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RESEARCH ARTICLE

Blood Transfusion for Iron Deficiency Anaemia in Antenatal and Postnatal in Maternal Specialist Hospital, 2018-2019: An Analytical Cross-sectional Study

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Abstract:

Objective:

Estimate the proportion and outcomes of blood transfusion in iron deficiency anemia in a specialist maternal hospital in Dubai, United Arab Emirates (UAE).

Methods:

In a cross-sectional study, data were collected from 177 pregnant inpatients and delivered outpatients with haemoglobin less than 12g/dL at the hospital in Dubai (UAE) between the 1st of February 2018 to 31st of January 2019. Sociodemographic factors were age, parity (number of birth to a live neonate or gestational age more than 24 weeks), and ethnicity. The outcome variable is blood transfusion. Different variables such as age, parity, nationality, gestational age at diagnosis, most severe haemoglobin reading, serum ferritin, haemoglobin electrophoresis, treatment, gestational age at delivery, mode of delivery, postpartum haemorrhage, neonatal birthweight, neonatal haemoglobin were tested using frequencies and means (standard deviation), chi-square and sample T-test was used.

Results:

One hundred and seventy-seven ladies had anemia, and one hundred and twenty-two (68%) had iron deficiency anemia (ferritin<30ng/dL). 52.5% (N=93) had moderate to severe anemia, and only 7.3% (N=13) received a blood transfusion. Anaemia was mostly diagnosed in the first trimester (40.7%; N=72) and second trimester (38.4%; N=68). 11 (6.2%) ladies had hemoglobinopathies such as beta-thalassemia, 138 (78%) ladies didn't have hemoglobin electrophoresis reading. 37.9% (N=67) of vaginally delivered ladies and 4.5% (N=8) of cesarean section-delivered ladies had a postpartum hemorrhage. The majority of anemic antenatal and postnatal were Emiratis (74.6%; N=132), and a greater number fell in the middle age group between 30-39 (58.2%; N=103). The larger part had normal neonatal birthweight (76.8%; N=136) and only had a low neonatal birthweight (18.1%; N=32). 105 (59.3%) of neonates had abnormal hemoglobin readings.

Conclusion:

This is the first study in the UAE that assess both maternal and fetal outcome due to iron deficiency anemia in pregnant ladies. The prevalence of blood transfusion increased as iron deficiency anaemia was more severe. We endorse health practitioners to regularly measure serum haemoglobin, to treat anaemia early in pregnancy to avoid the need for blood transfusion.

Keywords: Blood transfusion, Iron deficiency anemia, Pregnancy, Antenatal, Postnatal, Serum haemoglobin.

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1. INTRODUCTION

'Anaemia is the most widespread of the haematological disorders; it 'is considered one of the main nutritional deficiency disorders' affecting about one-third of the global population' [1 - 3]. 'It causes a reduction in the circulating red cell mass and a corresponding decrease in hemoglobin mass and oxygen carrying capacity of blood' [4]. Maternal anemia during pregnancy in the first trimester can be considered a risk factor for pregnancy outcomes, as it may result in 'increased risk of low birth weight, small-for-gestational-age babies and perinatal death' [5 - 7]. On the other hand, some studies said that maternal anemia was no longer a risk factor for poor pregnancy outcomes during the third trimester [8]. Iron deficiency anemia is one of the most common disorders globally; it affects 50% of pregnant ladies and may lead to

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maternal and fetal morbidity [9 - 11]. Iron deficiency anemia is the most prevalent, preventable, and treatable cause of anemia worldwide [10, 11]. Maternal iron deficiency in pregnancy reduces fetal iron stores, and this can be restored by iron supplements that improve iron status during pregnancy [12]. Treatments for anemia that include red blood cell transfusions have shown an improved decrease in maternal and effects on the fetus [9, 13]. 'the world health organization (WHO) defines anemia of pregnancy as hemoglobin (Hb) <11 g/dL' [14]. Management of iron deficiency anemia is a target to avoid red blood cell transfusion, and awareness of this health problem should be among the first pillars of any patient blood management program [15].

2. OBJECTIVE

Estimate the proportion of blood transfusion in iron deficiency anaemia in antenatal and postnatal pregnancies between 1st of February 2018 to 31st of January 2019.

3. RESEARCH HYPOTHESIS

If iron deficiency isn't treated early in pregnancy, then it will increase the need for blood transfusion during pregnancy, and it will lead to fetal complications.

4. METHODS

4.1. Study Design

This is an analytical cross-sectional study to analyse blood transfusion in iron deficiency anaemia in antenatal and postnatal. Analysis of data was done on iron-deficient pregnant and delivered ladies from 1st of February 2018 to 31st of January 2019.

4.2. Study Settings

Data used in this study were collected from the Salama electronic database in Latifa Hospital in Dubai, UAE. Latifa Hospital provides tertiary care for pregnant ladies and neonates; all subjects recruited are seen by different specialized doctors (gynaecologist, emergency, interns, *etc*.).

4.3. Participants

All pregnant and delivered ladies with iron deficiency anaemia. Diagnosis of anaemia is confirmed by a blood test that includes serum haemoglobin, serum ferritin, haemoglobin electrophoresis. All ladies with haemoglobin less than 12g/dL were identified as anaemic, and serum ferritin less than 30ng/mL was identified as iron deficient; these ranges were set by Dubai Healthcare Authority and are used in Latifa Hospital [16]. Inclusion criteria are pregnant and delivered ladies who are anaemic. Exclusion criteria included ladies who didn't deliver in Latifa Hospital, those with haemoglobin more than 12g/dL, stillbirth and neonates who underwent abortion.

4.4. Variables

Collection tool includes healthcare number, age (years), nationality, parity, gestational age at diagnosis of anaemia (weeks), most severe haemoglobin reading, serum ferritin that is done after confirming haemoglobin less than 12g/dL to confirm that the anaemia is caused by iron deficiency (ferritin less than 30ng/mL), haemoglobin electrophoresis reading to note hemoglobinopathies such as sickle cell disease and beta thalassemia (percentage), treatment given for the recorded haemoglobin level, gestational age at delivery (weeks), mode of delivery (caesarean section or vaginal), postpartum bleeding (liters), neonate weight (kilograms), neonatal haemoglobin (g/dL). Ladies received different types of treatments, which include ferric carboxymaltose, ferric pyrophos liposom, ferrous fum, ferrous sulfate, folic acid, iron glycinate, iron succinyl, iron sucrose, and blood transfusion, and some ladies didn't receive any treatment.

4.5. Data Sources/measurements

All the variables are categorical except for the sociodemographic, which includes parity as a continuous variable. Age is divided into 3 groups; from 20-29, 30-39, 40-49 years old, nationality was divided into UAE local and non-local, severity of anaemia is combined into 2 groups because of the small group of ladies; mild (<10-12g/dL), moderate-severe (>9.9g/dL), serum ferritin is divided into 2 groups; iron deficiency (<30mg/dL) and not iron deficiency (>30mg/dL), haemoglobin electrophoresis is grouped into normal (normal is 2.0-3.3% of Hb A2) [17] and abnormal, treatment given is divided into blood transfused and no transfusion, postpartum haemorrhage is divided into 2 groups vaginal and caesarean-section, and each is subdivided into normal and abnormal; vaginal postpartum blood loss normal is 500L and C-section postpartum blood loss normal is 1000L, vaginal postpartum haemorrhage is more than 500L and C-section postpartum haemorrhage is more than 1000L, neonatal weight is divided into normal (>2.5kg) and abnormal (<2.5kg), neonatal haemoglobin is divided into normal (14-22g/dL) and anaemic (<14g/dL). All variable ranges are done following the hospital laboratory guidelines.

4.6. Study Size

Calculation of sample size is done using Cochran's sample size formula [18]. Random sampling method is used to recruit 177 pregnant and delivered anaemic ladies from an electronic database. One hundred and seventy-seven ladies' data were collected in a specific time frame and met the study eligibility criteria.

N = sample size of reference study

P = prevalence of anaemia

q = 1 – p

d = width of the 95% confidence interval

$$N = \frac{z_{\frac{\alpha}{2}}^2 pq}{d^2}$$

$$d = \sqrt{\frac{z_{\frac{\alpha}{2}} pq}{N}}$$

N = 177

4.7. Statistical Methods

Data were entered into the computer using IBM-SPSS for Windows version 24.0 (SPSS Inc., Chicago, IL) [19]. For the descriptive analyses, categorical variables are presented as frequencies and percentages and continuous variables are presented as mean ± standard deviation (SD). Age, nationality, gestational age of diagnosis, the severity of anemia, serum ferritin, treatment, mode of delivery, and neonatal weight are categorical data that are analysed using chi-squared or Fisher's exact test. Sample T-test is used to analyse continuous data that includes parity and serum haemoglobin. The alpha value of a P-value of less than 0.05 is considered significant in all statistical analysis.

4.8. Ethical Consideration

This study was approved by the MBRU-IRB committee. No ethical approval is required for data collection because it was collected anonymously.

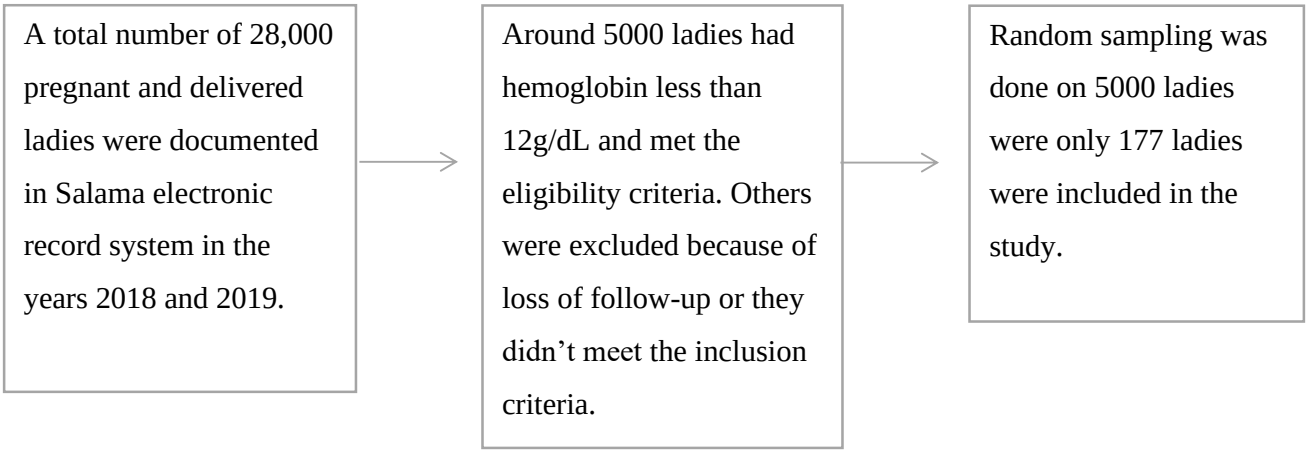
4.9. STROBE

This study was reported according to the STROBE statement and protocols [20].

5. RESULTS

5.1. Participants

All pregnant and delivered ladies who were diagnosed with iron deficiency anemia from the time frame extending from the 1st of February 2018 to 31st of January 2019. A total number of 28,000 ladies were recorded in the system for pregnancy follow-up and delivery during 1 year, more than 5000 met the eligibility criteria, but after random sampling, only 177 ladies were included (graph 1). Among those 177 ladies, 74.6% (N=132) of them were Emiratis, 25.4% (N=45) of them were from other nationalities. Most ladies had 2 previous pregnancies (mean=2.07) . Majority of ladies who had anaemia were aged from 30-39 (58.2%; N=103), 55.3% (N=57) of this age group had moderate to severe anaemia. Fifty-two point five percent (52.5%; N=93) of all anaemic ladies had moderate to severe anaemia (haemoglobin of less than 10g/dL). Sixty-eight percent (68%; N=122) had serum ferritin less than 30ng/dL, which means anaemia related to iron deficiency. Six point 2 percent (6.2%; N=11) had abnormal haemoglobin electrophoresis reading, which means they may have sickle cell disease or beta thalassemia, 15.8% (N=28) had normal HBELC reading, 78% (N=138) were missing data. Only 7.3% (N=13) received a blood transfusion, while others had iron or folic treatment. Anaemia was mostly diagnosed in first trimester (40.7%; N=72) and second trimester (38.4%; N=68). Only 4.5% (N=8) were still pregnant, 95.5% (N=169) delivered, 52% (N=92) had a normal vaginal delivery, 43.5% (N=77) had a caesarean section. 86.4% (N=153) of delivered ladies had data computed about postpartum bleeding, others were still pregnant, or data was missing, 37.9% (N=67) of ladies who had a vaginal delivery experienced postpartum haemorrhage, 4.5% (N=8) of ladies who had a c-section delivery experienced postpartum haemorrhage. Sixty-seven-point two percent (67.2%; N=39) of ladies who experienced vaginal postpartum haemorrhage had iron deficiency anaemia. 77.2% (N=98) of ladies who had c-section delivery but didn't experience PPH had iron deficiency anaemia. 76.8% (N=136) of neonates had a normal birth weight of more than 2.5 kilograms. Neonatal anaemia was evident in 59.3% (N=105), 40.7% (N=72) of neonates had normal haemoglobin (Table **1**).



Graph. 1. Flow chart.

Table 1. Variables.

Variable	Number of Ladies
Nationality:	
Emirati	132 (74.6%)
Non-Emirati	45 (25.4%)

(Table 1) contd.....

Variable	Number of Ladies
Age:	
20-29	52 (29.4%)
30-39	103 (58.2%)
40-49	22 (12.4%)
Gestational age at diagnosis:	
First trimester	72 (40.7%)
Second trimester	68 (38.4%)
Third trimester	37 (20.9%)
Serum haemoglobin:	
Mild (10-12g/dL)	84 (47.5%)
Moderate to severe (<9.9g/dL)	93 (52.5%)
Serum ferritin:	
<30ng/dL (iron deficiency anaemia)	122 (68.9%)
>30ng/dL (other causes of anaemia)	36 (20.3%)
Haemoglobin electrophoresis (Hb A2):	
Normal	28 (15.8%)
Abnormal (beta thalassemia)	11 (6.2%)
Treatment given:	
Blood transfusion	13 (7.3%)
Others, such as iron and folate supplements	154 (87.1%)
Not treated	10 (5.6%)
Mode of delivery:	
Vaginal	92 (52%)
Caesarean-section	77 (43.5%)
Postpartum haemorrhage in vaginal delivery:	
Normal (<500L)	86 (48.6%)
Abnormal (>500L)	67 (37.9%)
Postpartum haemorrhage in c-section delivery:	
Normal (<1,000L)	145 (81.9%)
Abnormal (>1,000L)	8 (4.5%)
Neonatal birth weight:	
Normal (>2.5kg)	136 (76.8%)
Abnormal (<2.5kg)	32 (18.1%)
Neonatal anaemia:	
Normal (14-22g/dL)	72 (40.7%)
Anaemic (<14g/dL)	105 (59.3%)

Table 2. Statistics.

Parity		
N	Valid	177
	Missing	0
Mean		2.07
Std. Deviation		1.850

Table 3. Variables and severity of anaemia.

Variables	All	The severity of anemia: mild	The severity of anemia: moderate to severe	p-value
Age:				-
20-29	52 (29.4%)	27 (51.9%)	25 (48.1%)	0.672
30-39	103 (58.2%)	46 (44.7%)	57 (55.3%)	0.672
40-49	22 (12.4%)	11 (50%)	11 (50%)	
Blood transfusion:				
Transfused with RBC	13 (7.3%)	0 (0%)	13 (100%)	0.00
No transfusion	164 (92.7%)	84 (51.2%)	80 (48.8%)	0.00

Table 4. Variables and birth weight.

Variables	All	Birthweight <2.5kg	Birthweight > 2.5kg	p-value
The severity of anemia:				
Mild	84 (47.5%)	14 (17.9%)	64 (82.1%)	0.844
Moderate to severe	93 (52.5%)	18 (20%)	72 (80%)	0.844
Blood transfusion:				
Transfused with RBC	13 (7.3%)	3 (23.1%)	10 (76.9%)	0.715
No transfusion	164 (92.7%)	29 (18.7%)	126 (81.3%)	0.715
Gestational age at diagnosis:				
First trimester	72 (40.7%)	14 (21.2%)	52 (78.8%)	0.816
Second trimester	68 (38.4%)	12 (18.5%)	53 (81.5%)	0.816
Third trimester	37 (20.9%)	6 (16.2%)	31 (83.8%)	0.816

Table 5. Variables and serum ferritin.

Variables	All	Serum Ferritin: <30	Serum Ferritin: >30	p-value
Vaginal delivery:				
No postpartum hemorrhage	86 (48.6%)	65 (84.4%)	12 (15.6%)	0.023
Postpartum hemorrhage	67 (37.9%)	39 (67.2%)	19 (32.8%)	0.023
Caesarean-section:				
No postpartum hemorrhage	145 (81.9%)	98 (77.2%)	29 (22.8%)	1.00
Postpartum hemorrhage	8 (4.5%)	6 (75%)	2 (25%)	1.00

6. MAIN OUTCOME

The main objective of this study is to calculate and analyse the proportion of blood transfusion in pregnant and delivered ladies. The prevalence of blood transfusion in antenatal and postnatal is 7.3% (N=13). When testing for associations, a statistical significance was found between blood transfusion and severity of anaemia ($p<0.05$)* as seen in Table **3**. 100% (N=13) of moderate-severe anaemic ladies received a blood transfusion. Association was established between age and severity of anaemia with a p-value of 0.67* (Table **3**). P value was less than 0.05, which means there was no significant between blood transfusion and other variables such as neonatal birthweight. Table **4** shows that an association was not found between the severity of anaemia and neonatal birthweight and between gestational age at diagnosis of anaemia and neonatal birthweight. When testing for association between parity and severity of anaemia, we found that mild anaemia had a mean of 2.04 (SD=1.62) and moderate anaemia had a mean of 2.11 (SD=2.04); the association was not significant. Negative association was found between maternal age and neonatal birthweight ($p=0.010$)*, so older mother tends to deliver babies with low birthweight. A p-value of 0.205 was found, which means there is no association between the mother's age and neonatal haemoglobin level. Table **5** shows a significant association between serum ferritin and postpartum haemorrhage caused by vaginal haemorrhage with a p-value of 0.023*; no significance was recorded between serum ferritin and PPH caused by c-section (p-value=1).

7. DISCUSSION

This is the first study assessing the epidemiology of blood transfusion in anaemia in antenatal and postnatal in Dubai, UAE. This study was conducted in Latifa Hospital, which is one of the most known hospitals that provides tertiary medical care for women and children; the study includes anaemic pregnant and delivered ladies. Anemia is a frequent condition during pregnancy, particularly among ladies from developing countries who have insufficient iron intake to meet the increased iron needs of both the mother and the fetus [21]. Anaemia in pregnancy can be caused by iron, or folate deficiency, hemoglobinopathies such as beta-thalassemia, and other causes [22]. Of all anemia's diagnosed during pregnancy, 75% are due to iron deficiency [23]. Iron deficiency is more likely to occur at certain times in life, such as adolescence, pregnancy, and breastfeeding [24]. Anaemia in antenatal and postnatal can have many obstetric complications.

7. SUMMARY OF MAJOR FINDINGS

Out of 177 anaemic pregnant and delivered ladies, 74.6% (N=132) of them were Emiratis, and 58.2% (N=103) of them belonged to the younger age group 30-39. Sixty-eight percent (68%; N=122) of anaemic ladies are caused by iron deficiency. Fifty-two point five percent (52.5%; N=93) of ladies had moderate to severe anaemia. Night two point seven percent (92.7%; N=164) received iron and folate treatments. Seven point three percent (7.3%; N=13) of moderate to severe anaemic ladies received a blood transfusion, 100% association is established between the severity of anaemia and blood transfusion. As the mother's age increase, the neonatal birth weight decreases; this explains a reciprocal association between maternal age and neonatal birth weight. A significant association is proven between serum ferritin and vaginal postpartum haemorrhage.

8. COMPARISON WITH PREVIOUS STUDIES

There was only one study about the impact of anaemia in pregnant ladies that was conducted in AlAin, which reported retrospective hospital data where it included 100 cases of anaemic and 100 non-anaemic pregnant ladies that had been recorded for almost 14 years [25]. In the study group, iron

deficiency anaemia was the most common type of anaemia (91%), followed by beta thalassaemia trait (8%) [26]. In our study, 68% of anaemic ladies had iron deficiency anaemia. This supports the fact that most anaemia in pregnant and delivered ladies is related to iron deficiency. Eight percent (8%) of 100 anaemic ladies received a blood transfusion, and 5% received a blood transfusion because they had symptoms of chronic anaemia with haemoglobin <8g/dL; in our study, 100% of blood transfusion was done on moderate to severe anaemic ladies. This finding reinforces the significance between blood transfusion and the severity of anaemia. There was no significant increase in adverse neonatal outcomes in our anaemic ladies; another study with a similar outcome states that birth weight is correlated negatively and independently with maternal haemoglobin concentration, and therefore anaemia during pregnancy is expected to increase and not decrease birthweight [27]. Both findings support our study, where we found no association between maternal anaemia and neonatal low birthweight. However, some studies reported a positive association between anaemic ladies and low birth weight [24, 28]. A study conducted in the United Kingdom provides a positive relationship between gestational age at diagnosis of anaemia and low birth weight, unlike our study, which neglects the association between these variables [29]. Niger [30], India [31], China [32], Japan [33], Ireland [34], France [35], and Denmark [36] reported a lack of association between maternal and neonatal haemoglobin concentrations, which was similarly found in our study. Post-partum haemorrhage was more common in our anaemic subjects compared with non-anaemic ladies [26]; in our study, we found that iron-deficient anemic ladies experienced vaginal postpartum hemorrhage.

9. IMPLICATIONS FOR PUBLIC HEALTH PRACTITIONERS/ CLINICIANS/EDUCATORS

One of the study's aims is to treat iron deficiency anaemia early in pregnancy to avoid blood transfusion. Health clinicians should start to educate pregnant ladies about iron deficiency anaemia, how to avoid it, and how to treat it. Inadequate nutrition and restrictive diet are major causes of iron deficiency anaemia. Health practitioners should monitor the haemoglobin levels of pregnant ladies to detect anaemia early in pregnancy. Failure to take iron supplements can contribute to an increased risk of severity of anaemia. For this reason, doctors should emphasize the importance of taking iron supplements to prevent the need for blood transfusion.

10. STRENGTHS, LIMITATIONS AND GENERAL-INSABILITY

One of the main strengths of this study is that data was collected from one of the largest maternal and children hospital in the UAE, which include nearly about 7000 birth per year. This is the first study to assess the prevalence of blood transfusion in iron deficiency anaemia in pregnant and delivered ladies in the UAE. Regardless of the study's strengths, there are a couple of limitations that should be discussed. Missing data is a huge burden when data collection is secondary; in this case, multiple ladies did not have all the variables recorded on the system, and some had password-protected profiles; thus, they were not included in the study. This study is cross-sectional, which is limiting in terms of determining the cause and effect, establishing a temporal relationship between exposure and outcome is not possible, and risk cannot be measured. In this study, results cannot be generalized as the data was collected from one hospital with a small sample size.

11. AREAS FOR FUTURE RESEARCH

Iron deficiency anaemia in antenatal and postnatal is a major nutritional problem that may result in mild to serious obstetric outcomes. Research should be done across the UAE to accent the need to treat anaemia early in pregnancy before it becomes more severe, where the need for blood transfusion is a necessity. Researchers should look at the causes of iron deficiency anaemia and how can they prevent it. A cohort study can be useful to know the different causes of anaemia. A case-control study can be used to know which type of iron supplement is more effective in treating iron deficiency anaemia.

CONCLUSION

In conclusion, the prevalence of blood transfusion was higher in moderate to severe anaemia in antenatal and postnatal. Compared to another study, our hospital had a slightly low prevalence of blood transfusion. Neonatal low birthweight is associated with increase in maternal age. Iron deficient anaemic pregnant and delivered ladies have increased risk of vaginal postpartum haemorrhage. This study provides a basic analysis and description of iron deficiency anaemia along with different variables, this study can be used as a helpful reference to future studies. Nonetheless, local and regional studies should be conducted to enhance the study findings and to help in generalizability.

LIST OF ABBREVIATIONS

WHO	=	World Health Organization
Hb	=	Hemoglobin
SD	=	Standard Deviation

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by the MBRU-IRB committee. No ethical approval is required for data collection because it was collected anonymously.

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All procedures performed in studies involving human participants were in accordance with the ethical standards of institutional and/or research committees and with the 1975 Declaration of Helsinki, as revised in 2013

CONSENT FOR PUBLICATION

Informed consent was obtained from all the participants.

AVAILABILITY OF DATA AND MATERIAL

All the data and supporting information is provided within the article.

STANDARDS OF REPORTING

STROBE guidelines were followed in this study.

FUNDING

None.

CONFLICT OF INTEREST

The authors declared no conflict of interest, financial or otherwise.

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