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RESEARCH ARTICLE

A Study on Knowledge, Attitudes, Practice and Awareness towards Pre-Marital Carrier Screening of Thalassemia among the University Students of Biological Faculty in Bangladesh: A Cross-Sectional Study

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ABSTRACT

Thalassemia is a hereditary hemoglobinopathies that results from the absence of a globulin chain and it is a very common problem in Southeast Asia. Like many other countries' community based premarital carrier screening (PMCS) of thalassemia is extremely rare in Bangladesh. This study aimed to investigate knowledge, attitude, practice, and awareness towards PMCS among University students in Bangladesh. A cross-sectional study was conducted from January to March 2020 using a self-administered questionnaire which was distributed to 911 Jahangirnagar University students aged 18 to 24. The questionnaire was composed of five parts: personal information, knowledge, attitudes, practice, and awareness. On the basis of the answers, knowledge, attitudes, practice, and awareness towards PMCS were evaluated. About (88.80%) of the total participating students thought that PMCS is necessary before marriage. In the case of thalassemia carrier parents, 81.00% of students replied that prenatal screening is important before pregnancy. 610 students (66.95%) of the total 911 students considered that thalassemia can be caused by marrying between blood relatives. Most of the students (79.80%) supported that thalassemia screening should be an obligatory procedure and 91.98% would like to raise social awareness about PMCS and thalassemia. The students of Jahangirnagar University have good knowledge about PMCS program and a positive attitude but it is difficult to implement in real life without continuing practice. The outcome of this study suggested the necessity of increasing student's awareness of Bangladeshi PMCS program.

Keywords: Blood transfusion, Social awareness about thalassemia, Thalassemia, Thalassemia carriers.

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1. Introduction

Genetic blood disorders are considered to be the most common causes of physical and mental disabilities in infants and children [1]. Sickle cell anemia and thalassemia —are the most common genetic hemoglobinopathies worldwide [2]. World Health Organization (WHO) accorded that, the prevalence rate of the sickle cell trait was 6% and 2% for beta-thalassemia trait and around 240 million people are carriers for these genetic disorders [3], [4].

Thalassemia is a hereditary hemoglobinopathies that results from the absence of globulin polypeptide chain synthesis [5]. This is a very common problem in Southeast Asia. Thalassemia is classified into two types, a) thalassemia major and b) thalassemia minor [6]. The disease is inherited in children if one of the parents becomes a carrier of this hemoglobin gene. If both parents are carriers, they have a 25% chance of having a thalassemia major child and a 50% chance of having children with thalassemia minor [7]. Birth of thalassemia major child can only be prevented by knowing which persons are carriers of thalassemia

and avoiding marriage between carriers. Thalassemia is likely to be a major public health concern in the coming decades in South Asia. Despite the fact that Bangladesh lies in the world's thalassemia belt, information on the number of thalassemia carriers, and different aspects (epidemiology, clinical course, mortality, complications, and treatment outcomes) of thalassemia carriers are lacking. So, screening and counseling programs are cost-effective preventative measures that decrease the prevalence of thalassemia.

The proper management of thalassemia requires a multidisciplinary approach such as identifying carriers, providing treatment knowing the molecular heterogeneity of thalassemia with clinical correlations, and transfusing only RBCs instead of whole blood etc. Like, other South Asian countries, Bangladesh has no national programs for raising awareness, screening carriers, or knowing patients with thalassemia [8]–[12].

As an alternative approach to reducing thalassemia prevalence in Bangladesh, this study was conducted to evaluate the knowledge, attitude, practices, and awareness about thalassemia among students of the biological faculty, Jahangirnagar University.

2. Materials and Methods

This is a cross-sectional descriptive study carried out among the students of biological faculty, Jahangirnagar University. The study was conducted during the period from 15 January 2020 to 15 March 2020. A total of 911 students took part to achieve the objectives of this study. Selection of the participants was done by simple random sampling among students of biological faculty, age range were 18 to 24. All potential participants received an information sheet that covered all aspects of the study and their inquiries were responded to and were asked to sign a consent form. A self-administered questionnaire was prepared by literature review and used to collect the data under the supervision of qualified students [13]–[16]. Based on available literature on Knowledge, Attitude, and Practice (KAP) paradigm on thalassemia, the questions were set in the questionnaire. The questionnaire included close-ended questions. Close-ended questions, in a checklist format, were designed to investigate people's knowledge of thalassemia.

The questionnaire was composed of five main parts: personal information, knowledge, attitudes, practice, and awareness. The first part includes personal information concerned about age, sex, name of the department, academic year, home district, marital status, religion, individual history of thalassemia, and family history of thalassemia. The second part was concerned with the knowledge of thalassemia. For example, we asked the participants if there was any connection of this disease with marriage. In the third part, attitudes towards thalassemia will help us to know the mindset of the participants about thalassemia. For example, the participants were asked about their willingness to marry a thalassemia carrier, if he/she (the carrier) fulfills all other criteria to get married. The fourth part justifies their practice towards thalassemia such as willingness to test thalassemia before marriage. The final part was concerned about their awareness of thalassemia.

2.1. Statistical Analysis

To evaluate the statistical significance of differences among proportions of categorical data Pearson's Chi-square analyses were used. The odds ratios (OR) and 95% confidence intervals (CI) obtained from logistic regression models were taken. All statistical analyses were conducted using Statistical Package for Social Sciences (SPSS 20.0) [17].

2.2. Ethical Clearance

The study was approved by the Jahangirnagar University Ethics Committee. Participation was voluntary and written informed consent was obtained prior to data collection. All participants were informed about their right to withdraw from the study at any time and their anonymity and confidentiality were assured and emphasized.

3. Results

A total of 911 students of the biological faculty of Jahangirnagar University participated in this pre-KAP study. Among them 431 were male and 480 were female students. The age range of the participants was 18 to 24 years. Most of the male students (88.16%) reported that they have no history of thalassemia and in female students, this was 83.75%. In the case of family history of thalassemia, 85.83% ($P = 0.023$) of the participants reported that they have no family history of thalassemia, and 88.16% and 83.75% for male and female students, respectively.

Though the majority of the participants (701 among 911 participants, 76.94%) answered they have no known person suffering from thalassemia disease, a large participant (191 among 911, 20.96%) do know some thalassemia patients who are mostly neighbors (3.95%) (Table I).

The knowledge about thalassemia among the participants was evaluated under two headings: i) general knowledge about thalassemia such as is thalassemia a familiar word or not, major and minor forms of thalassemia, signs and symptoms of thalassemia, is this disease linked with marriage or not, etc., and ii) knowledge dealing with diagnosis and treatment of thalassemia.

Among the participants, 869 participants (95.40%) had heard the term thalassemia and among the rest 42 (4.60%), 19 participants (2.08%) had never heard the term thalassemia and 23 participants (2.52%) had no idea. Though 95.40% of the participants have heard the term thalassemia, a number of participants (109 among 911, 11.96%) do not know that thalassemia is a blood disorder. Almost half of the participants (382 among 911, 41.93%) answered that either they did not know such types of forms of thalassemia or they did not have any idea about the thalassemia major and minor forms. On the other hand, 239 participants (26.23%) also did not know that thalassemia disease has a connection with marriage.

These statistics of knowledge about thalassemia clearly show a great percentage of biological science students at a University do not know how to avoid the future occurrence of thalassemia.

TABLE I: Thalassemia History of the Participants (Both Personal & Family History) Who Participated (N = 911) in this Study

History	n%			P-value
	Total	Male (n = 431)	Female (n = 480)	
Q: Individual history of thalassemia				
Yes	12 (1.31)	8 (1.85)	4 (0.83)	
No	782 (85.83)	380 (88.16)	402 (83.75)	0.023
Don't know	117 (12.84)	43 (9.97)	74(15.41)	
Q: Family history of thalassemia				
Yes	12 (1.31)	4 (0.92)	8 (1.66)	
No	782 (85.83)	380 (88.16)	402 (83.75)	0.146
Don't know	117 (12.84)	47 (10.90)	70 (14.58)	
Q: Do you know any thalassemia patients?				
Yes	191 (20.96)	92 (21.34)	99 (20.62)	
No	701 (76.94)	320 (74.24)	381 (79.37)	<0.001
Don't know	19 (2.08)	19 (4.40)	0 (0)	
Q: What is your relationship with the patients?				
Parents	14 (1.53)	9 (2.08)	5 (1.04)	
Cousins	21 (2.30)	11 (2.55)	10 (2.08)	0.473
Neighbors	36 (3.95)	15 (3.48)	21(4.37)	
No relation	624 (68.49)	330 (76.56)	294 (61.25)	

TABLE II: General Knowledge about Thalassemia among the Students (N = 911) of the Biological Faculty of Jahangirnagar University

Knowledge items (General)	n%			P-value
	Total	Male (n = 431)	Female (n = 480)	
Q: Have you heard the term thalassemia?				
Yes	869 (95.40)	413 (95.82)	456 (95)	
No	19 (2.08)	8 (1.85)	11 (2.29)	0.836
Don't know	23 (2.52)	10 (2.32)	13 (2.70)	
Q: Is thalassemia a blood disorder?				
Yes	730 (80.13)	331 (76.79)	399 (83.12)	
No	109 (11.96)	51 (11.83)	58 (12.08)	0.001
Don't know	72 (7.90)	49 (11.36)	23 (4.79)	
Q: Do you know thalassemia major is the disease form and thalassemia minor is the carrier form?				
Yes	529 (58.06)	241 (55.91)	288 (60)	
No	288 (31.61)	147 (34.10)	141 (29.37)	0.671
Don't Know	94 (10.31)	43 (9.97)	51 (10.62)	
Q: Is there any connection to this disease with marriage?				
Yes	672 (73.76)	329 (76.33)	343 (71.45)	
No	185 (20.30)	70 (16.24)	11 (23.95)	0.005
Don't Know	54 (5.92)	32 (7.42)	22 (4.58)	
Q: What are the signs and symptoms of thalassemia?				
Pale skin and dark urine	429 (47.09)	244 (56.61)	185 (38.54)	
Muscle weakness	316 (34.68)	173 (40.13)	123 (25.62)	0.777
Headache and diarrhea	27 (2.96)	14 (3.24)	13 (2.70)	

Among the 911, 613 participants (67.28%) considered that thalassemia can be diagnosed but the idea of thalassemia treatment was mostly unknown (604 participants, 66.30%). Most of the students (64.21%) answered that thalassemia is a hereditary disease while 5.48% answered that it is an autoimmune disease.

Little more than half of the population (59.05%) answered that blood transfusion is the main treatment of thalassemia and the rest (34.13%) gave negative answers and 6.80% of participants had no idea (Table III). Among the total participants, 47.09% considered that the signs and symptoms of thalassemia were pale skin and dark urine, 34.68% considered muscle weakness, and the rest (2.96%) considered headache and diarrhea (Table II).

Next, we tried to focus on the attitudes of the participants toward thalassemia. Most of the participants (800 among 911, 87.81%) ($P = 0.008$) did not want to marry thalassemia carrier and 809 among 911 (88.80%) ($P = 0.007$) significantly thought that thalassemia screening is necessary before marriage.

In the case of prenatal screening of neonates, 81.00% of participants ($P = <0.001$) significantly replied that prenatal screening is important before the late stage of pregnancy if parents are thalassemia carriers. They (91.98%) would like to raise social awareness about thalassemia. Among the total study population, 595 (65.31%) participants would like to give birth if the neonates are even affected by thalassemia though 220 (24.14%) participants will consider aborting the pregnancy.

Table V reports the practice of the participants with thalassemia. Most of the test population (92.09%) (P = 0.086) wanted to test thalassemia before marriage. About 89.68% of the participants wanted to suggest others perform prenatal screening. Even they (79.80%) ($P = <0.001$)

TABLE III: Knowledge Dealing with Diagnosis and Treatment of Thalassemia among the Students (N = 911) of the Biological Faculty of Jahangirnagar University

Knowledge items (diagnosis & treatment)	n%			P-value
	Total	Male (n = 431)	Female (n = 480)	
Q: Do you know thalassemia can be diagnosed?				
Yes	613 (67.28)	293 (67.98)	320 (66.66)	0.019
No	246 (27.00)	123 (28.59)	123 (25.62)	
Don't know	52 (5.70)	15 (3.48)	37 (7.70)	
Q: Do you know the treatment of thalassemia?				
Yes	270 (29.63)	142 (32.94)	128 (26.66)	0.116
No	604 (66.30)	272 (63.10)	332 (69.16)	
Don't know	37 (4.06)	17 (3.94)	20 (4.16)	
Q: Do you know blood transfusion is the main treatment of thalassemia?				
Yes	538 (59.05)	253 (58.70)	285 (59.37)	0.972
No	311 (34.13)	148 (34.33)	163 (33.95)	
Don't know	62 (6.80)	30 (6.96)	32 (6.66)	
Q: Do you know the type of thalassemia?				
Hereditary	585 (64.21)	255 (59.16)	330 (68.75)	0.123
Autoimmune	50 (5.48)	15 (3.48)	35 (7.29)	

TABLE IV: Attitudes of the Participants (N = 911) of the Biological Faculty, Jahangirnagar University, Towards Thalassemia

Attitudes	n%			P-value
	Total	Male (n = 431)	Female (n = 480)	
Q: Do you like to marry a thalassemia carrier?				
Yes	77 (8.45)	47 (10.90)	30 (6.25)	0.008
No	800 (87.81)	373 (86.54)	427 (88.95)	
Don't know	34 (3.73)	11 (2.55)	23 (4.79)	
Q: Do you think that thalassemia screening is necessary before marriage?				
Yes	809 (88.80)	377 (87.47)	432 (90.0)	0.007
No	60 (6.58)	39 (9.04)	21 (4.37)	
Don't know	42 (4.61)	15 (3.48)	27 (5.62)	
Q: After screening if you find that you are thalassemia carrier or minor, do you like to marry a thalassemia carrier partner?				
Yes	136 (14.92)	80 (18.56)	56 (11.66)	0.008
No	718 (78.81)	329 (76.33)	389 (81.04)	
Don't know	57 (6.25)	22 (5.10)	35 (7.29)	
Q: Do you think prenatal screening of the neonates is important in pregnancy, if parents are thalassemia carriers?				
Yes	738 (81.00)	329 (76.33)	409 (85.20)	<0.001
No	112 (12.29)	73 (16.93)	39 (8.12)	
Don't know	61 (6.69)	29 (6.72)	32 (6.66)	
Q: Is it important to raise social awareness for thalassemia?				
Yes	838 (91.98)	398 (92.34)	440 (91.66)	0.260
No	20 (2.91)	6 (1.39)	14 (2.91)	
Don't know	53 (5.81)	27 (6.26)	26 (5.41)	
Q: What should you do when you find out that neonatal is thalassemia affected after screening?				
Give birth	595 (65.31)	291 (67.51)	304 (63.33)	0.678
Abortion	220 (24.14)	104 (24.12)	116 (24.16)	

significantly thought that thalassemia should be obligatory before marriage while 8.45% of participants were neutral and 11.74% disagreed with making this obligatory. More than 90% of the participants (91.43%) of this study wanted to inform other persons about its consequences. A very positive event was observed in the case of blood donation to thalassemia patients, most of the study population (80.79%) ($P = 0.002$) wanted to donate blood and 88.47% of the participants wanted to encourage others to give blood to thalassemia patient.

About three-fourths (80.13%) of the study population considered thalassemia to be a blood disorder and 11.96% had no idea about it (Table II). Over half of the students (67.83%) reported that it is not caused by malnutrition but about 22.06% of the participants considered it as a malnutritional disease (Table VI).

610 among 911 (66.95%) ($P = 0.049$) students significantly thought that thalassemia can be caused by marrying between blood relatives and 7.90% were neutral. About 88.69% of the participants answered blood tests are required for diagnosis of thalassemia. Three-fourths (79.58%) of the total participants thought that blood transfusion is necessary throughout the life of a thalassemia patient, while 12.84% of the participants did not know about it and 7.57% were neutral in this case (Table VI).

TABLE V: Practice of the Participants (N = 911) of the Biological Faculty, Jahangirnagar University, about Thalassemia

Practice	n%			P-value
	Total	Male (n = 431)	Female (n = 480)	
Q: Do you want to test thalassemia before marriage?				
Yes	839 (92.09)	395 (91.64)	444 (92.50)	
No	43 (4.72)	26 (6.03)	17 (3.54)	0.086
Don't know	29 (3.18)	10 (2.32)	19 (3.95)	
Q: Will you suggest others to perform prenatal screening?				
Yes	817 (89.68)	379 (87.93)	438 (91.25)	
No	39 (4.28)	26 (6.03)	13 (2.70)	0.046
Don't know	55 (6.03)	26 (6.03)	29 (6.04)	
Q: Will you suggest others perform prenatal screening if parents are carriers?				
Yes	799 (87.70)	372 (86.31)	427 (88.95)	
No	61 (6.69)	40 (9.28)	21 (4,37)	0.005
Don't know	51 (5.59)	19 (4.40)	32 (6.66)	
Q: Do you think that screening for thalassemia should be obligatory producer before marriage?				
Yes	727 (79.80)	322 (74.71)	405 (84.37)	
No	107 (11.74)	73 (16.93)	34 (7.08)	<0.001
Don't know	77 (8.45)	36 (8.35)	41 (8.54)	
Q: Do you think you should inform other people about its consequences?				
Yes	833 (91.43)	384 (89.09)	449 (93.54)	
No	27 (2.96)	15 (3.48)	12 (2.5)	0.047
Don't know	51 (5.59)	32 (7.42)	19 (3.95)	
Q: Do you want to donate blood to thalassemia patient?				
Yes	736 (80.79)	334 (77.49)	402 (83.75)	
No	102 (11.19)	48 (11.13)	54 (11.25)	0.002
Don't know	73 (8.01)	49 (11.36)	24 (5.0)	
Q: Will you encourage others to give blood to thalassemia patients?				
Yes	806 (88.47)	376 (87.23)	430 (89.58)	
No	48 (5.26)	26 (6.03)	22 (4.58)	0.512
Don't know	57 (6.25)	29 (6.72)	28 (5.83)	

TABLE VI: Awareness of the Participants (N = 911) of Biological Faculty, Jahangirnagar University, about Thalassemia

Awareness	n%			P-value
	Total	Male (n = 431)	Female (n = 480)	
Q: Is thalassemia caused by malnutrition?				
Yes	201 (22.06)	103 (23.89)	98 (20.41)	
No	618 (67.83)	281 (65.19)	337 (70.20)	0.271
Don't know	92 (10.09)	47 (10.90)	45 (9.37)	
Q: Can thalassemia be caused by marrying between blood relatives?				
Yes	610 (66.95)	297 (68.90)	313 (65.20)	
No	229 (25.13)	94 (21.80)	135 (28.12)	0.049
Don't know	72 (7.90)	40 (9.28)	32 (6.66)	
Q: Are blood tests required for diagnosis of thalassemia?				
Yes	808 (88.69)	378 (87.70)	430 (89.58)	
No	48 (5.26)	25 (5.80)	23 (4.79)	0.665
Don't know	55 (6.03)	28 (6.49)	27 (5.62)	
Q: Do you think that thalassemia patients need blood transfusions throughout his/her life?				
Yes	725 (79.58)	337 (78.19)	388 (80.83)	
No	117 (12.84)	59 (13.68)	58 (12.08)	0.613
Don't know	69 (7.57)	35 (8.12)	34 (7.08)	

4. Discussion

Hereditary or communicable disease carrier detection is important to control prevalence and this is an acceptable international practice [18]. The application of PMCS is likely to bear enormous benefits in coping with the burden of congenital and inheritable genetic diseases. In highly consanguineous populations, it is one of the most suggested effective prevention strategies [19]. In any program of premarital screening, special focus is given to unmarried young people such as University students because their knowledge, beliefs, and attitudes will help them to choose their life partner [20]. In this connection, a large number of students choose their life partners during their study in the University. Therefore, University students have been chosen for this Pre-KAP (knowledge, attitudes, and practice) study towards PMCS program of thalassemia, and to the best of our knowledge, it is the first University level PMCS program in Bangladesh.

In our study, most of the students said that they had no individual history or family history of thalassemia. Most of the respondents (95.38%) had heard the term

thalassemia as compared to other thalassemia prevalent countries such as Malaysia (~87%), Italy (85%), Greece (95%), Bahrain (65%), Turkey (58%) and Saudi Arabia (48%) [21]–[24] but only 58.06% students knew about the type of thalassemia major is the diseased form and minor is the carrier form (Table II). Though it is a positive sign that about three-fourths of the students (73.76%) knew this disease is connected with marriage but a little more than one-fourth (26.24%) had no idea about the occurrence of thalassemia with marriage which is also a matter of great concern.

Another important issue is that 11.96% even do not know that thalassemia is a blood disorder (Table II). About 80.13% of participants recognized that thalassemia is a blood disorder (Table II), which was more than shown by Basu at Kolkata (67.52%) [25], Srivastava *et al*. at rural Bengal (50.67) [26] and Wong *et al*. at Malaysia among multi-racial population (76.4%) [27]. About 67.28% of participants answered that thalassemia can be diagnosed but most of the students (66.30%) had no idea about its treatment. Results showed that 311 out of 911 participants (34.13%) confirmed that they do not know that blood transfusion is the only treatment for thalassemia which is also not enough for the survival of the patients (Table III). One of the most concerning findings of this study and some previous studies was that many of the respondents were unaware of the genetic nature of this disease. Our study demonstrated that 64.21% of respondents had correct knowledge about the inherited/genetic nature of this disease (Table III) and only 5.48% considered it an autoimmune disease while this percentage was found higher in some other previous studies [22], [24]–[27]. Here, it is worth mentioning that in another study in Bangladesh, Hossain *et al*. found about 56.0% of the participants do not know about the inherited/genetic nature of this disease [24]. The reason behind this high percentage is that their target group of participants was college students who might not come through the knowledge of thalassemia occurring.

About 88.80% of participants had a positive attitude to have premarital testing/screening of blood for thalassemia (Table IV). This particular finding was also found to be higher in other cities or countries like Bahrin (77.8%) [23], Kolkata (92.06%) [25], Malaysia (90.6%) [27], Sri Lanka (82%) [28] and Karachi (74%) [29]. Most of the participants (91.98%) thought that raising social awareness about thalassemia is very important. Only 24.14% agreed for opting termination of pregnancy in the case of thalassemic fetus rather than letting the child suffer (Table IV). In contrast, in most other previous studies it was 81.31% at Kolkata [25], 88.0% at Thailand [30], 36.6% at Malaysia [27], but only 2.2% at Karachi [29].

In this study, we found most of the participants (89.68%) had wanted prenatal diagnosis for thalassemia which was higher than Malaysia (13.6%) [27], Sri Lanka (17.0%) [28], and Karachi (35.9%) [29]. This high percentage (89.68%) of participants willing to have a prenatal diagnosis for thalassemia might be due to the fact that all of the participants are University students of biology background. They might be aware of the outcome when a baby is born with thalassemia disease. This is also reflected in their answers when they are asked to test thalassemia before marriage. 839 out of 911 participants (92.09%) answered that they want to know if they are carriers of this disease or not before marriage (Table V). Therefore, making PMCS an obligatory procedure before marriage was favored by about 79.80% of the participants. This percentage is lower than what was found in Saudi Arabia where 85.0% agreed on making PMCS a mandatory procedure before marriage and 63.0% agreed on legal interference in case of a positive result [30]. Maximum (91.43%) students agreed to inform others about the consequences of thalassemia. In our study, 80.79% of participants wanted to donate blood and 88.47% encouraged others to donate blood for thalassemia patients in contrast to 98.83% in Kolkata [25], 97.1% in Karachi [29] and 60.8% in Bangladesh in another study on college students [24]. It was found that thalassemia could be caused by marrying between blood relatives was assumed by 66.95% of participants (Table VI). Surprisingly, only 79.58% were aware that blood transfusion is required throughout life in the present study (Table VI) compared to 66.59% by Basu at Kolkata [25], 42.1% by Ebrahim *et al*. at Karachi [29], 47.9% by Wong *et al*. at Malaysia [27] and 33.9% by Hajeri *et al*. at Bahrin [23] among the general public.

5. Conclusion

The current study was performed only in one faculty of Jahangirnagar University and the results may not be represented in other regions of the country. However, this study showed that students of biological faculty from Jahangirnagar University have good knowledge about PMCS program and a positive attitude towards the program but it is difficult to implement in real life without continuing practice. The findings of this study highlight the necessity to increase student's awareness and enhance their knowledge and attitudes toward Bangladeshi PMS program. Various media of communication such as TV, radio, newspaper, and social platforms can be used to circulate essential information about the PMCS program among the target population. Community based awareness campaigns should be performed. Religious leaders and lawmakers can play an important role in raising compliance and exercise of the PMCS program. For the performance of premarital and prenatal diagnosis, diagnostic centers can be increased to provide quality control programs at a minimum cost or free of cost to the poor. Overall, this study will be considerably helpful in preventing the propagation of thalassemia in resource-limited countries like Bangladesh.

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Conflicts of Interest

The authors have no conflicts of interest to disclose.

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