Design and Validation of a Survey Questionnaire for the Assessment of Physician Transfusion Medicine Knowledge

IBSA ABDI, LAUREN GAGNON, SCOTT WISE, GREGORY PASSMORE

ABSTRACT

The clinical appropriateness of blood transfusion rests with physicians having the correct knowledge when making decisions concerning the selection and transfusion of blood and blood components. Transfusion medicine knowledge (TMK) is typically acquired during medical school, as on-the-job training during residency or fellowship, and through continuing education (e.g., online, seminars, workshops) in practice. To obtain a baseline of TMK in physicians at Augusta University Medical Center (AUMC) (formerly Georgia Regents University Medical Center), a multiple-choice survey questionnaire was designed and validated using input from individuals with expertise in the field of transfusion medicine. The survey was then deployed to physicians at AUMC. Analysis of survey response data showed that there were significant knowledge gaps among physicians that varied among specialty groups as well as with the number of formal education hours that physicians received as part of their medical training and in practice. The purpose of this research study was to establish the baseline TMK level of physicians at AUMC.

ABBREVIATIONS: TMK - Transfusion Medicine Knowledge, AUMC - Augusta University Medical Center -, ARC - American Red Cross, CMS – Centers for Medicare & Medicaid Services, CFR - Code of Federal Regulations, ASCP - American Society for Clinical Pathology, BEST - Biomedical Excellence for Safer Transfusion, TJC - The Joint Commission, PBM - Patient Blood Management

INDEX TERMS: Blood Transfusion, Blood Banks, Physicians, Surveys and Questionnaires, Transfusion Medicine

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Ibsa Abdi MHS, MLS (ASCP), *Department of Medical Laboratory, Imaging and Radiologic Sciences, College of Allied Health Sciences, Augusta University, Augusta, Georgia/ Georgia Piedmont Technical College, Clarkston, GA*

Lauren Gagnon MHS, *Department of Medical Laboratory, Imaging and Radiologic Sciences, College of Allied Health Sciences, Augusta University, Augusta, GA*

Scott Wise, MSAD, MT (ASCP) SBB, *Department of Medical Laboratory, Imaging and Radiologic Sciences, College of Allied Health Sciences, Augusta University, Augusta, GA*

Gregory Passmore, Ph.D., CNMT, *Department of Medical Laboratory, Imaging and Radiologic Sciences, College of Allied Health Sciences, Augusta University, Augusta, GA.*

Address for correspondence: Scott Wise, MSAD, MT (ASCP) SBB, *Department of Medical Laboratory, Imaging and Radiologic Sciences, College of Allied Health Sciences, Augusta University, 987 St. Sebastian Way, EC 2410 Augusta, GA (706) 831-5307, swise@gru.edu*

INTRODUCTION

Blood transfusion is a lifesaving intervention that can also pose increased and unnecessary risk to transfusion recipients.[1] These risks include potential transmission of infectious agents as well as suppression of the immune system. In order to minimize the inappropriate use of blood products, the American Red Cross (ARC) developed "A Compendium of Transfusion Practice Guidelines", compiled from peer-reviewed journals, to further educate physicians and other healthcare providers involved in transfusion medicine practice on the proper selection and use of blood components.[1] The AABB, which is the primary accrediting body for most Blood

Banks and Transfusion Services, also publishes the "Circular of Information" and "Blood Transfusion Therapy, A Physician's Handbook." Both of these resources include valuable information regarding the indications, contraindications, and dosing requirements for the various types of blood components as well as substitutes such as factor concentrates.[2] In addition, the Joint Commission for the Accreditation of Health Care Organizations (TJC), which is the primary entity responsible for accrediting hospitals, now requires that hospitals develop and implement Patient Blood Management (PBM) programs in order to receive accreditation.[3]

In order to develop an effective PBM program, physicians must first be educated on the proper selection and use of blood components. In 2002, Rock et al conducted a baseline physician transfusion medicine knowledge assessment using a multiple-choice strategy based upon Canadian blood transfusion guidelines.[4] Results of the study showed that only 37% of the respondents answered basic questions on blood products correctly and that the percentage answered correctly varied significantly with the specialty. In 2007, Gharehbaghian et al, performed a similar study in Iran.[5] Results of their study showed that the knowledge of physicians was one-third lower than expected and that educational materials should be provided for medical students, residents, and fellows. In 2010, O'Brien et al, performed a transfusion medicine knowledge assessment of postgraduate year 1 residents.[6] Results of this study concluded that there was a lack of emphasis on transfusion medicine education during medical school. The last published study was in 2011 in which Arinsburg et al attempted to evaluate the baseline knowledge of attending clinicians, residents, and medical students in transfusion medicine at their facility in order to develop specialty-specific lectures.[7] Results of this study concluded that there was a general lack of knowledge in transfusion medicine across all specialties and all training levels and indicated that additional education was needed. The purpose of this study was to characterize areas in which further education was needed so that appropriate educational interventions could be developed to improve baseline TMK.

MATERIALS AND METHODS

The target population for this study consisted of attending physicians, fellows, and residents at AUMC. The estimated size of the target population was about 900. Using a sample survey size calculator (900 total population, 95% confidence interval) the total sample size was calculated to be 269. The initial survey instrument consisted of 33 questions. The instrument was electronically submitted to a transfusion medicine expert panel at AUMC for expert opinion input for the establishment of construct validity. Of the 33 questions submitted, 30 were validated with further modification by incorporating transfusion medicine expert opinion. The final survey instrument deployed consisted of 30 questions, covering background demographic data, knowledge assessment, and opinions on educational needs. (Refer to Table 1 for survey study topics). The validated instrument was deployed electronically using an anonymous survey tool (Qualtrics.com). Members of the study population were invited to participate in the survey and were provided with the link to the survey by the Graduate Medical Education Office (GME) and the AUMC Medical Staff Office. The survey was self-administered by the respondents after review and approval by the AUMC Institutional Review Board (IRB).

Table 1. Topics covered in the Transfusion Medicine Competency Survey

Demographics
Sample Collection, Storage, and Administration of Blood Components
Selection and Use of Blood Components
Complications of Transfusion
Transfusion-Transmitted Infections
Opinions on Education Needs

Statistical analysis of data collected was performed using computer software (Excel 2010 Microsoft Corp., Seattle, WA, USA, version 14.4). The results were reported as the mean percentage of questions answered correctly ± standard deviation. Differences in the percentage of questions answered correctly were considered statistically significant if the 95% confidence interval between measures did not overlap. Internal consistency and reliability of the survey instrument was determined using Cronbach's alpha, as shown below:[8]

RESULTS

Internal Consistency and Reliability

A total of 78 physicians responded to the survey. Based on the calculated sample size of 269, the response rate was determined to be 29%. Internal consistency and reliability of the instrument was estimated using

Cronbach's alpha (Figure 1). The calculated alpha value was 0.77 which is within the acceptable range ($0.7 < \alpha < 0.9$) as reported in the literature.[9] (Individual data on responses for Cronbach's alpha is not included due to the large size of the data table, but a summary of the results is given in Table 2).

$$\alpha = \frac{n}{n-1}\left(1 - \frac{\sum_i V_i}{V_t}\right)$$ (Cronbach, 1951, p. 299)

Figure 1. Cronbach's alpha formula.

Table 2. Internal Consistency and Reliability Determination

n	22	Number of Survey Questions
$\sum V_i$	4.64	Sum of individual variances for each question answered correctly
V_t	17.8	Variance for total answered correctly for all questions for all respondents
α	0.77	Alpha coefficient

Mean Percentage Answered Correctly by Specialty

The degree of participation in the survey varied by medical specialty group. (Table 3) Internal Medicine had the highest representation within the survey respondents (17.9%) followed by Pediatrics (12.8%), while Anesthesiology, Department of Surgery and Others (specialty not disclosed) each represented 10.3% of the total respondents. Participation levels were even lower for Radiology, Family Medicine, Emergency Medicine, Orthopedics, Obstetrics/Gynecology, Otolaryngology, and Pathology.

The overall mean percentage (%) score for the knowledge assessment ranged from 41.5% to 81.8% (Table 2). The highest performer was the Pathology specialty group who achieved 81.8% overall correct responses. The next highest performers were the Department of Surgery (62.5%) and Obstetrics/Gynecology (62.1%), Emergency Medicine (61.8%), Anesthesiology (60.8%), followed by Internal Medicine (59.4%) and Pediatrics (55.0%). The lowest scores were attained by physicians in the Otolaryngology specialty group (47.0%), followed by Radiology with 46.2% and the three lowest performers were Orthopedics (45.8%), Family Medicine (43.6%), and Other (respondents whose specialty was not disclosed) (41.5%).

Formal Education Hours

Twenty-two of the seventy-eight respondents (28%) indicated that they had no transfusion medicine education during the past 5 years, while 32% had less than an hour of transfusion medical education during the same time period (Table 4). These two groups combined accounted for 60% of respondents. Thus only about 40% of the respondents had more than an hour of transfusion medicine education in the past 5 years. Of those 40% with more than an hour of transfusion medicine education in the past five years (31 respondents), 45% had only 1-2 hours of transfusion medicine education, while 9.7% had 2-3 hours of transfusion medicine education, followed by 16% with 3-4 hours of transfusion medicine education, and finally 29% who had 4-5 hours of transfusion medicine education in the past five years. There was no significant difference in mean % of correct scores observed between those without and those with less than three hours of transfusion medicine education in the past five years. Furthermore, there were no statistically significant differences in mean percentage (%) of correct scores for respondents with less than an hour, 1-2 hours, 2-3 hours, 3-4 hours and 4-5 hours of transfusion medicine education the past five years. However, the mean percentage (%) of correct scores for respondents without transfusion medicine education over the past five years was significantly lower compared to those with more than 3 hours of transfusion medicine education during the same time period as evidenced by the lack of overlap in the 95% confidence interval for those groups.

The data in Table 5 represents whether surveyed physicians have knowledge about particular topics in transfusion medicine and on what topics they need more education. On average, 71% of respondents indicated that more education was needed in transfusion medicine across all subject areas. On average, 11% reported that they have no knowledge of various transfusion medicine topics at all, whereas, 18% felt that that no further education was needed. This data only serves to identify respondent opinion regarding transfusion medicine education and areas in which further education may be needed and indicates that the majority of respondents would like to have further education in all areas of transfusion medicine. It does not imply anything regarding the modality in which the current body of knowledge is being delivered nor the quality of the education that is being received.

DISCUSSION

The purpose of this study was to determine the baseline

Table 3. Mean Percentage of the Number of Questions Answered Correctly by Specialty

Specialty	No. Per Group	Collection, Storage, Administration (5)*	Selection and Use of Blood Components (10)	Complications of Transfusion (7)	Overall (22)	95% CI Overall Percent Score
Anesthesiology	8	52.5 ± 28.5	62.5 ± 32.1	64.3 ± 19.7	60.8 ± 27.4	49.4 – 72.2
Emergency Medicine	5	56.0 ± 35.8	56.0 ± 37.5	74.3 ± 27.6	61.8 ± 33.8	47.7 – 75.9
Family Medicine	5	36.0 ± 32.9	44.0 ± 36.3	48.6 + 15.7	43.6 ± 29.4	31.4 – 55.9
Internal Medicine	14	52.9 ± 20.6	60.0 ± 25.7	63.3 ± 15.1	59.4 ± 21.1	50.6 – 68.2
Pediatrics	10	54.0 ± 20.7	65.0 ± 31.4	41.4 ± 21.9	55.0 ± 27.4	43.6 – 66.4
Department of Surgery	8	55.0 ± 16.8	58.8 ± 31.2	73.2 ± 22.2	62.5 ± 25.9	51.7 – 73.3
Obstetrics/ Gynecology	3	73.3 ± 43.5	46.7 ± 45.2	76.2 ± 37.1	62.1 ± 44.0	43.7 – 80.5
Orthopedics	4	30.0 ± 41.1	35.0 ± 29.3	71.4 ± 30.4	45.8 ± 37.3	30.5 – 60.5
Otolaryngology	3	53.3 ± 38.0	40.0 ± 34.4	52.4 ± 26.2	47.0 ± 32.0	33.6 – 60.3
Pathology	3	80.0 ± 18.3	80.0 ± 23.3	85.7 ± 26.2	81.8 ± 22.4	72.5 – 91.2
Radiology	6	46.7 ± 18.3	51.7 ± 27.7	38.1 ± 15.9	46.2 ± 22.4	36.9 – 55.6
Other	9	37.5 ± 21.7	43.8 ± 18.9	41.1 ± 17.3	41.5 ± 18.3	33.9 – 49.1
Average for all specialties for question group	78	52.2 ± 29.3	53.6 + 33.9	60.8 + 25.0	55.6 + 31.0	44.7 – 69.1

Table 4. Mean Percentage Answered Correctly by Formal Education Hours (FEH) in Past 5 years

Formal Education Hours	Number	Mean % Correct Scores	95% CI
< 1 hour	25	57.5 ± 24.0	48.1 – 66.9
1-2 hours	14	57.1 ± 25.3	47.2 – 67.1
2-3 hours	3	59.1 ± 37.0	44.6 – 73.6
3-4 hours	5	70.0 ± 22.9	61.0 – 79.0
4-5 hours	9	62.6 ± 20.2	54.7 – 70.5
None	2	44.6 ± 17.8	37.7 – 51.6

*Scores are written as means ± standard deviation.

Table 5. Clinician Opinion on Personal Education Needs

Subject	No knowledge at all (%)	More education needed (%)	No education needed (%)
Immunohematology procedures	15	71	14
Selection and Use of Blood Components	7	65	28
Transfusion Practices	17	70	13
Complications of Transfusion	6	77	17
Average across all subject areas based upon opinion response	11	71	18

expert opinion. The validated survey instrument was then deployed to physicians at AUMC. Data was collected and analyzed based on the number of questions that were answered correctly by specialty group, the number of hours of education physicians have had previously, and clinician opinions on educational needs according to specific subject areas. From this data, we were able to characterize areas in which further educational interventions were needed.

The survey response rate in this study was 29% when calculated in terms of an expected sample size. This response rate was even lower when considered in terms of the actual size of the target population: 78 out of 900 with a resultant response rate of 8.7%. Rock et al used a printed format for the assessment of baseline transfusion medicine knowledge (in Canada) and obtained a 17.8% response rate.[4] Similarly, Arinsburg et al deployed a self-administered anonymous baseline transfusion knowledge assessment survey in four large New York hospitals, and obtained response rate of 3.8%.[7] Thus the low response rate for this study was not out of the ordinary.

The overall mean percentage (%) score for the knowledge assessment ranged from 41.5% to 81.8%. As expected, physicians in specialty groups who typically use a greater number of blood products, such as Pathology, Surgery, Emergency medicine, and Obstetrics/ Gynecology were among the higher scoring specialties. There was no statistically significant difference in overall mean percentage (%) of number of questions answered correctly among the above mentioned specialty groups. However, the mean percentage (%) of number of questions answered correctly by Pathologists (81.8%) was greater than all of the other specialty groups who participated in the survey.

The mean % correct scores observed also varied among the respondents based on the number of hours of education received. However, there was no significant difference in mean % correct scores observed between those without and those with less than three hours of transfusion medicine education over the past five years. Similarly, there were no statistically significant differences in mean percentage (%) correct scores for respondents with less than an hour, 1-2 hours, 2-3 hours, 3-4 hours and 4-5 hours of transfusion medicine education the past five years. The mean percentage (%) correct scores for respondents without transfusion medicine education over the past five years was significantly lower compared to those who had more than 3 hours of transfusion medicine education during the same time period. The data are in agreement with that of Arinsburg et al who noted stronger performance on the survey for participants who reported greater than 5 hours of formal transfusion medicine education in the past 5 years.[7]

Based on the responses of the clinicians who participated in this survey, the majority of respondents felt that more transfusion medicine education would be beneficial. (Table 4) In Table 2, the average percentage of questions answered correctly across all specialty groups and all question categories was 56 percent. Data analysis did not include a breakdown of the percentage answering correctly versus incorrectly and individual responses on their opinion on education. Therefore, the data only suggests that 71 percent of the survey respondents felt that more education was needed whether the question was answered correctly or incorrectly. There was a slight difference from survey respondents in feeling that more education was needed for the question category involving selection and use of blood components. Arinsburg et al reported a similar pattern in which the majority of participants believed that additional training in transfusion medicine was needed for themselves as well as for other physicians at all training levels.[7]

One limitation of this study may be that the survey instrument contained multiple-choice-strategy questions rather than open-ended questions. Using this question format, a survey instrument may be less rigorous in assessing an individual's actual knowledge level. The other limitation was the low response rate overall and especially within some specialties. A more accurate representation of physician TMK would require a much larger survey response.

CONCLUSION

Data from our study showed that physicians at AUMC had more knowledge of transfusion medicine practices if they were in a specialty group that was more likely to transfuse blood components, such as Pathology. Our data also showed that physicians with three or more hours of formal education achieved higher scores on the TMK survey. Over 70% of the survey respondents felt that more education in transfusion medicine overall was needed.

Physicians typically acquire knowledge related to transfusion medicine during medical school, post-graduation during fellowship/residency training, and through other forms of continuing education. Physicians must have the correct knowledge to make the appropriate decisions concerning the transfusion of blood products. Therefore, assessment of TMK is an important component of any patient blood management system. Not having the appropriate knowledge also puts patient safety at risk. More research is needed to further examine the effect that increased physician education has on actual clinical blood transfusion practices. Only by linking the two together, can we fully determine if effective knowledge transfer is occurring or not.

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