

## Practice of Auditable Pharmaceutical Transactions and Services at Dessie Referral Hospital, North East Ethiopia

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### Abstract

**Introduction:** Auditable pharmaceutical transactions and service established for transparent and accountable medicines transaction and service provision to optimize utilization of medicines budget, improve access to medicines, workflow, generate reliable information for decision making, and improve p customers' satisfaction. Although the system becomes a solution to improve the country's pharmaceutical service delivery system, not as effective as expected. Therefore, this study evaluated the practice of the system in the Dessie referral hospital.

**Methods:** A facility-based cross-sectional study was conducted using a structured questionnaire on pharmacy professionals and patients who received pharmacy service at Dessie referral hospital. A simple random sampling technique was used to select the study participants. Descriptive and inferential statistics were computed using the statistical package for social sciences version 20.

**Results:** Twenty-one (56.8%; 95% CI: 40.5%, 73%) pharmacy professionals perceived that auditable pharmaceutical transactions and services had improved the pharmacy services. Two-third (63%; 95% CI: 56.9%, 69.9%) of patients were satisfied with auditable pharmaceutical transactions and services. The number of pharmacy professionals service years was significantly associated (P-value: 0.01) with the good practice of auditable pharmaceutical transactions and services. Urban residence (P-value: 0.001, AOR: 11.76, 95% CI: 4.43-31.20), new visiting patients (P-value: 0.001, AOR: 14.32, 95% CI: 4.89-41.93) and male sex (P-value: 0.006, AOR: 0.36, 95% CI: 0.17-0.75) were predictors for satisfactory auditable pharmaceutical transactions and services. Human resource shortage, workload, attrition, lack of indemnity policy, inadequate salary, lack of capacity building, and absence of regular financial auditing were the major challenges.

**Conclusion:** More than half a pharmacy professional and two-third of patients was satisfied with auditable pharmaceutical transactions and services. Various factors hindered the successful implementation of pharmacy service. Workload determination, introducing indemnity and other incentive mechanisms, capacity building, management ownership, and follow up is recommended to improve pharmacy service.

**Keywords:** Auditable Pharmaceutical Transactions And Services; Pharmacy Service; Ethiopia

## Abbreviations

APTS: Auditable Pharmaceutical Transactions and Service; AOR: Adjusted Odds Ratio; FMOH: Ethiopia's Federal Ministry of Health; WHO: World Health Organization

## Introduction

According to the United Nations universal declaration of human rights, everyone has the right to a standard of living adequate for health and the right to security in the event of sickness or disability [1]. World Health Organization (WHO) outlined the provision of essential medicines as one of the eight essential components of primary health care [2].

Pharmacy service is a vital component of an institutional health-care system that needs to be delivered to the standard to improve the overall quality of health care [3]. Pharmaceutical care is pharmacy professionals care for patients to optimize medicines use and improve health outcomes [4]. Despite medication dispensing and drug distribution, compounding, medication utilization review, adverse drug reaction monitoring, and drug information service are the main services [5], pharmaceutical care services have been expanding with the increasing role of pharmacists [6].

The availability of essential medicines is integral to modern health care and 10 - 30% of health care costs allocated for pharmaceuticals [7]. Uninterrupted supply of safe, effective, quality drugs at an affordable price and rational use is crucial for the success of health program implementation [8]. However, according to WHO, approximately 67% of the population lives without access to essential medicines [2].

Practically, many governments and health care facilities do not have sustainable, uninterrupted, drug supply management [9]. More than 50% of all countries do not implement basic policies to promote the rational use of medicines [10]. Transparency and accountability remained as big challenge in the pharmaceutical sector [11]. According to the WHO, countries having weak medicines supply chain governance are more susceptible to being exploited by corruption [7] and contributed to most of the challenges related to pharmaceuticals management at different levels of the health system [12].

Conversely, evidence has proven that good governance can improve key development goals and resulted in better health outcomes [13]. Effective drug supply management includes proper selection, quantification, procurement, distribution, use, and appropriate provision of pharmaceutical services [14]. So far, many factors that affect the quality of pharmacy service provision were identified. These include lack of training, poor knowledge, chaotic workflow, poor infrastructure, insufficient equipment, and facilities needed to give the service, insufficient medicines budget, and a number of professionals [15,16].

Ethiopia's Federal Ministry of Health (FMOH) has made tremendous efforts to improve the quality of health services at health institutions [17]. To solve pharmacy service problems, Auditable Pharmaceutical Transactions and Service (APTS) was designed and implemented by FMOH with support from Systems for Improved Access to Pharmaceuticals and Services [8,18]. Auditable pharmaceutical transactions and service established for transparent and accountable medicines transaction and service provision to optimize utilization of medicines budget, improve access to medicines, the efficiency of pharmacy workforce, documentation, pharmacy premises, and workflow, generate reliable information for decision making, and improve patient knowledge on prescribed medicines and customers' satisfaction [18]. The system allowed pharmacists to change traditional dispensing to ensure quality in dispensing and effective patient risk management [19].

Although APTS become a solution for change to improve the country's pharmaceutical service delivery system [20], non-compliance with standard operating procedures, high staff turnover, limited training, and a low satisfaction level among professionals contributed to a low level of achievement in some areas [9]. Despite APTS implementation attained higher patient satisfaction on the overall pharmacy

services compared to non-APTS hospitals [9,21,22], some studies reported low patient satisfaction in this sector [23,24]. Hence, evaluating the implementation outcome of the system will help to make further improvements and to strengthen the pharmacy service provision. Therefore, this study evaluated the practice of APTS in the Dessie referral hospital.

### Methods

#### Study area and period

The study was conducted at Dessie referral hospital, located in Dessie city. Dessie is a city in the Amhara Region, in the South Wollo zone, which is found at a distance of 401km from the capital of the country, Addis Ababa. Dessie is the major city in the region with a population of 610,431 and is home to several public and privately owned hospitals of different levels. Dessie referral hospital is providing service in different units for the populations of Dessie town and the surrounding for about 7 million people.

#### Study design

A cross-sectional study design was employed to assess the practice of APTS among pharmacy professionals and patients from December 1-31, 2019. Key informants interview was also employed to further explore the practice of APTS.

#### Population

All pharmacy professionals and patients were the source population, while all pharmacy professionals and all patients who got pharmacy service at Dessie referral hospital during the study period and who fulfilled the inclusion criteria were the study population.

#### Sample size determination and sampling technique

All pharmacy professionals (41) were included. The sample size for patients was estimated by using a single population proportion formula using 74 % APTS service satisfaction (FMOH, 2015), 95% confidence level, and 5% tolerable sampling error. Adding a 10% contingency, a total of 228 patients were recruited. A simple random sampling technique was employed to select the study participants.

#### Inclusion criteria

All pharmacy professionals who were working in the pharmacy were included. Patients who received pharmacy service during the study period and willing to participate in the study with age of greater than or equal to eighteen were taken.

#### Exclusion criteria

Pharmacy professionals who were on annual leave during the study period were excluded. Patients who were unable to hear or communicate with and with mental disabilities and who refused to give information were excluded from the study.

### Variables

#### Dependent variable

The dependent variable was the APTS practice.

#### Independent variables

The independent variables were socio-demographic characteristics of pharmacy professionals and patients.

### Data collection and quality assurance

A structured self-administered questionnaire was employed to collect data among pharmacy professionals, while the data from patients were collected using a structured interviewer-administered questionnaire by two experienced druggists who had no working relationship to the hospital. After recruiting a half-day training was given by the principal investigators. The data collection format was pretested in five percent of the sample size at the Dessie health center. A 3-point Likert scale questionnaire used to assess the APTS services in the hospital. Data was checked for completeness, accuracy, and consistency immediately after collection, and confidentiality was maintained. The reliability of the self-administered questionnaire was also checked by Cronbach's alpha test and a value of 75.7% was obtained. All assumptions of the logistics regression test were checked and full field.

For the in-depth interview, the semi-structured interview guide consisted of background information of key informants, and probing questions were used. The principal investigator conducted an in-depth interview, audio-recorded, and transcribed verbatim. Key informants were selected purposefully by Dessie town Pharmaceuticals logistics officer.

### Data analysis and presentation

The quantitative data was entered and analyzed using the Statistical Package for Social Sciences version 20. The association between dependent and independent variables was tested by Fisher exact test and bivariate logistic regression analyses. In bivariate logistic regression analyses, variables with a p-value of less than 0.25 were transferred to multivariate logistic regression, and those with a p-value of less than 0.05 were taken as statistically significant. The mean score was used to dichotomize APTS pharmacy service practice as good or poor and satisfactory or non-satisfactory.

### Results

Out of 39 self-administered questionnaires distributed to pharmacy professionals, 37 were returned. Hence, the response rate was 95%. Out of the total respondents, 23 (62.2%) were pharmacists, and the primary area of practice for the majority of the respondents was dispensing 21 (56.8%) followed by clinical pharmacy service (18.9%). The majority of staff were in the age range of 20-30 years (70.3 %). Regarding the service years, most of the pharmacy staff had experienced between 2 and 4 years (40.5%) followed by 5 to 6 years (32.4%). Fisher exact test revealed that the number of service years was significantly associated with the good practice of APTS (Table 1).

Variables		Frequency	Percent	P value
Gender	Male	21	56.8	0.60
	Female	16	43.2	
Age in years	≤20	1	2.7	0.34
	20-30	26	70.3	
	≥30	10	27.0	
Marital status	Single	21	56.8	0.76
	Married	14	37.8	
	Divorced	2	5.4	
Academic qualification	Diploma	14	37.8	0.14
	Degree	23	62.2	
No of service years	≤2 years	3	8.1	0.01
	2-4 years	15	40.5	
	5-6 years	12	32.4	
	≥7 years	7	18.9	

No of years at current job	≤2 years	14	37.8	0.66
	2-4 years	17	45.9	
	≥5 years	6	16.2	
Access to written job description	Yes	25	67.6	0.58
	No	12	32.4	
Primary practice area	ART pharmacy	4	10.8	0.11
	Administrative area	1	2.7	
	Clinical pharmacy services	7	18.9	
	Dispensing	21	56.8	
	Drug information service	1	2.7	
	Drug supply chain management	1	2.7	
	Store	2	5.4	
Received training	Yes	27	73	0.44
	No	10	27	

**Table 1:** Socio-Demographic Characteristics of Pharmacy Professionals at Dessie Referral Hospital, 2019 (n=37).

The majority (89.2%) of pharmacy professionals believed that APTS implementation improved the availability of medicines, patient satisfaction, and reduced expiry of medicines. Nearly all (94.6%) pharmacy professionals also perceived that APTS implementation improved transparency of pharmaceutical transactions and record-keeping. However, 67.6% of pharmacy professionals believed that APTS implementation didn't reduce patient waiting time to receive their medication (Table 2). Twenty-one (56.8%; 95% CI: 40.5%, 73%) pharmacy professionals perceived that APTS had improved the pharmacy services.

Variables	Disagree n (%)	Neutral n (%)	Agree n (%)
APTS implementation improved availability of medicines	3 (8.1%)	1 (2.7%)	33 (89.2%)
APTS implementation increased my workload	20 (54.1%)	1 (2.7%)	16 (43.2%)
APTS implementation improved job opportunity for pharmacists	11 (29.7%)	-	26 (70.3%)
APTS implementation has reduced expiry of medicines	-	4 (10.8%)	33 (89.2%)
APTS implementation has reduced theft of medicines	3 (8.1%)	5 (13.5%)	29 (78.4%)
APTS implementation helped to reduce damage to medicines	19 (51.4%)	5 (13.5%)	13 (35.1%)
APTS has improved transparency of pharmaceutical transactions	1 (2.7%)	1 (2.7%)	35 (94.6%)
APTS has improved the record-keeping practice of the pharmacy	-	2 (5.4%)	35 (94.6%)
APTS implementation has improved patient satisfaction	-	4 (9.8%)	33 (89.2%)
APTS implementation has improved budget utilization efficiency	5 (13.5%)	12 (32.4%)	20 (54.1%)
APTS implementation has improved work flow	-	10 (27%)	27 (83%)
APTS implementation has reduced waiting time of patients to receive pharmacy service	25 (67.6%)	9 (24.3%)	3 (8.1%)
APTS implementation decreased attrition rate of pharmacists	22 (59.5%)	-	15 (40.5%)
APTS implementation improved treatment evaluation	5 (13.5%)	5 (13.5%)	27 (73%)

**Table 2:** Perception of Pharmacy Professionals on APTS Implementation at Dessie Referral Hospital, 2019 (n=37).

The total number of patients involved in the study was 219, which was 96% of the planned sample size. All age groups nearly equally visit the hospital pharmacy. More than half (52.5%) of patients were females. Besides, 125 (57.1%) were married and 142(64.8%) lived in an urban area. Concerning the educational level, 59 (26.1%) was completed primary education (Table 3).

Variables		Frequency	Percent
Age	>25	49	22.4
	25-29	61	27.9
	30-34	57	26
	≥35	52	23.7
Gender	Male	104	47.5
	Female	115	52.5
Marital status	Single	65	29.7
	Married	125	57.1
	Divorced	27	12.3
	Widowed	2	0.9
Place of residence	Urban	142	64.8
	Rural	77	35.2
Level of education	Unable to read and write	34	15.5
	Able to read and write	53	24.2
	Primary school	59	26.9
	Secondary school	28	12.8
	Diploma	35	16
	Degree and above	10	4.6
Employment status	Government	38	17.4
	Private company	11	5
	Nongovernmental organization	29	13.2
	Merchant	5	2.3
	House wife	68	31.1
	Retired	37	16.9
	Not working	31	14.2
Types of visit	New visit	111	50.7
	Repeated visit	108	49.3
Disease condition	Chronic	117	53.4
	Communicable	102	46.6
Type of medicine purchase	Cash	78	35.6
	Credit	114	52.1
	Free	27	12.3

**Table 3:** Socio-Demographic Characteristics of Patients at Dessie Referral Hospital, 2019 (n = 219).

A total of 683 medicines were prescribed, of which, 574 medicines were actually dispensed. Hence, the availability of medicine was 84%. Greater than two-thirds (71%) of the patient's prescription was adequately labeled. Nearly one-third of patients believed that the pharmacy wasn't clean, uncomfortable, and unsuitable for private conversations with the pharmacist. The location of the pharmacy was easily accessible for 163 (74.4%) patients (Table 4). Two-third (63%; 95% CI: 56.9%, 69.9%) of patients were satisfied with APTS pharmacy services.

Age, marital status, educational level, employment status, and types of medicine purchase had a p-value of less than 0.25 and were not fitted to multivariate logistics regression analysis. The adjusted model indicated that urban residence patients were about 11.76 times more likely satisfied with APTS pharmacy services compared to rural residents (adjusted odds ratio (AOR): 11.76(4.43-31.20)). Newly visiting patients were 14.32 folds to be satisfied with APTS pharmacy services than those who visited repeatedly (AOR: 14.32(4.89-41.93)). Males were 64% times less satisfied with APTS pharmacy services than females (AOR: 0.36(0.17-0.75) (Table 5).

Variables	APTS pharmacy services		(COR,95%CI)	(AOR,95%CI)
	Non-satisfactory n (%)	Satisfactory n (%)		
<b>Gender*</b>				
Male	51(49)	53(51)	0.37(0.21-0.66)	0.36(0.17-0.75)
Female	30(26)	85(74)	1.00	1.00
<b>Place of residence*</b>				
Urban	41(28.8)	101(71.2)	2.66(1.49-4.73)	11.76(4.43-31.20)
Rural	40(51.9)	37(48.1)	1.00	1.00
<b>Type of visit*</b>				
New visit	16(14.4)	95(85.6)	8.97(4.66-17.27)	14.32(4.89-41.93)
Repeated visit	65(60.1)	43(39.9)	1.00	1.00
<b>Disease condition</b>				
Chronic	59(50.4)	58(49.6)	0.27(0.14-0.49)	0.66(0.25-1.70)
Communicable	22(21.5)	80(78.5)	1.00	1.00

**Table 5:** Logistic regression of patient satisfaction with APTS pharmacy service at Dessie referral hospital, 2019 (n=219).

\*P value less than 0.05.

The hospital offering services except for compounding, drug information center, and chronic care pharmacy service. Despite baseline assessment was conducted to identify the human resource gap before the implementation of APTS and hiring around 14 pharmacy staffs, the existing staff levels in pharmacy departments were still insufficient to effectively implement APTS. The head of the pharmacy department stated the scenario "the APTS human resource categories with critical shortage were cleaner, security guards and cashiers next to pharmacy staff". Moreover, workload, attrition, lack of indemnity policy, inadequate salary, and lack of capacity building was major bottlenecks.

Conducting a complete count of the physical on a regular and timely basis is mandatory for a transparent and accountable pharmaceutical transaction system. In this regard, APTS contributed to transparency, audit ability, efficiency, and improved performance of staff. This was further substantiated by one key informant "the system has reduced the time required for undertaking physical count". The absence of regular financial auditing, lack of training for newly hired staff, and workload were reported to be the major challenges regarding the

auditing task. One key informant portrayed that “*APTS requires a training. We are new for the system. The problem further worsened due to shortage of pharmacy staffs*”. Besides, discrepancy analysis between the quantities of medicines recorded on bin cards and the actual physical count is not regularly conducted. However, discrepancy during sample product auditing was low during the last auditing due to APTS implementations. Despite these benefits, the pharmacy service is declining. One respondent substantiated that “*APTS implementation is declining as the regional health bureau decreases their strong push and supportive supervision*”.

## Discussion

Proper functioning drug supply management ensures steady availability of the right drug products, in the right quantities, of the right quality, reasonable price, at the right time, and with proper use. Hence, transparency and accountability in the practice of pharmaceutical transactions and the provision of pharmaceutical services will be granted [14]. The pharmacy practice model would demonstrate improved patient outcomes and maximize the pharmacist’s contributions to drug therapy [25]. The present study evaluated the practice of APTS at the Dessie referral hospital.

The number of service years was significantly associated with the good practice of APTS. The supply chain in the country is not as effective as desired and lack of expertise in supply chain management was contributing to the problem of the supply chain [26]. Pharmacy service comparisons by experience were explained by statistically significant differences between the pharmacy service of corporate-community and non-corporate-community sites [27]. A system that uses pharmacists as independent practitioners has achieved high-quality and cost-effective patient care [25]. It’s also noted that the involvement of a hospital-based community liaison pharmacist achieved seamless pharmaceutical care between the primary and secondary healthcare settings [28].

Lack of transparency in the pharmaceutical system can lead to wastage of resources [7]. Consistent generation and reporting of information are essential for proper decision making [14]. Auditable pharmaceutical transaction and service interventions improve the country’s pharmaceutical service delivery system through revitalizing multiple pieces of initiatives for improved health outcomes [20]. In this study, 21 (56.8%; 95% CI: 40.5%, 73%) pharmacy professionals perceived that APTS had improved the pharmacy services. Studies conducted in Ethiopia reported moderate [9] and low dissatisfaction [12]. This was attributed to increased workload and attrition rates among pharmacy professionals. Higher workload which was not supported by an indemnity assumes more responsibility resulted in job dissatisfaction due to delay in implementing an indemnity policy and the lack of performance management and incentive system [9]. As a result, pharmaceutical services provision will be below standards and are in urgent need of improvement [12].

The availability of medicines is the main factor that determines patient satisfaction. In this study, the availability of medicine was 84%. The finding was comparable with APTS implementing public hospitals at Gamo Gofa where 85% of the patients reported that prescribed drugs were available [24]. In the health centers of rural Ethiopia [29] Barbara S</author><author>Lagarde, Mylene</author><author>Tesfaye, Addis</author><author>Palmer, Natasha</author></authors></contributors><titles><title>Availability of essential medicines in Ethiopia: an efficiency-equity trade-off?</title><secondary-title>Tropical Medicine & International Health</secondary-title></titles><periodical><full-title>Tropical Medicine & International Health</full-title></periodical><pages>1394-1400</pages><volume>14</volume><number>11</number><dates><year>2009</year></dates><isbn>1360-2276</isbn></urls></record></Cite></EndNote> and Amanueal mental hospital [30] 84% and 88% of prescriptions were filled respectively. Studies also reported higher availability of key tracer medicines in APTS sites than non-APTS sites (90% vs. 70%) [9] and 83.1% and 72.0% in stores of APTS and non APTS hospitals [22]. However, various reasons were identified for inadequately available of essential medicines [2]. These factors include poor medicine supply and distribution systems, insufficient health staff, low budget, and the high cost of medicines [31].

World health organization outlined the provision of essential medicines as one of the eight essential components of primary health care as they have high-value in health care systems that often make a difference in the health outcomes for the individual and the population [2]. Lack of access to medicines causes households to face financial catastrophe through increased out-of-pocket expenses [32]. As a



result, medicines are unaffordable for large sections of the global population [9]. Thus, a steady supply of safe, effective, and quality drugs at an affordable price is crucial for the success of health program implementation [8]. Health managers should take this urgent issue and appropriate measures shall be taken [32].

The present study revealed that more than two-thirds (71%) of the patient's prescription was adequately labeled. The finding was lower than 100% labeling practice of Amanueal mental hospital [30] but higher (53.9%) than labeling practice of southern hospital [21]. It's also reported that patients in a general hospital were more likely to receive labeled drugs than those in a primary level hospital [24]. The use of appropriate labeling practices was better in APTS implementing sites than non-APTS sites [9]. Globally, more than half of all patients fail to take medicines correctly and hence inappropriate use of medicines harms people and waste resources [10]. The shortage of human resources and some structural constraints might compromise the labeling practice [33].

In the present study, 63% (95% CI: 56.9%, 69.9%) of patients were satisfied with APTS pharmacy services. The proportion of pharmacy service satisfaction was reported 46.19% in Eastern Ethiopia [23], 51.9% in Ethiopia [15] and 83% in the Harari region [34]. Higher mean level of satisfaction was found in APTS sites compared to patients satisfaction in non-APTS sites [9,22] and primary hospital than in general hospital [24]. Despite APTS contributed to improving patient satisfaction, inadequate number and trained staff, high staff turnover and low professionals satisfaction might contribute to a low level of patient satisfaction [9].

Patients from urban were 11.76 times more likely satisfied with APTS pharmacy services compared to rural residents (AOR: 11.76 (4.43-31.20)). Similarly, rural dwellers were found to be more satisfied compared with their equivalent (AOR: 2.2) in Eastern Ethiopia [23]. In this study, it was found that males were 64% times less satisfied with APTS pharmacy services than females (AOR: 0.36). However, the socio-demographic characteristics of a patient were not found to predict the level of satisfaction [15].

The present study revealed that a shortage of human resources, workload, attrition, lack of indemnity policy, inadequate salary, lack of capacity building, and absence of regular financial auditing, lack of training for newly hired staff, and workload were the major challenges for APTS. These factors were already identified by studies conducted previously [18,24]. Moreover, insufficient equipment and facilities needed to give the service, lack of using the highest efficient mix of services units of pharmacy [18], budget constraint [16], lack of supervision and patient factors [24] were also the bottleneck to APTS implementation. Given that APTS improved the quality of services, medicines availability, use of medicines budget, and reduced wastage [9].

Evaluating the effect of APTS implementation in health institutions will help health managers and decision-makers' effort in improving the quality of pharmacy service provision. The findings are also crucial to a ministry of health to design and implement strategies for rational and optimized pharmacy service. The present study had limitations. The cross-sectional nature of the study did not allow for the temporal relationship to be inferred. Social desirability bias might affect the study findings as respondents were requested to respond based on their experience.

## Conclusions

More than half of the pharmacy professionals perceived that APTS had improved pharmacy services. Two-third of patients were satisfied with APTS pharmacy services. The number of pharmacy professionals service years, urban residence, new visit, and male sex were significantly associated with satisfactory auditable pharmaceutical transactions and services. Human resource shortage, workload, attrition, lack of indemnity policy, inadequate salary, and lack of capacity building were major bottlenecks. The absence of regular financial auditing, lack of training for newly hired staff, and workload were reported to be the major challenges regarding the auditing task. Despite APTS improved pharmacy services, the pharmacy service is declining due to loss to follow up. Workload determination, introducing indemnity and other incentive mechanisms, capacity building, management ownership, and follow up is recommended to improve APTS implementation.

## Consideration

Ethical approval was obtained from Ethics Review Committee of the Department of Pharmacy, College of Medicine and Health Sciences, Wollo University (WU Phar/153/12). Then, the study was conducted after granting permission from the hospital administrator. Verbal informed consent was approved by the ethics review committee and this study was conducted in accordance with the Declaration of Helsinki. Verbal informed consent was obtained from study participants and confidentiality of patient-specific data was maintained.

## Consent for Publication

None.

## Availability of Data and Materials

The datasets are available from the corresponding author upon reasonable request.

## Funding

None.

## Competing Interest

The authors declare that they have no potential competing interest.

## Authors` Contribution

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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