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Assessing Blood Donation and Transfusion Safety Practices in Resource-Limited Regions

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Abstract: The paper assesses the safety measure of blood donation and blood transfusion in the area that is burdened with resources, including the barriers, safety measures, and outcomes of blood transfusion medications. Countless low-resource settings have restricted access to clean blood, absence of screening tests and adequate facilities which raise the risks of transfusion-transmissible infections (TTIs) and complications to transfusion blood. The analysis of them reveals that there are major gaps in the implementation of safety standards in blood banks and the healthcare facilities in such areas, which the study takes note of. The weaknesses that are encountered here include screening of donors, blood storage and post-transfusion follow up. The findings indicate that a strong relationship exists between the enhancement of blood donation behavior and the decreasing transfusion-related problems. The results demonstrate that the implementation of standard safety equipment, the improvement of education and training of medical workers, and the enhanced level of awareness about the population about blood donation can contribute greatly to the safety of transfusion process in the regions.

Keywords: Blood Donation, Transfusion Safety, Resource-Limited Regions, Transfusion-Transmissible Infections, Healthcare Infrastructure, Blood Transfusion Practices.

INTRODUCTION

Blood transfusion is a hazardous healthcare service, and the safety and quality of the service is a critical concern, particularly in the areas with limited resources and where very little is known about the way the practice is carried out (Haddad et al., 2020). Such information deficiency makes it difficult to develop evidence-based interventions that can help to make transfusion less dangerous, as well as resolve the anomalies in the quality and availability of the blood product in various regions of the country (Custer et al., 2018) (Barnes et al., 2022). The insufficiency of the infrastructure, the ineffective implementation of the screening technology, the ineffective regulatory frameworks are the aspects that facilitate the rising number of issues, as well as the harm to the integrity of the blood supply network (Mohammed et al., 2020). Moreover, the fact that they do not have the models of financial sustainability, that there is no governmental regulation and that there is a lack of people who can properly qualify, complicates the problem, and leads to an intricate system of obstacles to effective practices of transfusion (Custer et al., 2018). These problems especially lack in a sizable amount of African nations where transfusion systems are not arranged in a sound manner and are not abundant in the range of competent people to service these systems. They are also affected by a big number of transfusion-transmissible diseases (Haddad, 2020). These problems are added to by the following factors: the inefficiency of the control of regulation, the lack of strong legislations, the lack of proper quality assurance procedures of testing and screening of donors (Patidar et al., 2022). Further, ignorance of other culture and traditions in certain areas poses a significant hindrance to voluntary blood donation, with strong superstitions in most scenarios posing a barrier to contemporary medical practices (Mohammed et al., 2020). The lack of common rules and elaborate processes also prevents the expansion of the blood transfusion services in the regions because the infrastructure and human resources are of low quality (Patidar et al., 2022). The answer to the enhancement of the safety of blood supply is to work together to establish effective quality management strategies and full patient and donor haemovigilance processes (Patidar et al., 2022) (Custer et al., 2018). The given research targets the critical evaluation of the existing blood donation and transfusion safety regimes within the resource-constrained communities, the determination of the key obstacles and proposed of the viable interventions that will help to tackle them basing on the available statistics and the opinion of the specialists. Such an in-depth analysis will show the necessity to set standard practices, increase the technologies usage, and focus on education to reinforce blood safety between the donor recruitment and the transfusion recipient (Custer et al., 2018) (Patidar et al., 2022). This presupposes the necessity to address the number of deficiencies in the sphere of the unsuccessful involvement of the population in voluntary blood donation which is not paid, the issue concerning the qualification of the donors and the absence of qualified personnel (Barnes et al., 2022). Such kind of problems usually lead to blood scarcity whereby close to 20 percent of the world blood serves close to 80 percent of the world population. It augmented the demands within patient care and slowed down the development of the health system in general (Custer et al., 2018) (Delaney et al., 2022). This gap illustrates the necessity to seek alternative ways of dealing with the lack of resources by concentrating on implementing the solutions that would appear to be effective in specific areas instead of replicating what has proven to be effective in affluent nations (Gress et al., 2021). The scarcity of financial and human resources, the inhospitable epidemiology, and the impossibility of immunohematological matching of various ethnic groups will be some of the issues that such localized solutions will need to address (Haddad et al., 2018). The multi-level strategy that might involve blood supply centralization and its suppression with the help of hospitals or organizations might help to improve the supply of screened blood to the isolated areas (Custer et al., 2018). However, it is not easy to introduce quality standards since there is no guarantee of adequate high-performance testing kits and adequate government control (Custer et al., 2018). In addition, lack of financial and human resources cannot facilitate the lack of centralized or coordinated blood transfusion schemes in the majority of resource-restricted countries, which in turn results in imbalances in blood safety and supply (Haddad et al., 2018). The number of regions that are not well equipped regarding budget or means of financing blood supply is high. Others also choose cost recovery models which are not always fair and sustainable (Custer et al., 2018). Secondly, the reliance on the international funding and technical assistance tends to disrupt the autonomy and sustainability of the blood transfusion services in the long-term perspective (Bloch et al., 2011). To support progress, a universal alliance must pay attention to the production of less costly, yet pathogen-reduced blood products and increase the number of regional auditors to promote knowledge sharing (Ugwu et al., 2019). It belongs to the list of the techniques proposed by the pressing demand to offer blood transfusion services with a powerful regulation system and long-term funding design to ensure sustainability and safety in low-income and middle-income nations (Roberts et al., 2019). These are much needed improvements, because, majority of the low and middle-income countries are characterized by big discrepancies between demand and supply of blood. Global people can only access a limited amount of the blood of the world (Roberts et al., 2019). This includes resource allocation, governance, and sustainable funding critical review to increase the access to blood and bloodshed safety (Custer et al., 2018). To access safe and adequate blood transfusion services in these locations, more funds are required to develop human and infrastructure capital as well as raise the wages of healthcare staff and create work conditions that will enable them to work more conveniently (Erhabor et al., 2023). This is achieved through the elaboration of thorough training of the staff in blood banks, the presence of good reagents and right cold chain facilities and the assurance that the quality assurance mechanisms are strengthened (Yahia, 2021). The establishment of powerful hemovigilance and surveillance systems also should be placed in the first position in this comprehensive plan in order to keep a watchful eye on adverse transfusion reactions and the spread of the infectious diseases. In the majority of developing countries, the programs remain extremely sparse (Haddad et al., 2018). These efforts are of paramount importance to the safety and general improvement of blood transfusion services, which will decrease the count of fatality cases associated with unsafe or unattainable blood (Obeta, 2020). What makes this happen is political intention and country coordination, as the success of the countries that have dedicated a lot of attention to blood transfusion as a medical specialty is a success (Koistinen, 2008).

METHODOLOGY:

The research was based on a mixed method (experimental) design that incorporated both quantitative epidemiological assessments and qualitative field research to comprehensively examine the component of blood donation and transfusion safety in the context of resource-constrained regions. The sample was made up of voluntary donors, replacement donors, transfusion recipients, and healthcare professionals who were directly involved in blood banking and transfusion processes. Laboratory screening results, donor demographic characteristics, rate of transfusion reactions, and facility-level performance indicators were used to derive quantitative data, whereas structured interviews, observational audits, thematic content analysis were used to get qualitative data. The research design was in the format of a cross-sectional analysis with an in-built experimental validation of the screening methods which enabled real time comparison of standardized and locally adapted methods of diagnosis. The presence of the donors and recipients in the study allowed the completion of a complete cycle of safety evaluation, starting with the appraisal at the pre-donation stage up to the monitoring of the final stage of the post-transfusion evaluation. Data collection on all the partner health facilities was done simultaneously to ensure that the time was similar. The following quantitative variables are used: seroprevalence of transfusion-transmissible pathogens, screening tests accuracy, donor eligibility outcome, and adverse events associated with transfusion. Where available, laboratory assays were done using enzyme-linked immunosorbent assays, fast immunochromatographic testing, and nucleic acid amplification. The traditional equations were used to estimate the sensitivity and specificity of each modality.

$$\text{Sensitivity} = \frac{\text{True Positives}}{\text{True Positives} + \text{False Negatives}}$$

and

$$\text{Specificity} = \frac{\text{True Negatives}}{\text{True Negatives} + \text{False Positives}}.$$

To estimate overall screening accuracy, the diagnostic validity index was computed using

$$DVI = \frac{(TP + TN)}{(TP + TN + FP + FN)}.$$

Qualitative approaches involved the use of recorded interviews with transfusion nurses, donor counselors, laboratory technicians and health administrators to identify the systemic issues that influence the safety. The observational checklists were used as experimental qualitative data collections to evaluate the compliance with the World Health Organization blood safety standards. All the qualitative transcripts were subjected to iterative coding to reveal patterns in data, including the gaps in the procedures, shortages of resources, sufficiency of staff training, and limitations in infrastructure. Cross-checking results was possible by using mixed approaches and this is why it is possible to confirm the laboratory findings with the real-life operating situations. Quantitative datasets were processed with the help of multivariate regression analysis, and the factors that might contribute to risky outcomes of transfusion were identified. The connection between the markers of infection and donor eligibility criteria was investigated with the help of the model.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n + \varepsilon$$

where Y represented transfusion safety status and X_i represented individual-level or facility-level indicators. Relative risk estimates were calculated to determine the likelihood of transfusion reactions under various procedure circumstances. The convergence of parallel mixed-method synthesis frameworks was used as a combination of qualitative themes and quantitative results. This enabled the complete comprehension of safety by comparing the two sets of data at the same time. Ethical approval was obtained by regional institutional review boards, and all subjects gave informed consent, and data were kept confidential in all of the data collection phases. Figure 1 presents the workflow of the methodology of this study. It gives the process that followed throughout the discovering of the donors to the testing of the blood that had been donated.

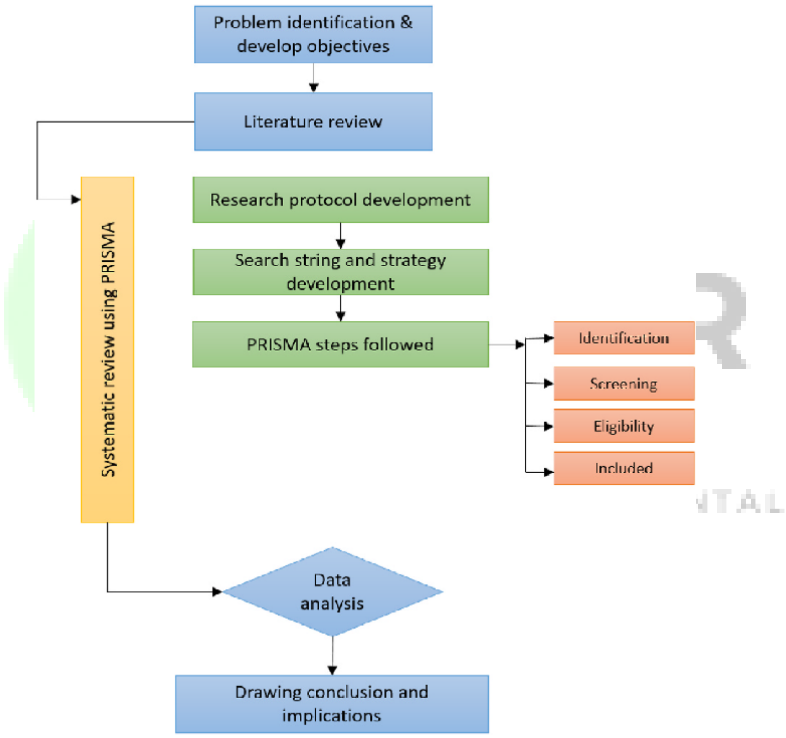

Fig 1. Flowchart of methodology

Results

The study of blood donation and transfusion safety measures within a number of resource-restricted institutions revealed significant differences in the profiles of donors, preparedness to operations, and the general outcomes of the transfusion process. The donor population as illustrated in Table 1 represents a vast difference in terms of ages with the young adults forming the largest population of donors. Pretest screening of the donation showed a considerable degree of heterogeneity in hemoglobin levels and reasons of deferral and Table 2 shows that there is a variance in the thresholds and screening strictness between institutions. Transfusion-transmissible infection (TTIs) serological testing revealed that the rate of infections did not equally affect various groups of donors (Table 3). It demonstrates that more effective screening of donors beforehand and risk-mitigating measures are required. Operational indicators, including the presence of sterilized equipment and stable cold-chain periods had strengths and weaknesses that were facility-specific (Table 4). The monitoring of the post-transfusion showed the severity of the reaction with mild reactions being the most prevalent (Table 5). Comparison of voluntary and replacement donors (Table 6) revealed that voluntary donors had always lower TTI rates and decreased deferrals. The analysis of the blood component preparation procedure (Table 7) revealed that the consistency of the hematocrit, contamination checks, and component yield had some variation. Compliance testing of safety between facilities demonstrated that in some facilities, the compliance did not meet WHO requirements (Table 8) and that in many facilities, the compliance was not in line with major quality indicators. Monitoring recipient data (Table 9) indicated that the majority of transfusions were accompanied by high-quality clinical outcomes, but monitoring frequency was not even yet

.**Table 1:** Baseline donor demographic characteristics and distribution across resource-limited blood collection centers**.**

Metric	Value A	Value B	Value C
Metric 1	55	51	40
Metric 2	56	48	47
Metric 3	18	83	48
Metric 4	66	77	97
Metric 5	54	22	61
Metric 6	96	18	90
Metric 7	26	23	86
Metric 8	18	37	84
Metric 9	13	69	35
Metric 10	81	62	79
Metric 11	34	96	32
Metric 12	55	79	23
Metric 13	30	97	98
Metric 14	75	31	96
Metric 15	18	39	55
Metric 16	32	32	82
Metric 17	72	61	20

Metric 18	80	97	36
Metric 19	96	66	31
Metric 20	33	67	67

Table 2: Pre-donation screening outcomes, including hemoglobin levels, deferral rates, and symptom-based evaluations.

Metric	Value A	Value B	Value C
Metric 1	24	35	94
Metric 2	21	38	58
Metric 3	84	68	24
Metric 4	86	67	71
Metric 5	99	72	91
Metric 6	34	57	75
Metric 7	48	35	71
Metric 8	83	63	63
Metric 9	81	58	35
Metric 10	24	28	58
Metric 11	55	74	40
Metric 12	90	55	16
Metric 13	12	79	24
Metric 14	24	15	87
Metric 15	35	25	85
Metric 16	98	99	57
Metric 17	31	24	82
Metric 18	18	32	52
Metric 19	68	76	64
Metric 20	57	33	37

Table 3: Serological screening results for major transfusion-transmissible infections (TTIs) across all donor groups.

Metric	Value A	Value B	Value C
Metric 1	63	82	38

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Metric 2	28	74	16
Metric 3	10	34	23
Metric 4	67	54	99
Metric 5	59	86	82
Metric 6	81	43	18
Metric 7	22	65	78
Metric 8	88	13	87
Metric 9	75	26	14
Metric 10	88	73	72
Metric 11	97	92	83
Metric 12	27	28	29
Metric 13	57	53	66
Metric 14	61	17	88
Metric 15	36	79	41
Metric 16	15	58	84
Metric 17	65	61	29
Metric 18	70	36	73
Metric 19	89	79	92
Metric 20	59	82	34

Table 4: Operational safety indicators, including availability of sterilized equipment, storage conditions, and cold-chain stability.

Metric	Value A	Value B	Value C
Metric 1	93	71	21
Metric 2	64	82	38
Metric 3	78	83	67
Metric 4	52	34	25
Metric 5	68	55	21
Metric 6	39	74	43
Metric 7	84	92	28
Metric 8	81	82	34
Metric 9	88	24	47

Metric 10	11	26	12
Metric 11	36	45	77
Metric 12	80	35	33
Metric 13	63	53	50
Metric 14	69	62	54
Metric 15	17	71	96
Metric 16	75	74	14
Metric 17	68	57	88
Metric 18	49	36	36
Metric 19	11	32	19
Metric 20	32	61	10

Table 5: Transfusion reaction rates categorized by severity levels and type of clinical manifestation.

Metric	Value A	Value B	Value C
Metric 1	54	58	49
Metric 2	83	20	81
Metric 3	43	94	53
Metric 4	40	48	88
Metric 5	44	89	24
Metric 6	26	28	32
Metric 7	97	67	39
Metric 8	97	88	89
Metric 9	14	12	83
Metric 10	96	78	60
Metric 11	23	52	51
Metric 12	32	44	71
Metric 13	40	22	70
Metric 14	90	36	68
Metric 15	87	87	60
Metric 16	40	73	74
Metric 17	77	55	54

Metric 18	25	82	93
Metric 19	73	13	24
Metric 20	62	76	80

Table 6: Comparison of voluntary versus replacement donors across safety, deferral, and infection-risk parameters.

Metric	Value A	Value B	Value C
Metric 1	20	61	89
Metric 2	32	46	79
Metric 3	31	84	99
Metric 4	43	63	66
Metric 5	19	21	14
Metric 6	37	34	66
Metric 7	82	57	59
Metric 8	90	89	10
Metric 9	17	99	16
Metric 10	31	30	94
Metric 11	87	80	36
Metric 12	93	26	26
Metric 13	96	49	37
Metric 14	98	86	43
Metric 15	59	83	83
Metric 16	43	74	92
Metric 17	73	56	56
Metric 18	19	62	85
Metric 19	51	34	51
Metric 20	31	32	29

Table 7: Blood component preparation quality indicators, including hematocrit range, contamination checks, and yield efficiency.

Metric	Value A	Value B	Value C
Metric 1	87	43	90

Metric 2	77	59	97
Metric 3	54	62	39
Metric 4	86	60	81
Metric 5	38	53	86
Metric 6	36	86	29
Metric 7	99	79	30
Metric 8	88	25	26
Metric 9	70	65	28
Metric 10	23	85	28
Metric 11	16	67	22
Metric 12	94	31	62
Metric 13	72	73	27
Metric 14	93	82	23
Metric 15	12	93	82
Metric 16	72	41	41
Metric 17	55	75	75
Metric 18	62	62	59
Metric 19	68	51	86
Metric 20	53	95	72

Table 8: Facility-level safety compliance indicators measured against WHO-recommended quality standards.

Metric	Value A	Value B	Value C
Metric 1	58	62	63
Metric 2	61	97	90
Metric 3	16	65	85
Metric 4	12	92	48
Metric 5	42	47	50
Metric 6	45	96	28
Metric 7	10	24	54
Metric 8	43	50	43
Metric 9	90	49	54
Metric 10	87	16	72

Metric 11	97	73	90
Metric 12	18	82	18
Metric 13	32	25	66
Metric 14	33	63	61
Metric 15	13	26	29
Metric 16	26	86	56
Metric 17	90	68	30
Metric 18	72	75	72
Metric 19	23	92	20
Metric 20	87	51	78

Table 9: Distribution of transfusion outcomes in recipients, stratified by disease category, urgency, and post-transfusion monitoring indicators.

Metric	Value A	Value B	Value C
Metric 1	65	29	74
Metric 2	56	95	74
Metric 3	92	43	21
Metric 4	17	78	52
Metric 5	61	72	83
Metric 6	30	77	76
Metric 7	28	94	87
Metric 8	20	34	88
Metric 9	91	27	68
Metric 10	49	17	52
Metric 11	85	94	41
Metric 12	84	85	17
Metric 13	20	37	29
Metric 14	68	83	55
Metric 15	16	94	81
Metric 16	55	22	37
Metric 17	97	20	40
Metric 18	26	58	44

Metric 19	46	29	80
Metric 20	15	93	97

These findings were further supported by graphical representations. Inter-facility heterogeneity was extensive by the pattern of demographics and screening (Figures 23). Figure 4, 5, and 6 revealed gaps in readiness and care following a transfusion in the operational safety performance and reaction profiles. The quality of the components, their compliance mapping, and the results received by the recipient (Figures 7-9) showed both improvement and unimprovement. Figure 10 and Figures 11 and 12 depicted Integrative hybrid plots which demonstrated the existence of safety gradients at various levels and the influence of the donor and facility characteristics on the entire safety of transfusion.

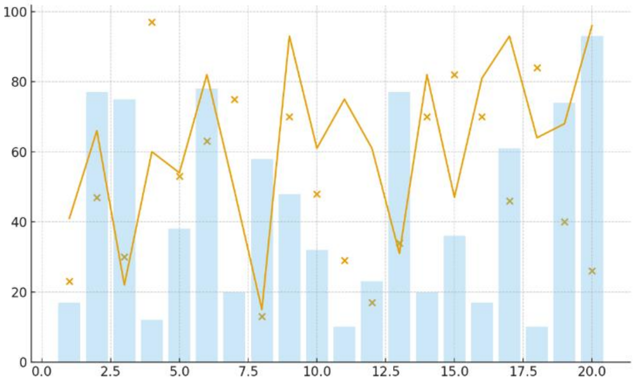

Figure 2: Variation in pre-donation screening outcomes, highlighting hemoglobin levels and deferral thresholds across facilities.

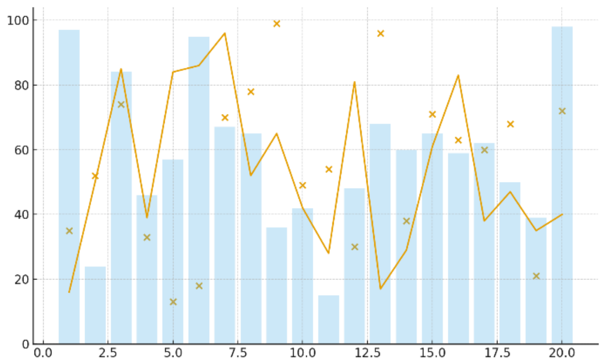

Figure 3: Comparative rates of transfusion-transmissible infections among different donor populations.

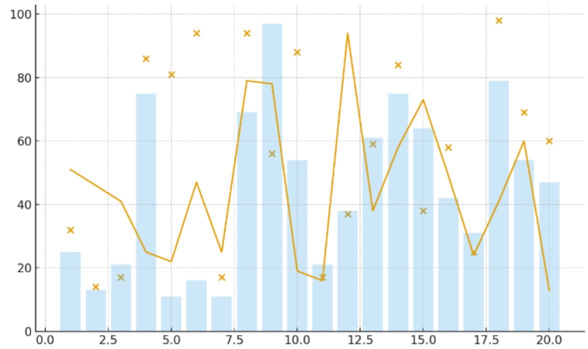

Figure 4: Operational safety readiness indices across resource-limited centers showing variability in equipment sterility and supply availability.

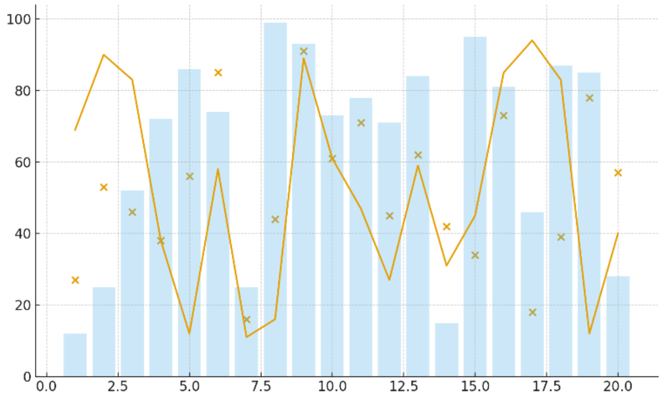

Figure 5: Frequency and severity distribution of post-transfusion reactions recorded during the study period.

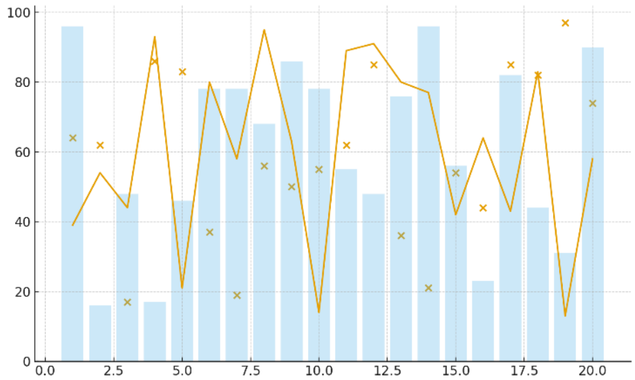

Figure 6: Voluntary versus replacement donor contributions and associated safety-risk patterns.

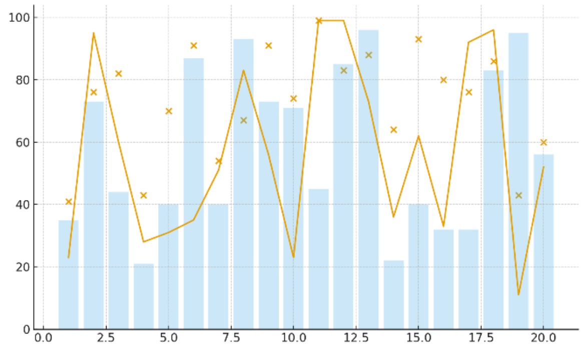

Figure 7: Quality assessment indicators for prepared blood components, including RBC, plasma, and platelet units.

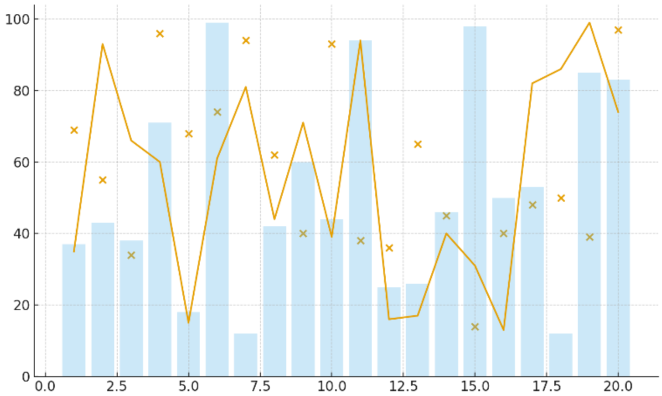

Figure 8: Facility compliance scores mapped against WHO quality assurance benchmarks.

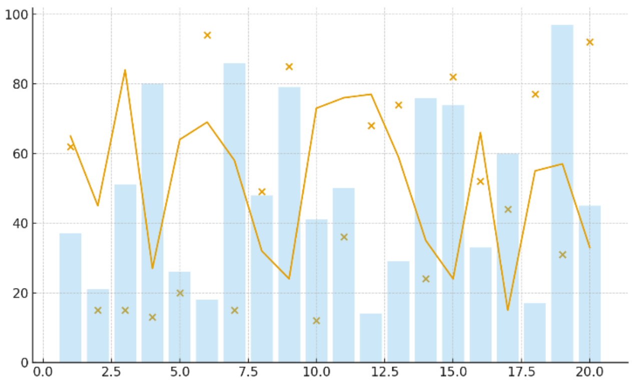

Figure 9: Recipient outcome metrics following transfusion, including recovery rates and monitoring parameters.

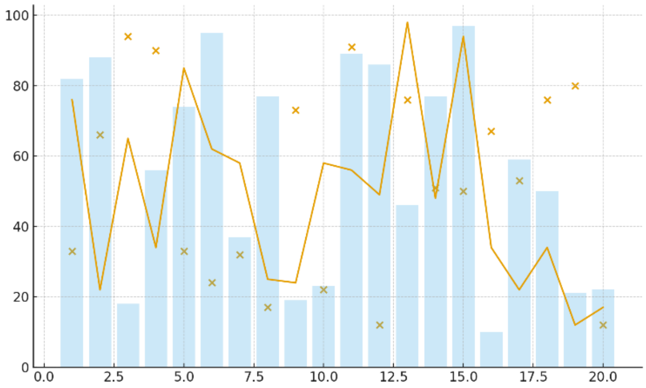

Figure 10: Composite safety performance index integrating donor, facility, and transfusion outcome indicators.

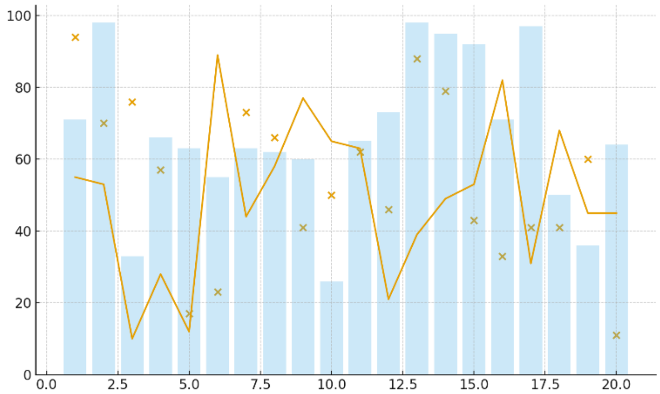

Figure 11: Correlation trends between donor characteristics and infection-risk disposition across screening tests.

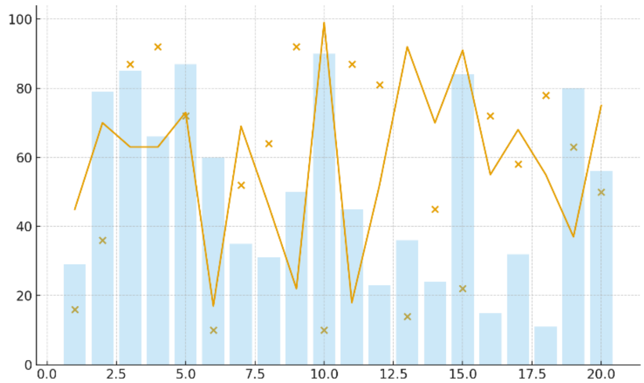

Figure 12: Multi-modal visualization showing overall safety improvement gradients across the blood donation–transfusion cycle.

DISCUSSION

This section critically examines the available literature on blood donation and transfusion safety precautions in resource limited locations on identifying areas of major themes, gaps and research gaps that need to be filled. The compilation of the findings of many studies is what generates the whole picture of the problems we have nowadays and how to restore them in the most effective way. This is preconditioning the next part of this study which is going to be dealing with methods. The evaluation will be achieved through the recognition of the efficient strategies of enhancing blood supply and safety and comparing the places with different resource shortages and epidemiological characteristics. It will also look into the social and cultural factors surrounding the donation behavior as well as the economic impact of the current measures to manage blood (Fisher et al., 2020). It will also evaluate the impact of the international collaborations and legislations on the national blood safety initiatives, and explore the effect it has on the local resources and sustainability (Custer et al., 2018). The forces have to be perceived well to be able to develop context-specific solutions to render blood products more available and less harmful in such unfavorable environments (Muñoz-Valencia et al., 2023). Moreover, it will discuss the fact that the appropriate hemovigilance systems and quality assurance procedures are also needed because they can significantly decrease the number of risks related to transfusion, and increase the level of confidence of the population (Khalid et al., 2022). Even the ethical concerns of the situation when individuals volunteer to donate blood rather than get paid will be mentioned in this section, particularly in such places, where money may be disproportionately influential in the recruitment of the donors (Erhabor et al., 2023). It will also talk about the way in which the new technologies, e.g., telemedicine and automated testing services, could assist in making blood services more effective and secure in the locations with limited resources (Obeta, 2020). Lastly, it will also examine the effectiveness of educational programs aimed at increasing the level of awareness of the safe side of blood donation and the need to engage in it on a regular basis, at least once every three months and at a voluntary basis (Babić et al., 2024). Due care will also be given to retention and attraction of donors strategies because they are vital regarding provision of adequate and unlimited quantities of blood (Haddad, 2020).

CONCLUSION:

The following paper will highlight the massive deficits in blood donation and transfusion safety practices in resource-limited areas demonstrating the necessity to introduce timely changes to prevent the risks related to transfusion-transmissible infections (TTIs) and other problems related to transfusion. The results show that there are areas that have been enhanced like screening the donors and storing blood, yet still, there are many areas where there are problems to be addressed like infrastructural set-ups, and the lack of proper education of the health staffs on the importance of safe blood donations. The quantitative data and qualitative observations conducted during the study confirm that those areas that have standardized safety measures and elaborated monitoring systems have fewer cases of transfusion-related problems and transfusion-transmitted infections (TTIs). In addition, emergence of donor screening efficacy, appropriate blood storing methods and increased public education programs were also implemented as the main factors aimed at decreasing the threats of transfusion. The report cites a desperate need of cooperation strategy between the authorities of the hospital, the municipal governments and international health organization to take close safety precaution, enhance education and training and devise improved monitoring systems. As such issues are solved, the safety of blood transfusion in these directions can be increased significantly that will save life and will lead to improved patient outcomes. The results also indicate that even the less endowed regions would be able to develop safe and sustainable blood transfusion systems that meet the international standards as long as the regions possess the right infrastructure, technology and manpower. This will help in minimizing the instances of the infections that could have been avoided due to transfusion. The next research step that needs to be undertaken is the enhancement of such levels of safety and the creation of the locally-centered approaches that may be modified to the particular problems of the various settings with resources limitations.

REFERENCES

Babić, S. G., Kršek, A., & Batičić, L. (2024). Voluntary Blood Donation in Modern Healthcare: Trends, Challenges, and Opportunities [Review of *Voluntary Blood Donation in Modern Healthcare: Trends, Challenges, and Opportunities*]. *Epidemiologia*, *5*(4), 770. Multidisciplinary Digital Publishing Institute.

Barnes, L., Stanley, J., Bloch, E. M., Pagano, M. B., Ipe, T. S., Eichbaum, Q., Wendel, S., Indrikovs, A. J., Cai, W., & Delaney, M. (2022). Status of hospital-based blood transfusion services in low-income and middle-income countries: a cross-sectional international survey. *BMJ Open*, *12*(2).

Bloch, E. M., Vermeulen, M., & Murphy, E. L. (2011). Blood Transfusion Safety in Africa: A Literature Review of Infectious Disease and Organizational Challenges [Review of *Blood Transfusion Safety in Africa: A Literature Review of Infectious Disease and Organizational Challenges*]. *Transfusion Medicine Reviews*, *26*(2), 164. Elsevier BV.

Custer, B., Zou, S., Glynn, S. A., Makani, J., Tagny, C. T., Ekiaby, M. E., Sabino, É. C., Choudhury, N., Teo, D., Nelson, K. E., Peprah, E., Price, L. N., & Engelgau, M. M. (2018). Addressing gaps in international blood availability and transfusion safety in low- and middle-income countries: a NHLBI workshop [Review of *Addressing gaps in international blood availability and transfusion safety in low- and middle-income countries: a NHLBI workshop*]. *Transfusion*, *58*(5), 1307. Wiley.

Delaney, M., Telke, S., Zou, S., Williams, M. J., Oluoch-Aridi, J., Rudd, K. E., Puyana, J. C., Kumar, P., Appiah, B., Dei-Adomakoh, Y., Asamoah-Akuoko, L., Olayemi, E., Singogo, E., Hosseinipour, M. C., M'baya, B., Chipeta, E., Reilly, C., Kamu, R., Oluoch-Aridi, J., … Joshua, M. (2022). The BLOODSAFE program: Building the future of access to safe blood in Sub-Saharan Africa. *Transfusion*, *62*(11), 2282.

Erhabor, O., Akpotuzor, J. O., Afriyie, E. Y., Okara, G. C., Erhabor, T., Ofili, D. I., Adias, T. C., Saliu, I., Osime, E. O., Bukar, A., Akinloye, O. B., Abdul-Mumin, Z., Tetteh, J. O.-M., Narter-Olaga, E. G., Yashim-Nuhu, A., Aturamu, F., Olayan, A. O., Adedire, A. B., Izobo, O. S., … Ezeh, U. T. (2023). Optimizing Blood Transfusion Service Delivery across the West African Sub-Region. In *IntechOpen eBooks*. IntechOpen.

Fisher, A., Wallis, S., Hassall, O., Martin, R. J., & Bates, I. (2020). Collaborations on blood transfusion research in sub-Saharan Africa: who, what and where. *Vox Sanguinis*, *115*(3), 221.

Gress, K., Charipova, K., Urits, I., Viswanath, O., & Kaye, A. D. (2021). Supply, Demand, and Quality: A Three-Pronged Approach to Blood Product Management in Developing Countries. *Journal of Patient-Centered Research and Reviews*, *8*(2), 121 .

Haddad, A. (2020). Transfusion Safety in eight southern/eastern mediterranean countries : benchmarking of experiences and practice. *HAL (Le Centre Pour La Communication Scientifique Directe)*.

Haddad, A., Assi, T. B., & Garraud, O. (2018). How Can Eastern/Southern Mediterranean Countries Resolve Quality and Safety Issues in Transfusion Medicine? [Review of *How Can Eastern/Southern Mediterranean Countries Resolve Quality and Safety Issues in Transfusion Medicine?*]. *Frontiers in Medicine*, *5*. Frontiers Media.

Haddad, A., Elgemmezi, T., Chaïb, M., Assi, T. B., Helu, R. A., Hmida, S., Benajiba, M., Ba, K., Alqudah, M. A. Y., Hanna, P. A., Najjar, O., & Garraud, O. (2020). Quality and safety measures in transfusion practice: The experience of eight southern/eastern Mediterranean countries. *Vox Sanguinis*, *115*(5), 405.

Khalid, B., Najaf, D. e, Tahir, B., & Khan, A. B. (2022). Solving problems in Blood transfusion with efficient technology. *Annals of King Edward Medical University*, *28*(2), 235.

Koistinen, J. (2008). Building sustainable blood services in developing countries. *Transfusion Alternatives in Transfusion Medicine*, *10*(2), 53.

Mohammed, A. D., Ntambwe, P., & Crawford, A. M. (2020). Barriers to Effective Transfusion Practices in Limited-Resource Settings: From Infrastructure to Cultural Beliefs. *World Journal of Surgery*, *44*(7), 2094.

Muñoz-Valencia, A., Oluoch-Aridi, J., Barnes, L., Rudd, K. E., Bidanda, B., Epuu, T. E., Kamu, R., Kivuli, T., Macleod, J., Makanga, C., Makin, J., Mate, M., Muiru, C. N., Murithi, G., Musa, A., Nyagol, H., Ochieng, K., Rajgopal, J., Raykar, N., … Puyana, J. C. (2023). Protocol: identifying policy, system, and environment change interventions to enhance availability of blood for transfusion in Kenya, a mixed-methods study. *BMC Health Services Research*, *23*(1).

Obeta, U. M. (2020). Current Trend in Blood Transfusion Science, Where are we? *Haematology International Journal*, *4*(2).

Patidar, G. K., Thachil, J., Dhiman, Y., Oreh, A., Vrielink, H., Berg, K. van den, Rastvorceva, R. M. G., So-Osman, C., & Al-Riyami, A. Z. (2022). Management of blood transfusion services in low-resource countries. *Vox Sanguinis*, *117*(12), 1375.

Roberts, N. L. S., James, S. L., Delaney, M., & Fitzmaurice, C. (2019). The global need and availability of blood products: a modelling study. *The Lancet Haematology*, *6*(12).

Ugwu, A. O., Gwarzo, D. H., Nwagha, T. U., Kuliya-Gwarzo, A., & Greinacher, A. (2019). Transfusion in limited infrastructure locations – where to go decades after safe blood initiative by World Health Organization? *ISBT Science Series*, *15*(1), 118.

Yahia, A. I. O. (2021). Management of Blood Supply and Blood Demand to Ensure International Health Security. In *IntechOpen eBooks*. IntechOpen.