

# Economic Burden of Adverse Drug Reactions among Hospitalized Patients in Eritrea: A Five-month Prospective Analysis of 5848 Patients

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## ABSTRACT

Many countries have been facing multiple disease burdens which have clinical, economic, and social impact; one of which is Adverse Drug Reactions (ADRs). In the United States, for example, the annual financial burden is estimated to be USD 177.4 billion. It is well-recognized that there is a strong linkage between health and economic growth. In Eritrea, healthcare is provided by the Government of the state of Eritrea (GOE) through public hospitals, which is highly subsidized. The health policy of the GOE is ensuring access to healthcare services to all citizens in an equitable and affordable manner guided by the principle of social justice. Despite the efforts underway in the country, Eritrea is still facing newly emerging public health problems like ADRs, whose clinical, economic and social burden need to be determined. In this nationwide study, 18 hospitals (17 public and one private) were included. During the five-month study period, a total of 5,848 patients admitted to the 18 Eritrean hospitals were screened for ADRs. Of the total patients screened, 922 (15.8%) were identified with at least one suspected adverse drug reaction. The average expenditure per patient was found to be ERN 4,766 (equivalent to USD 318) and the overall ADR related economic burden in the five months period was determined to be ERN 4,394,089 (USD 292,939). From this study it was concluded that, the occurrence of ADR was high which had substantial economic burden for the GOE and the patients. .

**Keywords:** Adverse Drug Reactions (ADR); Economic burden; Hospitalized patients; Eritrea

## INTRODUCTION

Many countries have been facing multiple disease burdens which have clinical, economic, and social impact; one of which is Adverse Drug Reactions (ADRs) [1-3]. ADRs accounted for more than 10% of the total hospital admissions [4] and it is ranked among the fourth to sixth cause of deaths. Different studies show that, ADR accounts for 4.2% to 30% of hospital admissions in the US [5,6]. In Australia, ADR related hospital admission was reported from 5.7% to 18.8%; while in Europe it was found to be 2.5%-10.6% [6]. In developing countries such as South Africa, studies conducted on adult medical inpatients found an ADR incidence of 12.6% [7]. The incidences of ADRs in many countries are resulting into economic burden related to morbidity, mortality and high cost of treatment. Many countries spend 15%-20% of their hospital

budget to treat drug complications [8,9]. In the US, for example, studies conducted show that the annual financial burden of ADR is estimated to be USD 177.4 billion [10]. In Spain, a study conducted for one month on adult patients with ADRs, the direct cost for diagnosis and treatment was estimated to be USD 54,299.57 [11]. Whereas, in China one study estimated the mean cost of treating an ADR per patient as USD 9,491, with 50% of this cost being the hospitalization or room charges alone [12]. Eritrea is one of the least developed countries. Reflecting its low level of economic and social development, the country has been facing several public health problems including communicable and non-communicable diseases. These disease burdens and their management have adverse economic, clinical and social impacts. Cognizant of these burdens, the Government of Eritrea has put human resource development as its top priority and has been approaching through two prong

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approach: provision of healthcare services and education to all guided by principles of social justice [13]. This is in line with the well-recognized strong linkage between health and economic growth [14]. Despite the efforts underway in the country, Eritrea is still facing newly emerging public health problems like adverse drug reactions, whose clinical, economic and social burden needs to be determined. According to WHO definition, ADR is a response to a drug which is noxious and unintended, and which occurs at doses normally used in man for the prophylaxis, diagnosis or therapy of disease, or for the modification of physiological function [15]. In Eritrea, ADR monitoring and reporting started in 2012. However, there have been no studies conducted on incidence and economic burden of ADR on patients and healthcare providers in the country. Hence, the objective of the study is to determine the economic burden<sup>13</sup> of ADRs which is borne by the Government of the State of Eritrea and patients at different levels of healthcare in order to provide evidence for appropriate interventions.

## METHODS

A nationwide prospective, longitudinal and observational study was conducted in all Eritrean public hospitals and one private hospital (17 public and one private) to determine the economic burden of ADR related health problems over a five-month period (March 20 to August 20, 2014). As a preparatory part of the study, the Research Ethics and Protocol Review Committee of the Ministry of Health approved the research project. In order to estimate the ADR related economic burden, the prevalence approach was used [16]. The prevalence approach measures costs of treating patients with ADR over a given period. This approach requires data on the number of patients treated and the cost of treatment of the illness over a given period of time. Prevalence-based studies include all medical care costs and morbidity costs for a disease within the study period [17]. Data on cost of healthcare services used in this study include primary and secondary. The main data collection instrument was questionnaire designed to trace the expenditure of patients and the subsidy component of the health expenditure borne by the Government. In addition, patient's medical cards and payments made during discharge, relevant textbooks, articles, policies and guidelines of the Ministry of Health were also consulted. Economic burden of ADR-related problems may be conducted from three different perspectives: healthcare system, healthcare provider or patient. Each perspective provides useful information about the costs of the healthcare services to the particular group [17]. This study uses the perspectives of service provider and patients to estimate the financial burden of ADRs on the Government and patients. The health policy of the GOE is ensuring access to healthcare services to all citizens in an equitable and affordable manner guided by the principle of social justice. The GOE allocates recurrent and capital budget for all public hospitals to provide various healthcare services, while collecting revenue from patients as part of cost sharing. Patients are charged user fees for various services as a mechanism of cost sharing of the recurrent expenditure. The user fees were introduced taking into account the low paying capacity of the population and the need to increase access to healthcare services. The user fee schedule were designed in a sliding scale with the lowest fees being paid at the health stations, health center and community hospitals and

<sup>1</sup>Economic burden in this text refers to the out-of pocket payments of the patient suffering from ADR to hospitals plus the subsidy component of the recurrent expenditures covered by the Government/hospitals.

a higher charge at the secondary and tertiary hospital levels. The community, zonal referral and National referral hospitals charge patients for registration, diagnosis, treatment, meal and bed services and surgical interventions, which have high subsidy component [18]. The economic burden of the patient is out-of-pocket payments made by the patient with an ADR to the public/private hospitals. It includes the cost of registration/consultation, diagnosis, treatment, surgical intervention, meals and bed charges at three levels: Community, Regional Referral and National Referral Hospitals. All cost items were summed up to reach at the total direct cost of the healthcare services borne by the patient with ADR. The patients' economic burden do not include indirect costs, such as transport cost of patient, loss of income of patient while receiving treatment as inpatient, loss of future earning potential due to premature death, loss of income of family member or other caretakers while supporting the inpatients. A greater part of the total ADR-related recurrent expenditure in all public hospitals in Eritrea is borne by the GOE as the healthcare services are highly subsidized. The subsidy covers part of the registration, diagnosis, treatment, surgical interventions, meals and bed charges and is the direct cost borne by the public hospitals (GOE) in managing patients with ADR. In determining the economic burden of ADR on the Government, we first calculated the average cost recovery of the hospitals by levels for 2013, the most recent data during the study period. Then, based on the actual payments made by the patient, the economic burden of ADR borne by the GOE is calculated using the following formula as indicated in Table 1. All, ADR related economic burden data gathered during the study period were analyzed using Microsoft Office Excel 2007.

## RESULTS

During the five-month study period, a total of 5,848 patients admitted to the 18 Eritrean hospitals were screened for ADRs. Of the total patients screened, 922 (15.8%) were identified with at least one ADR before and/or after admission. Of the 922 patients with ADRs, 891 patients received management and/or treatment at the different levels of public hospitals while 31 patients with ADRs managed at the only nationally available private hospital.

### Economic burden of ADRs on patients by hospital level

Over the five-month study period, there were 277 patients with ADRs who received the necessary healthcare services in the seven community hospitals. The total expenditure of these patients was ERN<sup>14</sup> 142,757 (USD 9,517). This patients' expenditure constituted 17% of the total recurrent expenditure of the community hospitals as there was 83% subsidy rate. At this level, on average, the economic burden per patient was ERN 515 (34.33 USD) (Table 2). At the Zonal referral hospitals, there were 287 patients with ADRs. The total expenditure of the patients was ERN 223,834 (USD 14,922.3) that constituted only 19% of the total recurrent health expenditure on ADRs. The average cost of treatment of the ADRs per patient was found to be ERN 780 (USD 52). At the national referral hospital level, there were 114 patients with ADRs. These were either referred patients from the zonal referral hospitals or directly admitted ones. The total economic burden of these patients was ERN 310,373 (USD 2,691.53). The expenditure constituted 35% of the total recurrent expenditures on ADRs. The overall average expenditure per patient was ERN 2,723 (USD 181.53). The GOE has put maternal and child healthcare as one of

<sup>2</sup>Nakfa is Eritrean currency. The official exchange rate is 15 Nakfa for one USA dollar.

its top priority. In order to give specialized services to children, it has established nationwide serving pediatric hospital.

Over the five-month study period, there were 102 pediatric patients with ADRs who received treatment and/or management. The total economic burden of the patients was ERN 124,470 (USD 8,298), which constituted three percent of the total recurrent healthcare expenditures on pediatric patients suffering from ADRs. The average expenditure of an ADR child was ERN 1,220 (USD 81.33).

#### Economic burden of ADRs on the GOE by hospital level

At the community hospital level, 83% of the recurrent healthcare expenditure is covered by the Government. As shown in Table 3, the total expenditure of the community hospitals on the 277 patients with ADRs was ERN 697,395 (USD 46,493) over the five-month period. The overall average expenditure of the community hospitals per patient was ERN 2518 (USD 167.87). At the zonal referral hospitals, 81% of the healthcare expenditure was a subsidy covered by the hospitals. As depicted in Table 3, the total Government expenditure on the 287 patients with ADRs was ERN 949,331 (USD 63,288.73). The overall Zonal hospital average expenditure per patient was ERN 3,308 (USD 220.52). At the national referral hospitals, 65% of the total healthcare expenditure on patients with ADRs was covered by the Government of the State of Eritrea, the healthcare provider. The total expenditure

on 114 patients with ADRs was ERN 573,557 (USD 38,237.13). The average ADR related expenditure per patient was ERN 5,031 (USD 335.40). At the pediatric hospital, 97% of the healthcare expenditure was subsidy which was covered by the Government. The expenditure of the Government on 102 children admitted due to ADR during the five-month period was ERN 873,484 (USD 58,232) (Table 3). The average expenditure per a child with ADR was ERN 8,564 (USD 571).

The study also included two other specialized nationwide serving public hospitals: Merhano MDR-TB and St. Mary Neuropsychiatric Hospitals, which provide healthcare services for free to the respective patients in Eritrea. There were 71 MDR-TB patients with ADRs over the study period. The total expenditure of the Government in this hospital was ERN 333,480 (USD 22,232). The average expenditure per MDR-TB patient with ADR was ERN 4,697 (USD 313.13). At the St. Mary Neuropsychiatric hospital, there were 40 patients with ADR-related problems. The total expenditure was ERN 115,609 (USD 7,707.27) and the average expenditure per patient was ERN 2,890 (USD 192.68) (Table 4).

In Eritrea, there is only one private hospital which provides services for free and was included in the study. Over the study period, there were 31 patients with ADRs, and the total ADR-related expenditure was ERN 147,033 (USD 9,802.20) (Table 5). The

**Table 1:** Formula developed to calculate economic burden of ADR on GOE.

<b>Out-of-pocket payment</b>	<b>OP</b>
Cost recovery of public hospitals by level (from patients)	X%
Cost covered by the GOE	100% -X%
Cost of ADR covered by Government of the State of Eritrea	GE
Cost of healthcare services covered by the GOE by hospital level is given by: $GE=AP*(100\%-X\%)/X\%$	
OP: Out of Pocket; GOE: Government of the state of Eritrea; GE: Government Expense; AP: Actual Payment.	

**Table 2:** Economic burden on patients with ADRs at different hospital levels (in ERN).

Level of hospitals	No. of patients	Consultation fee	Diagnostic expenditure	Treatment expenditure	Bed charge	Total expenditure	Average
Community	277	2,800	42,505	70,828	25,961	1,42,757	515
Zonal Referral	287	5,023	51,700	96,591	70,521	2,33,834	780
National Referral	114	3,990	45,345	83,024	1,78,014	3,10,373	2,723
Orotta Pediatric National Referral hospitals	102	1,152	10,843	9,847	5,173	27,015	265
Merhano MDR-TB Hospital	71	0	0	0	0	0	0
St. Mary Neuropsychiatric Hospital	40	0	0	0	0	0	0

ADR: Adverse drug reaction; ERN: Eritrean Nakfa; MDR-TB: Multidrug resistant tuberculosis

**Table 3:** Economic burden of ADRs on the GOE at different hospital level (in ERN).

Level of hospitals	No. of patients	Consultation fee	Diagnostic expenditure	Treatment expenditure	Bed charge	Total expenditure	Average
Community	277	17,313	2,07,524	3,45,807	1,26,751	6,97,395	2,518
Zonal Referral	287	16,503	2,20,405	4,11,781	3,00,642	9,49,331	3,308
National Referral	114	4,560	84,212	1,54,187	3,30,597	5,73,557	5,031
Orotta Pediatric National Referral Hospitals	102	37,248	3,50,590	3,18,386	1,67,260	8,73,484	8,564
Merhano MDR-TB Hospital	71	15,214	12,643	85,571	2,20,051	3,33,480	4,697
St. Mary Neuropsychiatric Hospital	40	1,200	0	1,461	1,12,948	1,15,609	2,890

ADR: Adverse Drug Reaction; GOE: Government of the state of Eritrea; ERN: Eritrean Nakfa; MDR-TB: Multidrug Resistant Tuberculosis.

Table 4: Summary Expenditure in ERN on patients with ADRs by level of hospitals.

Hospitals	Number of patients	Expenditure of ADR patients	Government (subsidy at public hospitals)	Total expenditure on ADR inpatients	Average expenditure
<b>Public hospital</b>					
Community	277	1,42,757	6,97,395	840152	3,033
Zonal Referral	287	2,23,834	9,49,331	1173165	4,088
National Referral	114	310373	5,73,557	883930	7,754
Orotta Pediatric National Referral hospital	102	27,015	8,73,484	9,00,499	8,828
Merhano MDR TB	71	0	3,33,480	333480	4,697
St. Mary Hospital	40	0	1,16,254	116254	2,906
Total	891	7,03,979	35,43,501	42,47,480	4,767
<b>Private hospital</b>					
Sembel	31	1,47,033	0	1,47,033	4,743
ERN: Eritrean Nakfa					

Table 5: Economic burden of Sembel hospital (in ERN).

Number of patients	Consultation fee	Diagnostic expenditure	Treatment expenditure	Bed charge	Total expenditure	Average
31	2,325	11,163	28,663	1,04,832	1,47,033	4,743
ERN: Eritrean Nakfa						

average expenditure per patient was ERN 4,743 (USD 316.20).

## Discussion

Over the study period, there were 922 patients with ADRs, constituting 15.8% of the total screened patients. They all received healthcare services in the hospitals. Taking into account the widely practiced self-medication in Eritrea, the incidence of ADRs is even probably under reported. ADRs are an important cause of hospital admission and prolonged hospitalization. The overall mean duration of ADR related hospital stay was 9.2 days compared to 4.5 days at the national level. Thus, ADRs have posed a significant economic burden for the patients, their care givers, and the healthcare system in Eritrea. The findings of this study indicate that expenditure on ADRs continued to increase at the Regional and National Referral levels. The average expenditure of a patient at Community hospital level was ERN 3,033 (USD 202.20); at the regional referral and national referral hospital levels, the average expenditure is ERN 4,088 (USD 272.53) and ERN 7,754 (USD 516.93) respectively. The increasing trend of expenditure is attributed to severity of ADRs, the use of advanced technology in diagnosis, expensive treatment and higher bed charges. Economic burden of ADRs is now a real concern both for the Eritrean people and the GOE. In a low-income country such as Eritrea, where the paying capacity of the people for healthcare services is low, ADRs are posing additional economic burden to the society that needs urgent attention. Similarly, as Eritrea is a resource-constrained country, emergence of ADRs is becoming another public health problem, competing for resources, putting more pressure on the Government to increase its healthcare expenditure. With respect to the National Referral Pediatric Hospital, 97% of the recurrent cost was covered by the Government. The average cost of a patient with ADR (USD 588.5) was much higher than the average expenditure of other national referral hospitals. This was mainly because most children came with severe ADR cases that required extensive diagnosis, prolonged hospitalization and treatment. The implication is that child and healthcare services need to be

strengthened to rescue the incidence of ADRs and subsequently the economic burden in the country. The average expenditure on a patient at the MDR-TB hospital (USD 313.13) was higher than that of St. Mary Neuro-Psychiatric hospital as the patients need prolonged, extensive and aggressive treatment which leads to manifestation of complicated ADRs. The implication is that attention needs to be given to therapeutic monitoring of anti-MDR-TB medications in terms of early detection and proper management of ADRs. Working proactively in reducing the occurrence of new TB/MDR-TB cases through community awareness, early detection and enhancing treatment success has also implication in reducing the economic burden associated with ADRs.

## Conclusion

This study revealed that ADR related economic burden in Eritrea was found to be substantial. As healthcare is increasingly subject to cost containment on the one hand and the growing demand for high quality healthcare on the other hand, relevant programs should closely work on prevention and proper management of ADRs to save unnecessary expenditures both from patients and the GOE. Without targeted interventions, it is likely that the incidence of ADRs may increase in future and that the cost associated with ADRs will be much higher and the burden will increase, particularly when taking into account the health sector in Eritrea has scarce resources and competing demands for more resources. Public awareness campaigns on the rational use of medicines and self-medication, provision of training to healthcare professionals on prevention and management of ADRs, strengthening hospital medicine and therapeutic committees and safety monitoring activities are among the suggested intervention in reducing the incidence of ADRs and subsequent expenditures.

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