Original article

Effectiveness of Initiatives to Minimize Blood Usage and Wastage at a Public Hospital Setting in Guyana

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Abstract

Objectives: This is a cross-sectional descriptive follow-up study which analysed the pattern of blood usage and wastage after initiatives were taken following the initial study done in Guyana from 2012 to 2014. This study also assessed the healthcare personnel's knowledge regarding blood transfusion.

Methods: A study was conducted concerning blood product usage and wastage using data from the laboratory blood bank information system in 2016–2018 in the public hospital. Information on knowledge, attitude, practices and administrative guidance of healthcare personnel was assessed using a self-administered questionnaire on different areas of transfusion medicine. Usage of blood products was calculated as a percentage, and wastage of blood products was calculated as the number of units wasted due to each reason divided by the total number of units wasted. The data were entered and analysed in SPSS 21.0.

Results: A total of 29,577 units of blood were issued by the National Blood Transfusion Service. Each year, a blood unit collection of 9,745 (32.9%), 9,765 (33.0%), 10,067 (34.0%) units, respectively, was recorded. Data indicated that 3,851 units (13.0%) of blood were wasted at the Georgetown Public Hospital Cooperation due to various reasons. Packed red blood cells were the most commonly used blood product that was issued (52.5%) and platelets (47.8%) were the most commonly wasted product. In comparison to the previous study, blood wastage decreased from 25.4% to 13.0% after implementing simple interventions. Results of examination of knowledge, attitude, practices and administrative guidelines of health personnel were not satisfactory.

Conclusion: Simple and relatively cheap interventions introduced following the previous study had a dramatic impact on reducing blood wastage in the public hospital in Guyana.

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Introduction

Ensuring and practising safe and rational blood transfusion is important for high-quality and effective patient care in hospitals. The World Health Organization (WHO) defines blood management as "a patient-focused, evidence-based and systematic approach to optimize the management of patient and transfusion of blood products for quality and effective patient care. It is designed to improve patient outcomes through the safe and rational use of blood and blood products and by minimizing unnecessary exposure to blood products" (1). However, providing a safe and adequate supply of blood and blood products for transfusion is always expensive.

Appropriate clinical use of blood is an important aspect of blood safety and it reduces unnecessary exposure of patients to allogeneic blood and its associated risks (2). Despite extensive use in emergency settings, blood transfusion decisions are always made without reasonable training and with limited knowledge of the patients' situation. Overuse or inappropriate use of blood products leads to inadequacy of blood components and a substantial increase in the cost of care. Although blood components are a precious resource, their wastage is a critical problem in hospitals, especially in developing countries (3). Blood and blood components are extremely valuable and require careful allocation to maximize clinical benefits.

WHO reports that "[t]here are currently no global standards for the estimation of national requirements for blood and blood products. The need for blood and blood products is dynamic and is dependent on many factors related to health service coverage, the level of development and sophistication of the health care system and hospital blood usage" (2). There are multiple causes of blood wastage in hospitals, but the two major ones are: 1) delay in returning blood products after ordering and 2) exceeding shelf life (expiry) (3). As per the US Food and Drug Administration (FDA) and American Association of Blood Banks (AABB) guidelines, the criterion for accepting issued blood products is that the product was kept within a temperature range of 1–6 ˚C (4, 5). In most countries, including Guyana, blood banks follow a 30-minute rule for returning red blood cell (RBC) units. If the ordered RBC units are returned to the blood bank after 30 minutes without a controlled temperature, they must be discarded (6-8). Therefore, wastage occurs if the product has not been transfused or returned within 30 minutes of its issue.

In a previous study done in Guyana on blood wastage and usage, it was found that 25% of blood was wasted due to various reasons (9). This study identified a large percentage of blood wastage in the only tertiary hospital in the country. In an ideal setting, expiry and wastage of blood products should not occur, although a very low level of expiry of blood products could be expected due to blood product stocks and unpredictable demands on inventory (10).

Moral responsibilities of healthcare providers, along with strict interventions and awareness, could reduce wastage of blood products (11). Blood product wastage could be reduced through simple and cheap interventions (12). A study done on blood wastage by Heitmiller et al. indicated that RBC wastage could be decreased by 61% over 4 years, saving more than $800,000 (13). Simple interventions like strict management of blood stocks, tracking of released blood products and awareness of blood usage among clinical staff were introduced after the first similar study in the same setting. Transfusion guidelines among clinicians could also increase awareness of blood transfusion.

This study aimed to evaluate the efficiency of guidelines/interventions implemented after the previous study on blood usage and wastage. The interventions implemented after the first study helped in creation of awareness among hospital staff, creation of a proper electronic inventory and maintaining of proper temperature for blood and blood products. In order for the health professionals to make appropriate decisions in regard to proper management of blood products, it is very

important to educate them regarding the risks and benefits of transfusion. This study also aimed to investigate the adequacy in terms of knowledge, attitude and practices among doctors, nurses and laboratory technologists in the public hospital.

Materials and Methods

This was a cross-sectional, descriptive study conducted between 2016 and 2018 in the only referral hospital in Guyana. It was a follow-up study aimed at analysing the effectiveness of initiatives for minimizing blood usage and wastage in a public hospital setting in Guyana. Georgetown Public Hospital Cooperation (GPHC) is faced with high demand for blood for transfusion. National Blood Transfusion Service (NBTS), Guyana, is responsible for ensuring and providing an adequate supply of blood components. Blood collection, processing and screening of blood from donors is performed at the blood bank of the NBTS. It is a centralized blood centre which collects blood directly or through blood drives from voluntary blood donors. NBTS also collects blood through its blood facilities at the New Amsterdam, West Demerara, Suddie and Linden hospitals, along with mobile units for blood camps.

This study was conducted in three phases to meet the objective of the study: a) to assess the usage and wastage of blood and blood products; b) to investigate the knowledge, attitude and practices (KAP) of the health personnel; and c) to compare the usage and wastage of blood products with the data obtained in previous study.

Usage and wastage of blood and blood products

Wastage as a percentage of units issued (WAPI) was calculated for red blood cells (RBC), platelets (PLT), fresh frozen plasma (FFP), Pre-thawed FFP (PTFFP), Pediatric Packed Cell (PedPC), thawed fresh frozen plasma (TFFP) and packed red blood cell (PRBC):

$$\text{WAPI} = \frac{\text{sum of wasted units for each component} \times 100}{\text{sum of units issued for each component to the hospital}}$$

Percentage of blood and blood product wastage was calculated using the following formula:

$$\text{Percentage} = \frac{\text{number of units wasted} \times 100}{\text{total number of units wasted}}$$

KAP of health personnel

A carefully formulated multiple choice questionnaire, identifying areas of knowledge, attitude and practices (KAP) about blood usage and wastage, was prepared. The questions were adapted and modified from the AABB Technical Manual (17th Edition), AABB Standards for Blood Banks and Transfusion Services (27th Edition) and other literature to focus on local interests. The questionnaire was divided into four sections to meet the objectives. The first part was on knowledge assessment, the second on attitude assessment, the third on practice assessment and the last on assessing administrative guidelines. The questionnaire took less than 15 minutes to complete. Only doctors and nurses answered questions related to administrative guidelines.

A score was given for each correct answer and converted into a percentage. Mean scores were used to place each participant in a group: good or poor. Participants who scored above the mean were considered to have good KAP and those with a score below the mean were considered to have poor KAP. The same applied to the independent components of KAP. An overall average was calculated to compare the groups. A t-test and ANOVA were used to compare a statistically significant difference in mean KAP among the clinical staff involved. To validate and improve the questionnaire, a pilot study was conducted among a small group of clinicians and was not included in the actual study. Data were first entered in MS Excel and later analysed using SPSS 21.0.

Ethical considerations

Ethical approval for the study was obtained from the Institution Review Board, Ministry of Public Health, Guyana and from the Director of GPHC before proceeding with the research. A signed

consent form was obtained from all participants prior to their participation in the study.

Statistical analysis

The data related to usage and wastage of blood products were presented as number, percentage, and standard deviation. The hi-2 test was used for statistical analysis and a p-value less than 0.05 was considered statistically significant.

Results

Status of blood usage

A total of 29,577 units of blood were collected in the referral hospital from the blood bank during the period from 2016 to 2018. For each year, a blood unit collection of 9,745 (32.9%; 95% CI 32.4–33.5), 9,765 (33.0%; 95% CI 32.5–33.6), 10,067 (34.0%; 95% CI 33.5¬–34.6) units, respectively, was recorded. Mean (± SE) blood products collected annually were 331 ± 3.91 (95% CI 323.4–338.7), 335 ± 4.43 (95% CI 326.3–343.7), 359 ± 4.33 (95% CI 350.5–367.5) for 2016, 2017 and 2018, respectively. Compared to 2016, there was an increase in collection (by the referral hospital) of PRBC, FFP, platelets and PedPC in 2018 by 4.7%, 6.1%, 16.6%, and 16.1%, respectively (Figure 1).

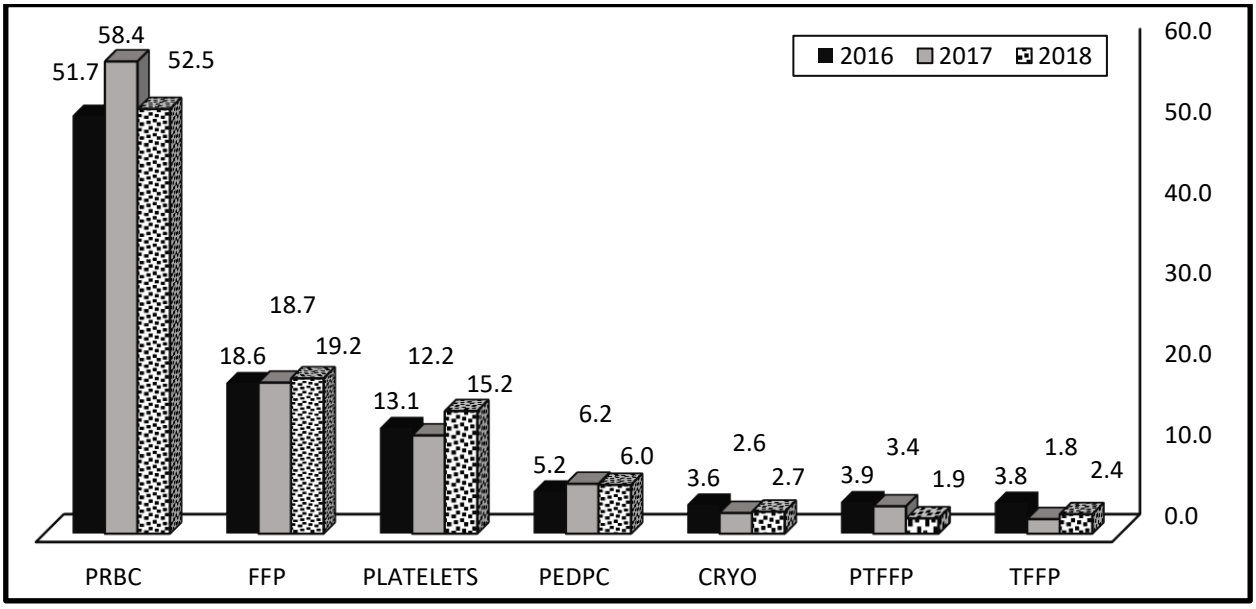

Figure 1: Distribution of blood products during the study period (2016–2018)

Of the blood products collected collectively and annually, the most frequent blood type was O+ with 50.6% (95% CI 50.0–51.2), followed by B+ (20.2%, 95% CI 19.7–20.6) and A+ (18.9%, 95% CI 18.4–19.3) (Figure 2). Usage of blood components during each quarter of the study period is shown in Figure 3..

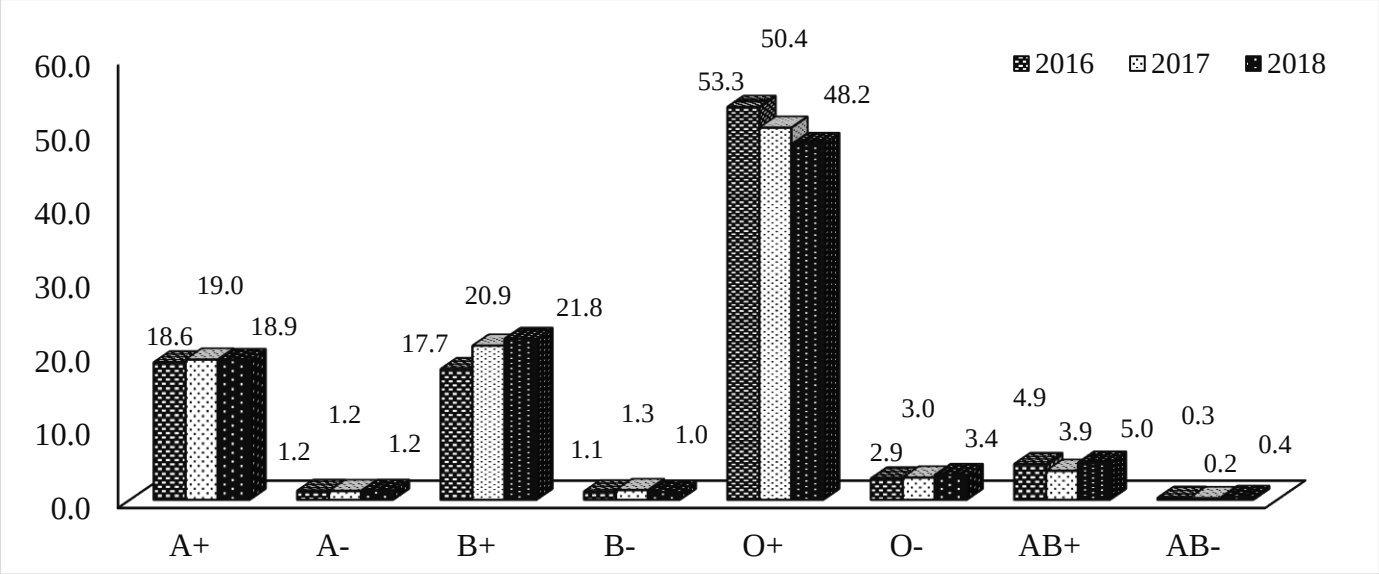

Figure 2: Distribution of blood groups during the study period (2016–2018)

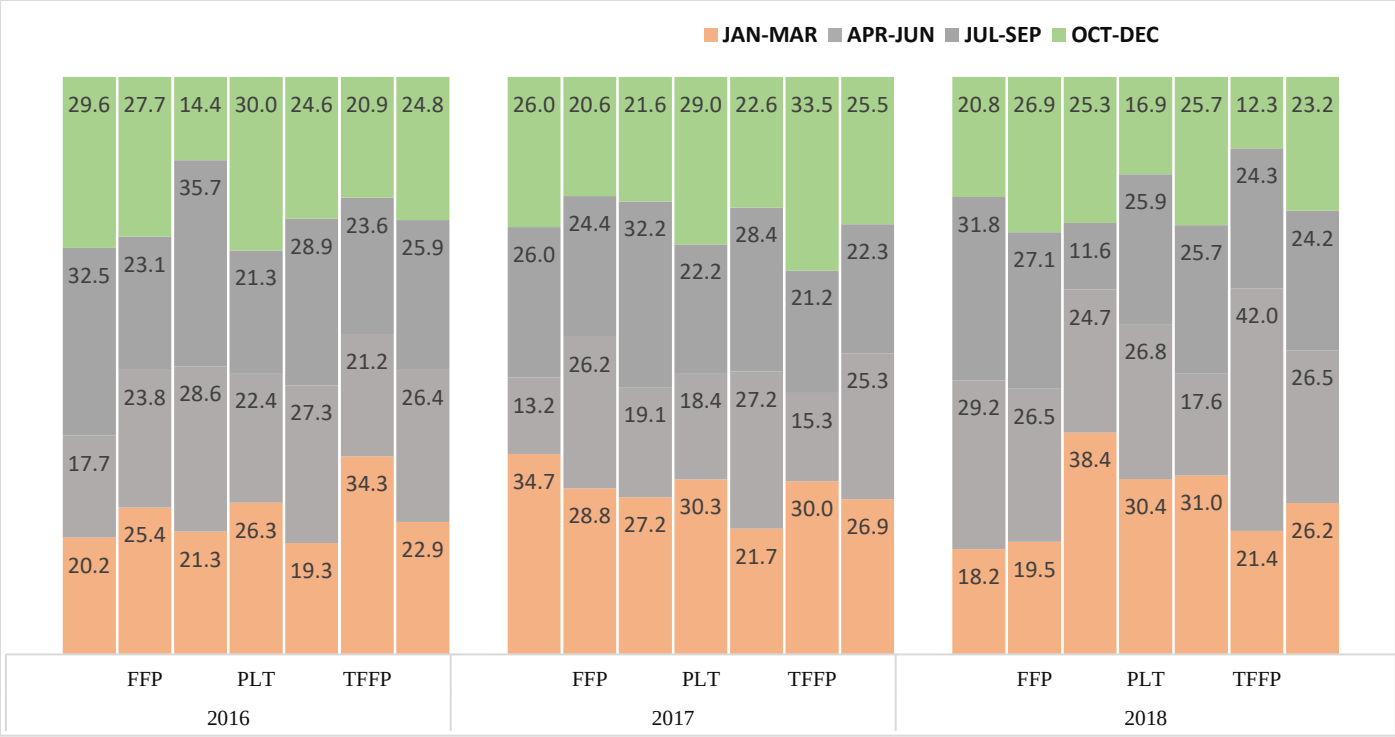

Figure 3: Blood components and their usage every quarter (2016–2018)

Status of blood wastage

The WAPI rates of Cryo, FFP, PTFFP, platelets, PedPC, TFFP, and PRBC were 17.2% (95% CI 14.7–19.9), 15.9% (95% CI 14.9–16.9), 42.9 (95% CI 39.6–46.2), 46.6 (95% CI 45.0–48.2), 5.0 (95% CI 4.0–6.1), 23.3 (95% CI 20.4–26.4) and 2.1 (95% CI 1.9–2.3), respectively. The highest wastage was observed with platelets, followed by PTFFP and TFFP.

Table 1 shows the various causes of blood wastage during the study period. The major reasons for significant blood wastage during the study period were expired blood unit (91.4%; 95% CI 90.4–92.2), broken bag (3.8%; 95% CI 3.2–4.4), unit returned after 30 minutes (1.0%; 95% CI 0.7–1.4).

Table 1: Reasons for blood component wastage during the study period (2016–2018)

Reason for blood wastage	2016	2017	2018	TOTAL	difference (%)	p-value
Expired unit	1301 (90.5)	1190 (91.6)	1028 (92.2)	3519 (91.4)	1.7	0.00
Broken bag	72 (5.0)	34 (2.6)	40 (3.6)	146 (3.8)	-1.4	0.0002
Broken cold chain	21 (1.5)	28 (2.2)	19 (1.7)	68 (1.8)	0.2	0.4
Return after 30 minutes	21 (1.5)	16 (1.2)	3 (0.3)	40 (1.0)	-1.2	0.0
Clotted blood	10 (0.7)	9 (0.7)	5 (0.4)	24 (0.6)	-0.3	0.4
Broken seal	8 (0.6)	9 (0.7)	2 (0.2)	19 (0.5)	-0.4	0.1
Component with RBC	3 (0.2)	4 (0.3)	0	7 (0.2)	-0.2	0.2
Expired transfusion unit	1 (0.1)	4 (0.3)	13 (1.2)	18 (0.5)	1.1	0.002
Transfusion reaction	0	5 (0.4)	5 (0.4)	10 (0.3)	0.4	0.1

Comparison of blood wastage with previous study

Figure 4 compares the blood wastage percentage recorded in the current three-year study and in the previous three-year study. Each year showed a gradual decrease in blood wastage in the current study. Year 1 of the previous study, showed a decrease in blood wastage by 15.4% (95% CI 13.0–17.7, $p \leq 0.05$), year 2 a decrease of 13.1% (95% CI 11.9–14.3, $p \leq 0.05$), year 3 a decrease of 12.3% (95% CI 11.2–13.4, $p \leq 0.05$). Overall, the current study recorded a significant decrease in blood wastage of 12.4% (95% CI 11.6–13.1, $p \leq 0.005$).

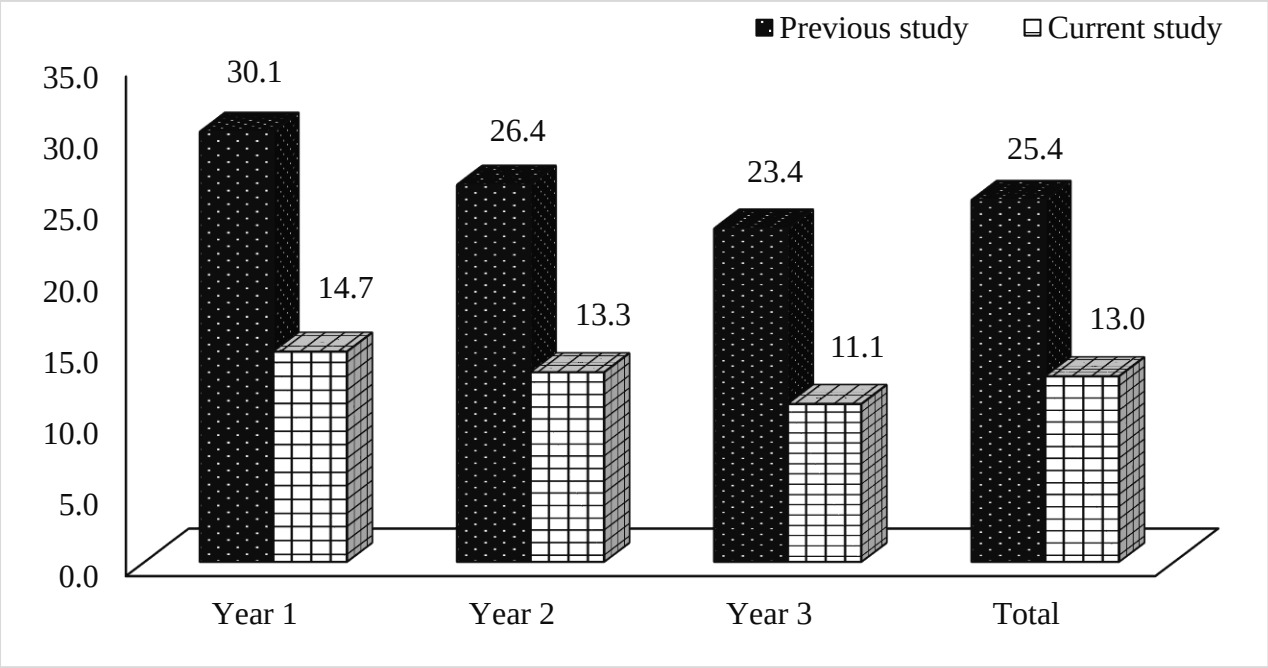

Figure 4: Percentage of blood wastage recorded in the current study (2016–2018) and in the previous study (2012–2014)

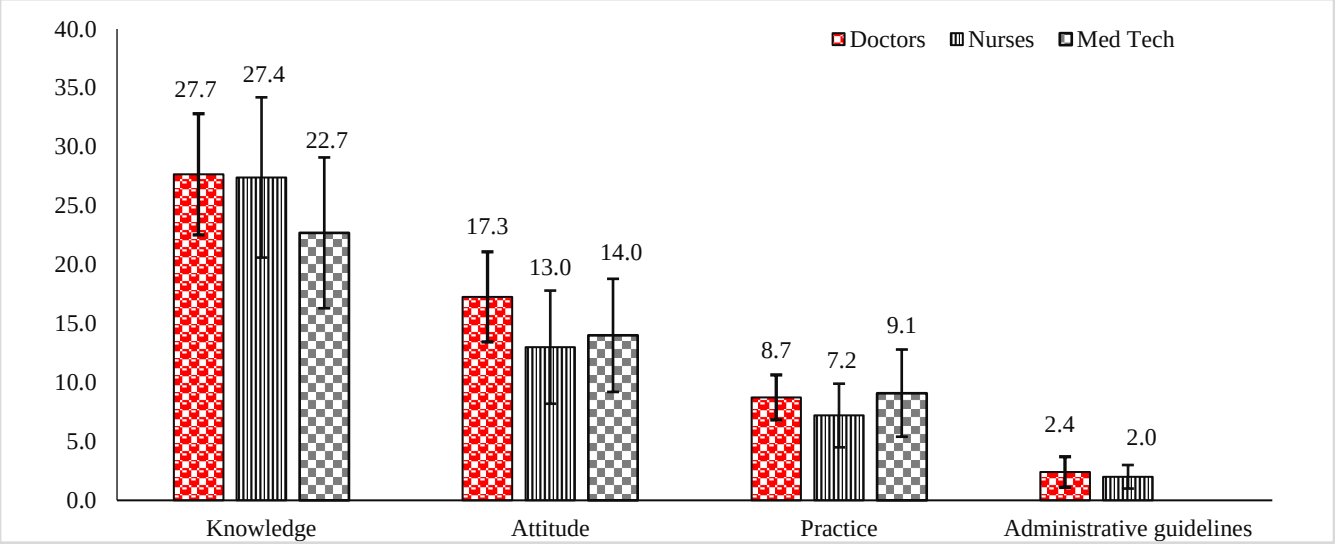

Figure 5: Mean ± SD of KAP and AG of health personnel regarding blood transfusion

(SD = standard deviations; KAP = knowledge, attitude and practices; AG = administrative guidelines)

KAP scores of medical personnel

The study included 30 doctors, 31 nurses and 12 medical technologists. The mean (± SD) age of doctors, nurses and medical technologists was 28.9 ± 5.1, 28.5 ± 4.9 and 26.3 ± 4.0, respectively, and the average number of years of experience was 2.9, 4.9 and 4.0, respectively. Only the group of doctors included male (30%) and female (70%) participants, while all nurses and medical technologists were female. The mean ± SD (95% CI) scores of KAP-AG among doctors, nurses and medical technologists were 27.7 ± 5.1 (95% CI 25.5–29.9), 17.3 ± 3.8 (95% CI 15.7–18.9), 8.7 ± 1.9 (95% CI 7.7–9.7), 2.4 ± 1.3 (95% CI 2.0–2.8); 27.4 ± 6.8 (95% CI 25.2–29.5), 13.0 ± 4.8 (95% CI 11.4–14.5), 7.2 ± 2.7 (95% CI 6.3–8.2), 2.0 ± 1.0 (95% 1.6–2.5); 22.7 ± 6.8 (95% CI 19.2–26.2), 13.0 ± 4.8 (95% CI 11.5–16.5), 9.1 ± 3.7 (95% CI 7.6–10.6) (Figure 5).

A significant difference was observed among health professionals in regard to knowledge ($F = 3.2$, $p < 0.05$), attitude ($F = 7.6$, $p < 0.001$) and practices ($F = 3.5$, $p < 0.05$); however, no significant difference was observed in regard to administrative guidelines ($t = 1.3$, $p > 0.05$). No significant difference was observed between the genders in terms of knowledge ($t = -0.5$, $p > 0.05$).

Discussion

This study aimed to investigate the pattern of usage and wastage of blood products before and after simple interventions. Likewise, this study aimed to assess the KAP of the health personnel regarding blood transfusion. This study was a follow-up study of the study on blood usage and wastage done in a public hospital in Guyana in 2012–2014 (9). The previous study indicated a wastage of 25% of blood units (9). To prevent such wastage, several initiatives were introduced in the public hospital under the supervision of the laboratory director, keeping on par with the findings of the previous study. Some of the initiatives included increased awareness among hospital staff, encouraging them to maintain the temperature of blood units and to return them before expiry if not used. Further, to control expiry of blood products, component identification modalities were included in an electronic registry in order to accurately review and monitor the release of blood units according to the expiry date. A similar study done by Collins et al. demonstrated that relatively inexpensive interventions can have a prompt and dramatic impact on reducing blood wastage with regard to both cost and resource savings (14).

The present follow-up study showed an increase in blood and blood products collection when compared to the previous study done in the same setting (9). This could be assumed to be the result of meeting the demands of the referral hospital and improved management. Similar to the previous study, the current study also showed a higher collection of PRBC, followed by FFP and PC (9, 15). However, the previous study showed a 25% blood unit wastage, which was greatly reduced to 12.3% blood unit wastage in the present study. The most common causes of blood wastage were expired unit, broken bag, broken cold chain, returning after 30 minutes.

Similarly, wastage of blood units has also been reported in other studies. In developing countries like Iran, blood product wastage of about 9.8% in the Qazvin Province and of 12% in Ahwaz hospitals was reported. Blood wastage in developed countries was also reported; 4.4% of issued RBC was wasted according to a study conducted in the United States (US), while a similar study in the UK reported 2.1% to 4.8% blood wastage (13, 16). Expiry of blood products was the main cause of wastage in our both current study and in the previous study (9). Expiry of blood products also remains the main reason for blood wastage in other studies (3).

Different intervention strategies have been introduced in various hospitals to reduce blood wastage. Educational interventions and simple review and documentation of blood products were introduced after the previous study. This study also included a KAP study to understand the basic knowledge, attitude and practices of the health personnel. Nurses had good knowledge, attitude and administrative skills concerning blood transfusion, while doctors had good practice scores. The KAP study results were not satisfactory and suggested a lack of knowledge and training among doctors, nurses and laboratory technologists regarding transfusion medicine. The results indicated a big gap in the health personnel's knowledge about transfusion medicine. Interns indicated that there was a lack of dedicated teaching or training in the undergraduate curriculum. However, an effective training program for all healthcare personnel would be an essential step in creating good knowledge and effective transfusion practice in any hospital setting. Every hospital should work on formulating a hospital transfusion policy and establishing a transfusion committee. This committee should be responsible for providing training to health personnel, implementing policies on blood usage and management of transfusion reactions. Such policies hope to reduce unnecessary wastage of blood, as well as provide good knowledge and awareness regarding blood transfusion.

Conclusion

This study showed a decrease in blood wastage from 25% to 13.0% since the introduction of interventions in the public hospital laboratory, Guyana. This study therefore represents a model for reducing blood wastage in hospitals worldwide. Prevention of blood wastage in hospitals can be achieved with simple, easy and inexpensive interventions, as well as with an efficient inventory system. Awareness and training of all healthcare personnel should be encouraged for the purpose of effective blood usage and management in hospitals.

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Disclosure

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Competing interests. None to declare

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[1] **Author contribution.** RK, AA, RB, SA, CC, PR contributed equally to this paper. RK did the statistical analysis and the first draft of the paper. RK and AA contributed to the conception of the study. All of the authors read and approved the final manuscript.