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A survey on the prevalence of health care–associated infections at the Fann University Hospital in Dakar, Senegal

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ABSTRACT

Objectives: This study aimed to determine the prevalence of health care–associated infections (HAIs) at Fann Hospital, describe the profile of patients with HAI, and identify the causative pathogens.
Methods: This was a cross-sectional survey of the records of patients hospitalized in eight departments of the Fann University Hospital for a microbiologically confirmed HAI from January 1, 2024 to March 31, 2024. Data were collected using an HAI surveillance form and analyzed using R software version 4.4.0.
Results: Over a 3-month period, 62 cases of HAI were recorded out of a total of 1725 patients, giving a hospital attack rate of 3.5%. The median age of the patients was 59 years (interquartile range: 68-47). Males predominated (54.8%). Hospitalized patients came directly from their homes (40.3%) or from other university hospitals (35.5%). Arterial hypertension (29%) and diabetes mellitus (19.3%) were the main comorbidities. A history of previous surgery was found in 8% of the cases. Fever was the most common clinical manifestation (71%), followed by respiratory symptoms (29%). The medical devices used were venous (100%) and urinary catheters (54.5%). The most frequently isolated bacteria were *Pseudomonas spp* (23.6%), *Staphylococcus aureus* (21.8%), and *Escherichia coli* (21.8%). In terms of the resistance phenotype, 43.6% and 21.8% of patients had extended-spectrum β-lactamase–producing Enterobacteriaceae and methicillin-resistant *S. aureus*, respectively. During hospitalization, 45 patients received nonspecific antibiotic therapy at the time of HAI. Death occurred in 11 patients, representing a fatality rate of 17.7%.
Conclusions: The quarterly prevalence of HAIs was high in our hospital. Therefore, it is necessary to investigate the factors associated with their occurrence.

Introduction

A health care–associated infection (HAI) is one that occurs during or after a patient's care (diagnostic, therapeutic, or preventive) and if it was neither present nor in incubation at the start of care within a period of ≥48 hours or greater than the incubation period [1]. These include nosocomial infections, defined as those contracted in a health care establishment and infections contracted during care provided outside a health care facility [1].

HAIs are among the most common adverse events in health care provision and a major public health problem with an impact on morbidity, mortality, and quality of life [2]. These infections pose significant social and economic burdens. In developed countries, 5-15% of patients admitted to short-stay facilities contract HAI at some point. This risk is 2-20 times higher in low-income countries [2]. The prevalence of patients with at least one HAI in the European United States/European Economic Area sample was 7.1% (country range: 3.1-13.8%) [2]. In a review of the literature on HAIs in Africa from 1995 to 2009, the prevalence ranged from 2.5% to 14.9% [3]. A study in Mali, including 200 patients hospitalized in a surgical unit, reported a hospital incidence rate of 10.5%. Despite their scale, HAIs are unavoidable due to effective infection prevention and control measures [4].

In Senegal, a recent study conducted in the Infectious and Tropical Diseases Department of Fann Hospital reported 123 cases of HAIs in 1987 patients, with a hospital prevalence rate of 6.2% [5]. Furthermore, most studies of HAIs are fragmented and focus on individual wards and units. To combat these infections more effectively in health care estab-

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lishments, it is necessary to determine their severity. This is the context in which this study was conducted.

Objectives

The main objective of this survey was to contribute to the reduction in morbidity and mortality related to HAIs at Fann Hospital in Dakar.

Specifically, the aims of this study were to determine the overall prevalence of HAIs at Fann University Hospital, describe the clinical, biological, therapeutic, and evolutionary characteristics of patients with HAI; identify the pathogens causing HAIs at Fann Hospital; and determine their resistance profiles.

Study context

Fann Hospital is a tertiary-level hospital that provides specialized inpatient and outpatient care services. In addition to the Reception and Emergency Department, Fann Hospital has several departments, including the Infectious Diseases Department (SMIT); ENT Department; Pulmonology; Neurology; Neurosurgery; Psychiatry; Thoracic and Cardiovascular Surgery; Intensive Care Unit; Cardio-Pediatric Centre; Plastic Surgery; Geriatrics; Cardiology; Radiology Department; Stomatoodontology Department; and Bacteriology, Parasitology, and Biochemistry Departments. The survey focused only on inpatient departments.

Methodology

Type and period of study

This was a cross-sectional survey of the records of patients hospitalized in eight specialized departments of the Fann University Hospital from January 1, 2024 to March 31, 2024.

Study population and data collection

All patients who developed HAIs during their hospital stay were included in this study; patients whose records were incomplete or unclear were excluded.

HAI was defined as any infection occurring during or after the care of a patient (diagnostic, therapeutic, or preventive) and if it was neither present nor incubating at the start of care, lasting ≥48 hours or greater than the incubation period [1].

Resistance profiles were defined based on antibiogram results and advice from an antibiology expert at the Fann Infectious and Tropical Diseases Department. The methicillin-resistant *Staphylococcus aureus* (MRSA) profile was attributed to *S. aureus* isolates that were not sensitive to oxacillin and/or cefoxitin. Extended-spectrum β-lactamase (ESBL)–secreting bacteria) was attributed to strains resistant to penicillins, cephalosporins, and aztreonam but sensitive to amoxicillin/clavulanic acid (ticarcillin/clavulanic acid for *Pseudomonas* sp and *Enterobacter* sp). Carbapenem resistance was retained in the case of imipenem resistance.

Four investigators, all doctors trained in infectious diseases and geriatrics, were sent to the eight sites. Their fieldwork involved collecting information directly from patient records. Patients diagnosed with HAI were included after verifying the definition criteria.

For the included patients, data were collected using an HAI surveillance form designed by the Ministry of Health of Senegal. This included the following:

- Socio-demographic characteristics: age, sex, geographical origin.
- Clinical and biological characteristics: clinical and biological signs including full blood counts, electrolytes, and bacteriology (antibiotic susceptibility test).
- Therapeutic and evolutionary data: treatment, complications, death.

Data capture and analysis

Data were entered using Epi Data 3.1 and analyzed using R version 4.4.0. Categorical variables are described in terms of relative and absolute frequencies. Quantitative variables are presented as mean ± SD or median, depending on the type of distribution.

Results

Prevalence

Over a 3-month period, 62 HAI cases were recorded in 1725 patients, representing a hospital prevalence rate of 3.5%.

Distribution of patients according to socio-demographic characteristics

The median age of the participants was 59 years (interquartile range: 68-47) and the age group >60 years was the most represented at 45.2% (Figure 1). Most patients were male, with an male/female sex ratio of 1.21. The majority of patients were from the suburbs of Dakar (41.9%). The patients were from the informal sector in 22.6% of the cases, and 9.7% of the patients were unemployed.

Distribution of patients by hospital department

Patients with HAI were hospitalized in the Neurology Department (13 cases), followed by the Geriatrics Department (nine cases), Infectious and Tropical Diseases Department (nine cases), Pulmonology Department (eight cases), and Neurosurgery Department (eight cases). These patients came directly from their homes in 40.3% of the cases and were transferred from another university hospital in 35.5% of the cases (Table 1).

Distribution of patients by comorbidity, reason for hospitalization, and clinical symptoms

The comorbidities found were arterial hypertension (18 cases), diabetes (12 cases), and heart disease (six cases) and five patients had a history of surgery (Table 2).

The reasons for hospitalization were stroke in six patients, cerebral hematoma in five patients, meningoencephalitis (four patients), and pleural or pulmonary neoplasia (four patients).

Fever was the most frequent clinical manifestation in 44 patients. It was followed by respiratory signs in 18 patients, urinary signs in 15 patients, and cutaneous signs in 14 patients (Table 3).

Distribution of patients by infection risk factors

The medical devices most frequently used in our patients were venous catheterization in 100% of the cases, urinary catheterization in 54.6%, and peripheral ventricular shunts in 9%. A total of 20 patients

Table 1
Distribution of patients hospitalized for health care–associated infection by hospital department.

Department	Number	Percentage (%)
Neurology	13	21.0
Geriatry	9	14.5
SMIT	9	14,5
Neurosurgery	8	12.9
Pulmonology	8	12.9
Cardio-thoracic surgery	5	8.1
ENT	5	8.1
Cardio-pediatric Center (CUOMO)	4	6.5
Intensive care unit	1	1,6
Total	**62**	**100.0**

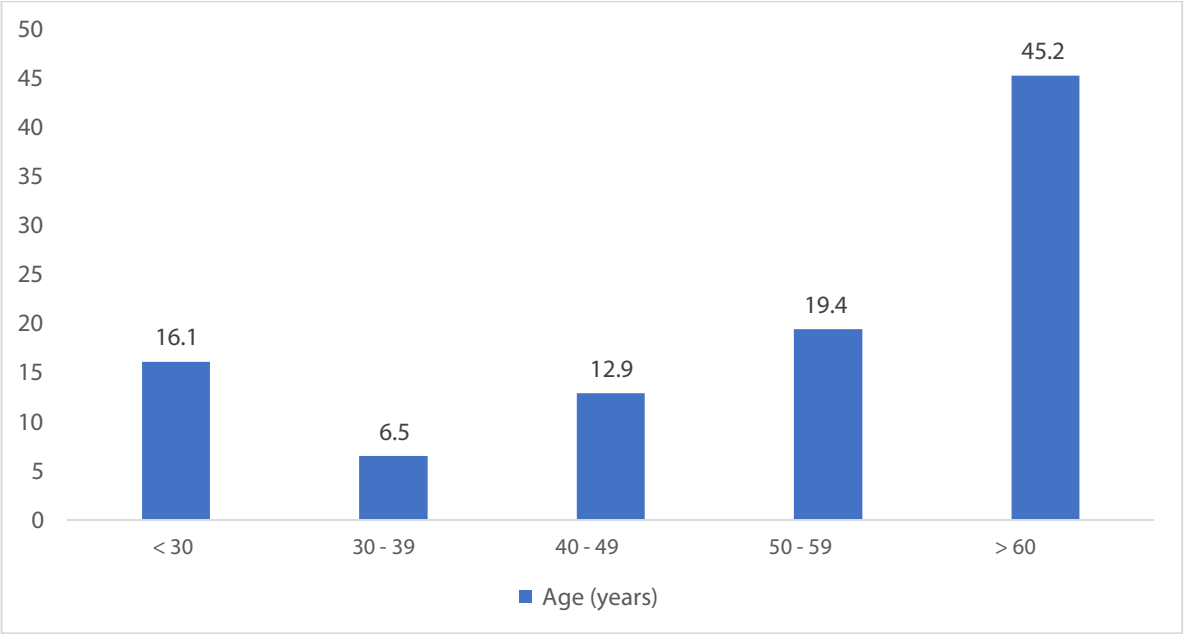

Figure 1. Distribution of patients hospitalized for health care–associated infection according to age.

Table 2
Distribution of patients hospitalized for health care–associated infection according to underlying pathology.

Underlying pathology	Number	Percentage (%)
Hypertension	18.00	29.03
Diabetes	12.00	19.35
Heart disease	6.00	9.68
Thrombo-embolic disease	4.00	6.45
HIV/AIDS	2.00	3.23
Neoplasia	2.00	3.23
Alcoholism	2.00	3.23
Cigarette smoking	4.00	6.45
Tuberculosis	1.00	1.61
Dermatologic disease	2.00	3.23
Surgical intervention	5.00	8.06

Table 3
Distribution of patients hospitalized for health care–associated infection according to clinical signs.

Clinical signs	Number	Percentage (%)
Fever	44.00	70.97
Respiratory Signs	18.00	29.03
Urinary Signs	15.00	24.19
Cutaneous signs	14.00	22.58
Digestive signs	4.00	6.45
ENT signs	3.00	4.84
Pain at infusion site	3.00	4.84
Neurologic signs	4.00	6.45

underwent surgery, including aseptic surgery in 15 patients. Antibiotic prophylaxis was instituted in eight patients, with ceftriaxone administered in three cases.

Distribution of patients according to biochemistry results

Most patients with HAI had a non-specific biological inflammatory response, with leukocytosis greater than 10,000/mm^3 in 43 patients, a strongly positive C-reactive protein level >100 mg/l in 39 patients, and anemia of inflammatory origin in 43 patients.

Distribution of patients by type of pathological sample and pathogens isolated

The biological products sampled were blood (42%), urine (35.5%), pus (21%), and cerebrospinal fluid (8%).

The most frequently isolated pathogens were gram-negative bacilli, including *Pseudomonas spp* (23.6), *Escherichia coli (*21.8%), *Klebsiella pneumoniae* (20%), *Enterobacter spp* (9%), and *Acinetobacter baumanii* (3.6%). *Staphylococcus aureus* was found in 12 patients and *Candida albicans* in two patients. ESBL bacteria were found in 24 patients, MRSA in 12, and wild-type phenotypes in four (Table 4).

Distribution of patients according to previous and current antibiotic treatment

A total of 15 (24.2%) patients had received antibiotic therapy in the previous 3 months, including five patients who had received third-generation cephalosporins.

During hospitalization, 45 patients received non-specific antibiotic therapy at the time of HAI, the majority of whom received single- and dual-antibiotic therapy (46.7% and 44.4%, respectively).

The most common dual-antibiotic therapy was a third-generation cephalosporin combined with an aminoglycoside (five patients).

Patients' evolution

The median hospital stay was 23 days, with extremes of 14 and 32 days, respectively. A total of 11 patients died, representing a fatality rate of 17.7%.

Discussion

This study has limitations. This was a retrospective study with incomplete records with missing data.

Table 4
Distribution of patients hospitalized for health care–associated infection according to pathogen isolated.

Characteristic	Number	Percentage
Pathogen isolated	55	88.71
Pseudomonas spp	13	23.64
Escherichia coli	12	21.82
Staphylococcus aureus	12	21.82
Klebsiella pneumoniae	11	20.00
Enterobacter spp	5	9.09
Serratia marcescens	4	7.27
Acinetobacter baumanii	2	3.64
Coagulase-negative staphylococcus	2	3.64
Candida albicans	2	3.64
Bukholderia capacia	1	1.81
Xanthomonas spp	1	1.81
Resistance profile		
ESBL	24	43.64
Methicillin-resistant *Staphylococcus aureus*	12	21.82
Not precise	9	16.36
Wild type	4	7.27
Méthi-S	3	5.45
C3G-S	1	1.82
Amikacine-S	1	1.82
EESBL	1	1.82

ESBL, extended-spectrum β-lactamase–secreting bacteria.

HAIs are the most common adverse events threatening patient safety worldwide. Although a significant proportion of infections and deaths attributable to HAIs are preventable and low-cost interventions are available to prevent and control infections, progress in this area remains slow [3].

This retrospective study was conducted over a 3-month period (January 1 to March 31, 2024).

In this study, the hospital prevalence of HAIs over a 3-month period was 3.7%. This result is lower than the World Health Organization estimates of the prevalence of HAIs in high-income countries, which state that between 5% and 15% of patients admitted to short-stay hospitals contract HAI at some point [2]. In a survey called “one day” conducted at Fann Hospital in 2011, the annual prevalence of HAIs was 10.9% [2,3]. The relatively low prevalence in our study could be explained by the short collection period and the fact that we included only patients with microbiological confirmation.

Concerning socio-demographic characteristics, the median age of the participants was 59 years (interquartile range: 68-47), and the age group >60 years was the most represented at 45.2% of the participants. This median age is much higher than that found by several authors who conducted the same study in the sub-region [3,5–7] and found an age range of 37.7-38.8 years. This can be explained by the fact that our study included patients from a geriatric ward.

Furthermore, the predominance of elderly patients in our study who required longer hospital stays for several reasons, including geriatric syndromes, may explain their heightened risk factors for HAIs. In our study, the majority of patients were male (54.8%), with a sex ratio male/female of 1.21. This result is inconsistent with that reported by Massaly et al. [1] who found 58 cases of HAI in women, representing 68% of their study population.

Most patients with HAIs were hospitalized in the Neurology Department (n = 13, 21%). This was followed by the Geriatrics and SMIT Departments, with nine cases (14.5%) in each department. This could be explained by the fact that the Neurology Department receives patients with neurologic disorders requiring intensive care, thus posing a risk factor for HAIs. On the other hand, for SMIT, one of the main factors associated with the occurrence of HAIs is immunosuppression due to HIV infection and multidrug-resistant bacteria [5].

Fever was the most common clinical manifestation (71.0%), followed by respiratory signs (29.0%) and urinary manifestations (24.2%). In a prospective longitudinal study conducted in the four largest universities and referral hospitals in Libya, Daw et al. [6] found that fever was the most common clinical sign in 71% of patients with HAI. This result could be explained by the fact that fever is an inflammatory reaction to infection and one of its main signs. Urinary manifestations were observed in 26.6% of patients in our study. These figures are comparable to those reported in studies conducted in Lithuania (28.5%) and Tanzania (31.1%) but higher than those found in Ethiopia (19.8%) [8]. Urinary tract infections are one of the most frequent routes of entry for HAIs [9].

In our survey, the most frequently used medical devices were peripheral venous catheters (100%) and urinary catheters (54.6 %). The frequency of peripheral venous catheterization in all our patients could be explained by the fact that they were all hospitalized patients receiving parenteral treatment. In a prospective study conducted in Mali over a period of 6 months, Konaté et al. [10] reported that 13% of patients with urinary catheters developed HAI. Indwelling urinary catheters are the most frequent reservoirs of multidrug-resistant bacteria, with contamination via retrograde urinary flow.

In our study, Gram-negative bacilli (36%) were mainly isolated from patients with HAI, including *Pseudomonas sp* (13 cases), *E. coli* (12 cases), and *K. pneumoniae* (11 cases). In other studies conducted in sub-Saharan Africa, notably, in Mali and Senegal, similar results were found [9,11–13]. Multidrug-resistant bacteria (88.71%) were most common, including *Pseudomonas* spp. (23.6%), *S. aureus* (21.8%), and *E. coli* (21.8%). According to the World Health Organization, the rate of resistance to ciprofloxacin, an antibiotic commonly used to treat urinary tract infections, ranges from 8.4% to 92.9% for *E. coli* and from 4.1% to 79.4% for *K. pneumoniae* in countries participating in the Global Surveillance System for Antimicrobial Resistance and Usage. The misuse and overuse of antimicrobials are believed to be the main factors leading to the emergence of drug-resistant pathogens, and self-medication and lack of management codification constitute additional factors.

Resistant pathogens that constitute a major global health problem and are on the Center for Disease Prevention and Control’s urgent and serious threat list include carbapenem-resistant Enterobacteriaceae and ESBL [14–16]. In our study, 43.6% of the patients had ESBL, whereas 21.8% had MRSA as the resistance phenotype.

Conclusion

The quarterly prevalence of HAIs was high in our hospital. Therefore, it is necessary to study the factors associated with their occurrence to improve their prevention.

Funding

The Medicines, Technologies, and Pharmaceutical Services program supports data collection and analysis; however, there is no funding for submission and publication.

Ethical aspects

The study was conducted in adherence with ethical principles and approved by the hospital ethics committee. Patient anonymity and data confidentiality were strictly monitored throughout the data collection and analysis. This study was approved by the Ministry of Health on 24 May 2024. No.0300/MSAS/CHNF/DIR/CLIN.

Author Contribution Statement

Daye Ka: Conceptualization, Methodology, Validation, Writing - Original Draft, Writing - Review & Editing, Writing - Review & Editing, Supervision, Visualization. **Emery Yongola Osongo:** Data collection, Writing - Original Draft, Review & Editing. **Fatoumata Diallo** Conceptualization, Data collection, Supervision. **Ahmadou Lo:** Conceptualization, Data collection, Supervision. **Bruce Shinga Wembulua:**

Data Curation, Methodology, Writing - Original Draft, formal analysis. **Catherine Sarr:** Writing - Review & Editing, translation, visualization. **Mame Diarra Mbaye:** Conceptualization, Funding acquisition. **Pape Amath Diagne:** Conceptualization, Visualization. **Mamadou Baila Diallo:** Conceptualization, Visualization. **Abdou Aziz Fall:** Conceptualization, Visualization. **Ndéye Maguette Fall:** Conceptualization, Visualization. **El hadj Cheikh Ndiaye Sy:** Conceptualization, Visualization. **Moussa Seydi:** Conceptualization, Supervision.

Declarations of competing interest

The authors have no competing interests to declare.

References

[1] Massaly M, Ka D, Sall K, Badiane AS, Fall NM, Diallo K, et al. The burden of healthcare-associated infection in Ethiopia: a systematic review and meta-analysis. *JACCR Infectiology* 2022;**4**:1–10.

[2] Alemu AY, Endalamaw A, Bayih WA. Le fardeau des infections associées aux soins de santé en Éthiopie: revue systématique et méta-analyse. *Trop Med Health* 2020;**48**:77. doi:10.1186/s41182-020-00263-2.

[3] Cassini A, Plachouras D, Eckmanns T, Abu Sin M, Blank HP, Ducomble T, et al. Burden of six healthcare-associated infections on European population health: estimating incidence-based disability-adjusted life years through a population prevalence-based modelling study. *PLoS Med* 2016;**13**:e1002150. doi:10.1371/journal.pmed.1002150.

[4] Augustine MR, Testerman TL, Justo JA, Bookstaver PB, Kohn J, Albrecht H, et al. Clinical risk score for prediction of extended-spectrum β-lactamase-producing Enterobacteriaceae in bloodstream isolates. *Infect Control Hosp Epidemiol* 2017;**38**:266–72. doi:10.1017/ice.2016.292.

[5] Bader MS, Loeb M, Brooks AA. An update on the management of urinary tract infections in the era of antimicrobial resistance. *Postgrad Med* 2017;**129**:242–58. doi:10.1080/00325481.2019.1680052.

[6] Daw MA, Mahamat MH, Wareg SE, El-Bouzedi AH, MO Ahmed. Epidemiological manifestations and impact of healthcare-associated infections in Libyan national hospitals. *Antimicrob Resist Infect Control* 2023;**12**:122. doi:10.1186/s13756-023-01328-7.

[7] Daye KA, Fall NM, Massaly A, Sall K, Diop ND, Badiane AS, et al. Prévalence et facteurs associés à la mortalité par bactériémie associée aux soins au sein du service des maladies infectieuses et tropicales de l'Hôpital Universitaire national de Fann. *J Infect Dis Ther* 2023;**11**:553. doi:10.4172/2332-0877.1000553.

[8] Fraser JL, Mwatondo A, Alimi YH, Varma JK, Vilas VJDR. Healthcare-associated outbreaks of bacterial infections in Africa, 2009–2018. *Int J Infect Dis* 2021;**103**:469–77. doi:10.1016/j.ijid.2020.12.030.

[9] Dabo G, Traore AM, Touré MK, Allasem-Dingambaye M, Sy D, Cisse T, et al. Évaluation des Pratiques de Prévention des Risques d'Infection Nosocomiale lors du Sondage Urinaire dans les Services de Médecine du CHU du Point G. *Health Sci Dis* 2022;**23**:120–4.

[10] Konaté M, Traoré A, Bah A, Diop T, Karembé B, Amadou I, et al. Health care-associated infections in teaching hospital Gabriel Touré. *Mali Med* 2020;**35**:39–42.

[11] Gastmeier P, Kampf G, Wischnewski N, Hauer T, Schulgen G, Schumacher M, et al. Prevalence of nosocomial infections in representative German hospitals. *J Hosp Infect* 1998;**38**:37–49. doi:10.1016/s0195-6701(98)90173-6.

[12] Haque M, McKimm J, Sartelli M, Dhingra S, Labricciosa FM, al Islam S, et al. Strategies to prevent healthcare-associated infections: a narrative overview. *Risk Manag Healthc Policy* 2020;**13**:1765–80. doi:10.2147/RMHP.S269315.

[13] World Health Organization, Eastern Mediterranean Regional Office, https://www.emro.who.int/fr/surveillance-forecasting-response/infection-control/; n.d. [accessed 26 June 2024].

[14] World Health Organization. Lignes Directrices sur les Principales Composantes des Programmes de Prévention et de Contrôle des Infections au Niveau National et au niveau des Etablissements de Soins de Courte Durée, https://www.who.int/fr/publications/i/item/9789241549929; 2016 [accessed 12 January 2025].

[15] Jroundi I, Khoudri I, Azzouzi A, Zeggwagh AA, Benbrahim NF, Hassouni F, et al. Prevalence of hospital-acquired infection in a Moroccan university hospital. *Am J Infect Control* 2007;**35**:412–16. doi:10.1016/j.ajic.2006.06.010.

[16] Khan HA, Baig FK, Mehboob R. Nosocomial infections: Epidemiology, prevention, control and surveillance. *Asian Pac J Trop Biomed* 2017;**7**:478–82. doi:10.1016/j.apjtb.2017.01.019.