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# Prevalence and factors associated to transfusion adverse reactions at the Sourou Sanou University Hospital of Bobo-Dioulasso between January and December 2019

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## Abstract

**Introduction:** Blood transfusions save thousands of lives every day all around the world. They can, however, cause severe adverses reactions in transfused patients, which can be fatal. Our study's goal was to estimate the incidence of transfusion related adverse events and to identify the factors that contribute to the occurrence of transfusion reactions in transfused patients.

**Methods:** Between January and December 2019, we conducted a cross-sectional study at the clinical departments of Sourou Sanou University Hospital (CHU-SS).

**Results:** Transfusion responses occurred at a rate of 29.91 per 1000 blood bags transfused, with 39.13% being infectious and 13.04% being allergic. Transfusion reactions were 3.54 times (p = 0.05) and 4.16 times (p = 0.004) more likely if the blood transfusion lasted less than 30 minutes or more than 60 minutes, respectively, compared to 30 to 60 minutes. When compared to transfusion of up to two blood bags, transfusion of three to four blood bags and more than four blood bags increased the risk of transfusion adverse reaction by 1.67 times (p = 0.032) and 2.17 times (p = 0.049), respectively.

**Conclusion:** Our research has revealed the prevalence and risk factors for transfusion adverses reactions. The introduction of prevention techniques would increase transfusion safety.

**Keywords:** Associated factors; Transfusion reactions; CHU-SS; Bobo-Dioulasso

## 1. Introduction

Blood transfusion is a key medicine that saves hundreds of human lives every day throughout the world. It should be tailored to the clinical needs of the patients, completed on schedule, and provided to the correct patients (1). Transfusion safety is a major public health issue in Sub-Saharan Africa because to the high frequency of infectious illnesses and a lack of financial and competent human resources (2). Transfusion events and mishaps can be fatal for recipients, and knowledge of the relevant elements necessitates regular monitoring by the various actors at all stages

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of the transfusion chain (3). As a result, individuals in charge of blood transfusion must implement mechanisms for monitoring and managing hazardous transfusion responses (4). In Africa, according to the report of the survey on blood safety and supply in the African region (5), out of 46 countries that participated in the survey, 82.6% had developed and adopted a national blood safety policy, 71.7% had developed a strategy for the implementation of their national blood transfusion policy, 41.3% had adopted blood safety laws, 73.9% had national guidelines on the appropriate clinical use of blood and blood products, and only 28.3% had actual blood and blood product supply.

The haemovigilance system, which monitors blood donors and users of blood products and detects any harmful effects, is underdeveloped in Burkina Faso, with few reports of events and accidents related to the transfusion of labile blood products (LBP). During 2019, no formal transfusion event reports were made in the Bobo-Dioulasso Regional Blood Transfusion Centre (CRTS/B), even though nine post-transfusion forms returned referenced it (6). The increase in the reported rate of transfusion episodes at CHU-SS (7) between 2005 and 2009 appears to have leveled out. The clinical services are failing to return post-transfusion and haemovigilance forms and, more importantly, to report transfusion incidents to the Bobo-Dioulasso Regional Blood Transfusion Centre (7). We chose to conduct this study to investigate the factors related with the occurrence of these reactions to take stock of the transfusion reactions that have happened at the CHU-SS.

## 2. Method

### 2.1. Study's setting, time and study design

From January 1 to December 31, 2019, we conducted our research at the Sourou Sanou University Hospital of Bobo-Dioulasso (CHU-SS). We did a cross-sectional investigation with retrospective data gathering from transfused patients' clinical records.

### 2.2. Study population

Our study population consisted of patients who had received at least one blood transfusion during the study period and whose clinical records were on file in the clinical departments.

### 2.3. Sampling

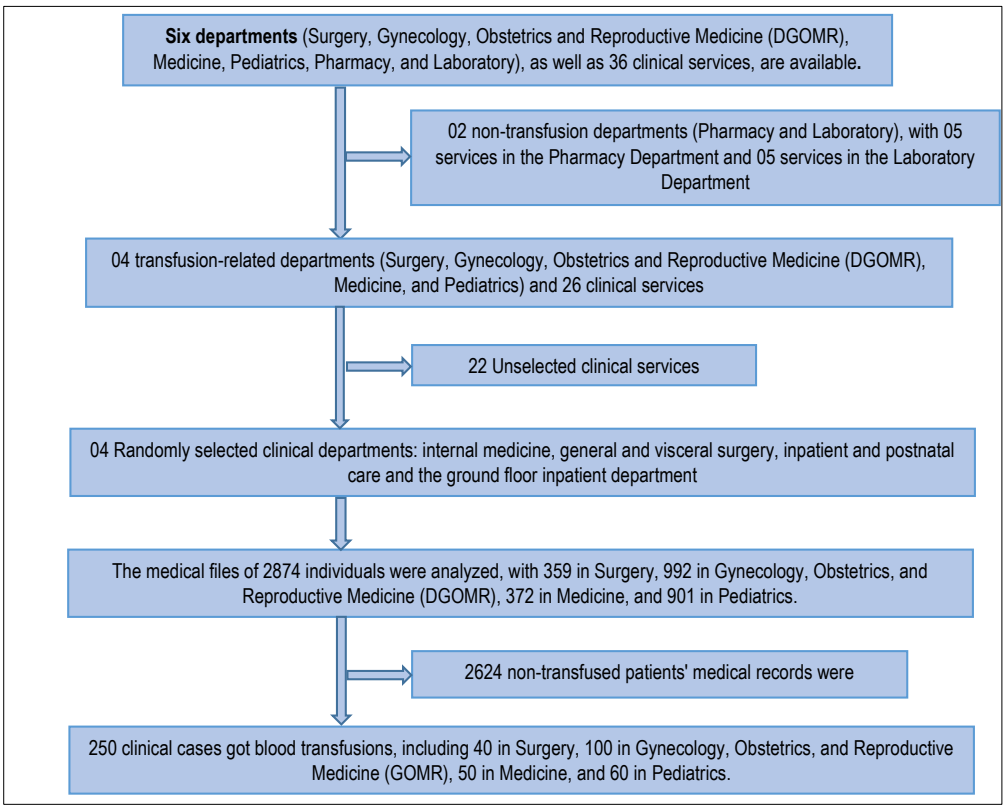


**Figure 1** Flow chart of the study's screening process for blood transfusion patients

We used a two-stage random cluster sampling method. The CHU-SS provides 36 clinical and medical-technical services organized into six (06) departments: Surgery, Gynaecology, Obstetrics and Reproductive Medicine, Medicine, Paediatrics, Pharmacy, and Laboratory. The pharmacy and laboratory departments were not included in the sample because they did not provide clinical services.

We chose one clinical service per department using a simple random draw, which allowed us to draw the internal medicine, general and visceral surgery, hospitalization and post-natal care, and bottom floor hospitalization services. After that, all medical records of individuals transfused in these designated departments were located and analyzed. Finally, we incorporated the records of patients who got blood transfusions during our research.

### 2.4. Data processing and analysis

Data were gathered using conventional questionnaires and digitized from medical records. The data collected included sociodemographic factors, the concept of adverse transfusion responses, and transfusion data (transfusion history, categories of LBP, quantity of LBP transfused, types of incidents, severity level, number of LBP bags transfused, and duration of transfusion). Outliers were deleted, and the mean of missing quantitative variables was used in their place.

The analyses were carried out using SPSS 20 and Excel 2013, and descriptive statistics were generated for each variable. The proportions were compared using Pearson's Chi-2 test. To determine the many parameters linked with the occurrence of transfusion reactions, logistic regressions were utilized. For all analyses, the significance level was fixed at $p = 0.05$.

## 3. Results

### 3.1. Prevalence of transfusion reactions reported in medical records by health care department.

We counted 702 bags of red blood cells transfused from a total of 250 transfused patient records, an average of 2.81 bags of blood transfused per patient. In the clinical records, a total of 21 adverse transfusion events were found, reflecting an incidence of 29.91 per 1000 blood bags transfused.

The transfusion reaction was infectious or allergic in 39.13% and 13.04% of the cases, respectively, whereas the kind of transfusion reaction was not described in 47.82% of the cases. However, nothing in the medical records indicated the severity of these transfusion reactions.

### 3.2. Socio-demographic characteristics of transfused patients

The median age of the transfused patients was 27.97 years, with a range of 1 month to 78 years. The average blood transfusion time was 40 minutes 20.50 minutes, with extremes of 15 and 127 minutes. Table 1 depicts the distribution of transfused patients based on sociodemographic and transfusion variables.

**Table 1** Distribution of sociodemographic and transfusion characteristics according to the occurrence of adverse transfusion reactions or not in patients transfused between January and December 2019 at the CHU-SS

| **Socio-demographic and transfusion characteristics** | **Occurrence of adverse transfusion reactions n (%)** | | **p-value** |
|---|---|---|---|
| | No<br>229 (91.6) | Yes<br>21 (8.4) | < 0.001 |
| **Gender** | | | |
| Male | 73 (29.2) | 10 (4.0) | 0.586 |
| Female | 156 (62.4) | 11 (4.4) | |
| **Age groups (in years)** | | | |
| < 5 | 28 (11.2) | 0 (0) | 0.513 |
| [5; 15[ | 28 (11.2) | 4 (1.6) | |
| 15 and more | 173 (69.2) | 17 (6.8) | |

| Socio-demographic and transfusion characteristics | Occurrence of adverse transfusion reactions n (%) | | p-value |
|---|---|---|---|
| | No<br>229 (91.6) | Yes<br>21 (8.4) | < 0.001 |
| **Place of residence** | | | |
| Bobo-Dioulasso | 117 (46.8) | 11 (4.4) | 1 |
| Out of Bobo-Dioulasso | 112 (44.8) | 10 (4) | |
| **Profession** | | | |
| Pupils/Students | 81 (32.2) | 8 (3.2) | 0.719 |
| Unemployed | 16 (6.4) | 0 (0) | |
| Housewife | 62 (24.8) | 5 (2) | |
| Employee of the government | 50 (20) | 6 (2.4) | |
| Private sector employee | 20 (8) | 2 (0.8) | |
| **Transfusion history** | | | |
| Yes | 51 (20.4) | 5 (2) | 0.015 |
| No | 106 (42.4) | 2 (0.8) | |
| Not mentioned | 72 (28.8) | 14 (5.6) | |
| **Types of labile blood products (LBP) transfused** | | | |
| Red blood cell concentrates | 224 (89.6) | 19 (7.6) | 0.311 |
| Whole blood | 2 (0.8) | 2 (0.8) | |
| Fresh Frozen Plasma | 3 (1.2) | 0 (0) | |
| **Quantity of labiles blood products (LBP) transfused in millilitres** | | | |
| < 50 | 2 (0.8) | 0 (0) | 0.253 |
| [50; 100[ | 12 (4.8) | 0 (0) | |
| [100; 200[ | 28 (11.2) | 0 (0) | |
| [200; 300[ | 16 (6.4) | 2 (0.8) | |
| [300; 400[ | 33 (13.2) | 2 (0.8) | |
| [400; 500[ | 37 (14.8) | 2 (0.8) | |
| [500; 600[ | 23 (9.2) | 2 (0.8) | |
| 600 and more | 78 (31.2) | 13 (5.2) | |
| **Types of transfusion-related incidents** | | | |
| Allergic | 0(0) | 3 (1.2) | < 0.001 |
| Infectious | 0 (0) | 8 (3.2) | |
| Not mentioned | 0 (0) | 8 (3.2) | |
| None | 229 (91.6) | 2 (0.8) | |
| **Type of severity of the transfusion event** | | | |
| Not severe | 0 (0) | 4 (1.6) | < 0.001 |
| Moderately serious | 0 (0) | 7 (2.8) | |

| Socio-demographic and transfusion characteristics | Occurrence of adverse transfusion reactions n (%) | | p-value |
|---|---|---|---|
| | No<br>229 (91.6) | Yes<br>21 (8.4) | < 0.001 |
| Not mentioned | 0 (0) | 8 (3.2) | |
| None | 229 (91.6) | 2 (0.8) | |
| **Number of blood bags transfused** | | | |
| 0 to 2 blood bags | 74 (36.6) | 6 (2.9) | 0.029 |
| 3 to 4 blood bags | 80(44.5) | 7(3.5) | |
| More than 4 blood bags | 17(8.4) | 8(3.9) | |
| **Average time of blood transfusion (in minutes)** | | | |
| < 30 | 31(12.4) | 4(1.6) | 0.054 |
| [30; 60[ | 171(68.4) | 11(4.4) | |
| 60 and more | 27(10.8) | 6(2.4) | |

### 3.3. Factors associated with the occurrence of adverse transfusion reaction.

The occurrence of transfusion reactions was statistically associated with the average time of blood transfusion and the number of blood bags transfused as shown in Table 2.

**Table 2** Sociodemographic and transfusion-related factors linked with transfusion reactions at the Sourou Sanou University Hospital of Bobo-Dioulasso between January and December 2019.

| Sociodemographic and transfusion-related factors | Odds ratio | Confidence interval 95% | p-value |
|---|---|---|---|
| **Ages groups (in years)** | | | |
| < 5 | 1.51 | [0.093; 24.534] | 0.39 |
| [5; 15[ | 1.13 | [0.245; 5.225] | 0.44 |
| 15 and more | 1 | - | - |
| **Gender** | | | |
| Male | 1 | - | - |
| Female | 2.72 | [1.35; 6.14] | 0.22 |
| **Place of residence** | | | |
| Bobo-Dioulasso | 1 | - | - |
| Out of Bobo-Dioulasso | 0.98 | [0.502; 3.909] | 0.47 |
| **Profession** | | | |
| Pupils/Students | 1 | - | - |
| Unemployed | 1.02 | [0.524; 2.952] | 0.47 |
| Housewife | 0.94 | [0.120; 2.084] | 0.4353 |
| Employee of the government | 1.53 | [0.369; 6.354] | 0.2782 |
| Private sector employee | 1.13 | [0.245; 5.225] | 0.4373 |
| **Average time of blood transfusion (in minutes)** | | | |

| Sociodemographic and transfusion-related factors | Odds ratio | Confidence interval 95% | p-value |
|---|---|---|---|
| 30 to 60 minutes | 1 | - | - |
| Less than 30 minutes | 3.54 | [1.983; 9.731] | < 0.001 |
| More than 60 minutes | 4.16 | [2.02; 10.36] | 0.004 |
| **Number of blood bags transfused** | | | |
| 0 to 2 blood bags | 1 | - | - |
| 3 to 4 blood bags | 1.67 | [1.08; 5.219] | 0.032 |
| More than 4 blood bags | 2.17 | [1.37; 7.340] | 0.049 |

## 4. Discussion

The parameters linked with the occurrence of transfusion reactions in the CHU-SS clinical services were identified in our investigation. Transfusion reactions occurred at a rate of 29.91 per 1000 blood bags transfused. Transfusion reactions were 3.54 times (p = 0.05) and 4.16 times (p = 0.004) more likely if the blood transfusion lasted less than 30 minutes or more than 60 minutes, respectively, compared to a length of 30 to 60 minutes. When compared to transfusion of up to two blood bags, transfusion of three to four blood bags and more than four blood bags increased the risk of transfusion responses by 1.67 times (p = 0.032) and 2.17 times (p=0.049), respectively.

Although our study met our aims, it had several limitations due to its retrospective nature, which prevented the gathering of some data such as the type and severity of transfusion responses, the amount of blood transfused, actual blood transfusion monitoring, and so on.

### 4.1. Prevalence of adverse transfusion reactions

According to our findings, 29.91 transfusion reactions occur for every 1000 blood bags transfused. These results are significantly higher than those found in Casablanca, Morocco between 1995 and 2003 (0.5 transfusion reactions per 1000 LBP distributed), Bordeaux, France (5 per 1000 LBP distributed), Lausanne, Switzerland (4.2 per 1000 LBP distributed), and Rotterdam, the Netherlands (1.42 transfusion adverses reactions per 1000 LBP distributed) (8). This disparity can be explained by the presence of a working haemovigilance system in these nations, which ensures the quality of the goods and transfusion services provided. Furthermore, broader phenotyping is used in these nations, but compatibility in Burkina Faso is primarily based on the ABO Rhesus D method.

However, they are lower than those observed in Mali by NIAMBELE and DEMBELE, who found 48 transfusion reactions per 1000 transfused LBP (9) and 87.6 transfusion reactions per 1000 transfused LBP (10) in their studies. This disparity could be explained by the fact that, unlike our study, both studies were prospective, allowing for a comprehensive census of all occurrences of transfusion reactions. These findings highlight the high occurrence of transfusion responses in underdeveloped nations with unstable transfusion programs. The formation of transfusion safety and haemovigilance committees, the identification and empowerment of a haemovigilance referent, the involvement of health care providers in the reporting of transfusion reactions, the inclusion of transfusion medicine training in health professional curricula, and the strengthening of the capacity of blood transfusion services would all help to reduce the prevalence of these transfusion adverses reactions and thus improve transfusion safety.

These transfusion responses were contagious in 39.13% of the cases. This infectious risk exists for all families of infectious agents, even though it has not been identified. Between 1992 and 2002, the cumulative risk for the most serious infections in items transfused decreased from 1/65,000 to 1/350,000 in affluent nations, particularly in France (11), but remains quite high in underdeveloped countries (12). This is assumed to be owing to health care personnel in blood banks, clinical departments, and patients themselves failing to follow operating procedures for blood collection, transfusion, and sanitation precautions. However, these findings should not be used to dismiss other types of transfusion reactions, such as ABO incompatibilities or overload reactions, as evidence of difficulties in clinicians' diagnosis of transfusion reactions or non-reporting of transfusion reactions in patients' medical records. To reduce morbidity and mortality associated with blood transfusion, all personnel participating in the whole transfusion chain, as well as all persons involved in the conduct of transfusion procedures, should be required to follow operational protocols. In addition to the emphasis placed on training health care providers in clinical services, it is critical to train

the staff of blood transfusion services on good practices on a regular basis, as well as to improve the quality of labile blood products served by the latter through extended phenotyping before the delivery of any blood product.

### 4.2. Socio-demographic characteristics of transfused patients

The median age of the transfused patients in our study was 27.17 years, with extremes of 1 month and 78 years, whereas FATAKI et al. reported an average age of 37.8 years (13). Furthermore, 66.8% of our transfused patients were female, which confirms national transfusion data that women, particularly those of childbearing age and children under the age of five, are the largest consumers of blood products, according to activity reports from the CRTS of Bobo-Dioulasso and the national blood transfusion center 2019. In Morocco in 2018, ABDELLAOUI discovered a male predominance of 54.06% (14). These discrepancies can be explained by the transfusion indications, which in Burkina Faso are malarial anaemia and delivery hemorrhage compared to Morocco. This highlights the issue of transfusion safety because the number of possible blood donors has decreased over time because of the permanent exclusion from donating blood in the event of a previous transfusion.

### 4.3. Factors associated with the occurrence of adverse transfusion reaction.

Analysis of factors associated with the occurrence of transfusion reactions in our study revealed that the risk of occurrence of transfusion adverses reactions was 3.54 times ($p < 0.05$) and 4.16 times ($p = 0.004$) higher respectively if the blood transfusion lasted less than 30 minutes or more than 60 minutes compared to a duration of 30 to 60 minutes. These figures are supported by those of TANKPE in Benin and KOSSI in Togo who found respectively that the occurrence of adverse transfusion events was associated with the duration of blood transfusion ($p = 0.001$) (15) and that 56% of reported adverse transfusion events occurred during blood transfusions lasting more than one hour (16). In fact, evidence of immunological or allergic reactions to blood transfusions develop within the first few minutes. In our case, a blood transfusion lasting more than an hour raises the chance of bacterial development, jeopardizing the vital prognosis of transfused patients. This necessitates that all blood transfusions be performed under proper conditions by qualified professionals, with proper monitoring of the blood transfusion.

Furthermore, compared to transfusion of no more than two blood bags, transfusion of 3 to 4 blood bags and more than 4 blood bags increased the risk of transfusion responses by 1.67 times ($p = 0.032$) and 2.17 times ($p = 0.049$), respectively. This finding supports the notion that there is a higher risk of transfusion reactions in poly-transfusions, particularly in developing countries such as Burkina Faso, due to incompatibility in other blood systems other than the ABO RhD system, individual polymorphism on the one hand, and circulatory overload associated with the transfusion on the other, which can lead to the patient's death. In the face of limited blood resources and products, it is prudent to limit the use of blood products to what is essential to prevent morbidity and mortality associated with blood transfusion.

## 5. Conclusion

To ensure the safety of recipients of blood products, it is imperative to put in place systems to monitor and manage transfusion reactions.

Our study revealed a high prevalence of transfusion reactions in the care departments of the CHU-SS and identified factors such as the duration of transfusion or the number of blood bags transfused that are associated with the occurrence of these transfusion reactions. Monitoring blood transfusions, rationalizing the use of blood products, carrying out extended phenotyping and leukoreduction of blood bags would contribute to improving transfusion safety by reducing the prevalence of these transfusion reactions.

## Compliance with ethical standards

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*Disclosure of conflict of interest*

The authors declare no conflict of interest in relation to the publication of this article.

*Statement of ethical approval*

The present research work does not contain any studies performed on animals/humans' subjects by any of the authors.

*Statement of informed consent*

Our research did not use surveys or individual interviews, but rather the clinical records of transfused patients. As a result, we did not need to get consent from study participants; nonetheless, before the study began, we got administrative permission from CHU-SS general management to gather data.

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