10.1186/cc5949>