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Original article

Knowledge, attitudes and clinical practice of blood products prescribers in Niamey

Connaissances, attitudes, pratiques des prescripteurs de produits sanguins à Niamey

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Abstract

Aim of the study. – The lack of traceability and monitoring of blood donors and transfused patients constitute a barrier to the most basic rules of haemovigilance and overall good transfusion practices. This study draws up an inventory of knowledge, attitudes and clinical practice of blood prescribers in Niamey.

Materials and methods. – A questionnaire was administered to 180 prescribers of blood products in Niamey in 2011. Questions were related to basic informations on blood transfusion and clinical use of blood. Analyses were performed using SAS 9.3 version.

Results. – The sample consisted of 180 respondents from several professional categories: 51 physicians (28.33%), 10 medical students (5.56%), 84 nurses (46.67%), 15 anaesthesiologist assistant (8.33%) and 20 midwives (11.11%). Among these, 22.2% received training in blood transfusion safety. Half of the respondents (50.8%) got between 50 and 75% of correct answers, 45.8% got less than 50% correct while 3.35% scored more than 75% correct answers. The overall quality of responses was higher among physicians compared to other prescribers ($P < 0.0001$); among respondents who received training in transfusion safety ($P < 0.0001$); and among males ($P = 0.0306$). For some items, subjects with more experience scored the best.

Conclusion. – The level of knowledge is still inadequate. More training in transfusion practices is necessary for prescribers of blood products. Accompanying measures to improve transfusion practice must be considered or strengthened through assessments, knowledge update/upgrade (regular, ongoing training) and establishment of active and motivated hospital transfusion committees.

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Keywords: Blood safety; Clinical use of blood; Haemovigilance; Niamey

Résumé

But de l'étude. – L'insuffisance de traçabilité et de suivi épidémiologique des donneurs de sang et des patients transfusés constituent une entrave à l'hémovigilance et aux bonnes pratiques transfusionnelles en général. L'objectif de cette étude est d'établir un état des lieux des connaissances, attitudes et pratique clinique des prescripteurs de produits sanguins à Niamey.

Matériel et méthode. – Un questionnaire a été soumis à 180 prescripteurs de produits sanguins à Niamey en 2011. Les questions étaient relatives aux notions de base sur la transfusion ainsi qu'à l'utilisation clinique du sang. L'analyse a été effectuée grâce au logiciel SAS version 9.3.

Résultats. – L'enquête a concerné 51 médecins (28,3 %), 10 étudiants en médecine (5,6 %), 84 infirmiers (46,7 %), 15 aides-anesthésistes (8,3 %) et 20 sages-femmes (11,1 %). Parmi ces sujets, 22,2 % ont reçu une formation en transfusion sanguine. La moitié des répondants (50,8 %) ont eu entre 50 et 75 % de bonnes réponses, 45,8 % moins de 50 %, et 3,35 %, plus de 75 %. La qualité globale des réponses était meilleure chez les médecins comparés aux autres prescripteurs ($p < 0,0001$), chez les participants qui ont reçu une formation en transfusion ($p < 0,0001$) et chez les hommes ($p = 0,0306$). Pour certains items, les sujets ayant plus d'ancienneté professionnelle étaient meilleurs répondants.

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Conclusion. – Le niveau des connaissances étant insuffisant, des formations en transfusion sont nécessaires pour les prescripteurs de produits sanguins. Des mesures d'accompagnement devraient être envisagées ou renforcées au moyen d'évaluations, de remises à niveau (formation continue), et par la mise en place de comités hospitaliers de transfusion actifs et motivés.

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Mots clés : Sécurité transfusionnelle ; Utilisation clinique du sang ; Hémovigilance ; Niamey

1. Introduction

Blood transfusion saves lives and improves health [1]. For that reason, nearly 108 million blood donations are collected annually worldwide [1]. However, this practice is not without risk as it can lead to incidents or accidents for both the donor and the recipient. Haemovigilance was introduced in France in the early 1990s [2,3] as a tool specifically dedicated to improving quality and safety of transfusions [4].

Clearly defined as an epidemiological surveillance system [3], haemovigilance is also “a set of surveillance procedures covering the whole transfusion chain (from the collection of blood and its components to the follow-up of recipients), intended to collect and assess information on unexpected or undesirable effects resulting from the therapeutic use of labile blood products, and to prevent their occurrence or recurrence” [5]. This monitoring and warning system is based on the traceability of blood component and steps involved in the process from donor to recipient and also relies on reporting of transfusion incidents [2]. Traceability, meanwhile, aims to help identify, from a blood component number, either the donor whose blood was used to prepare the product, or the recipient to whom the blood was administered [6].

The existence, structure and operational statuses of haemovigilance in a given country are correlated to the existence of an advanced transfusion system [4]. Thus, apart from local or institutional initiatives, organized haemovigilance is virtually inexistent in developing countries [4]. The same applies for quality assurance systems that may control the transfusion practice [7]. In 2010, only 1.3% of hospitals in World Health Organization (WHO) Africa Region conducted audits on blood transfusion, and only 26% were reporting transfusion incidents [8]. Similarly, less than one of 10 African countries have an adequate policy on clinical use of blood [7].

At the Niamey Regional Blood Transfusion Centre (BTC), quality assurance is being established gradually, but the lack of traceability and epidemiological monitoring of blood donors and transfused patients constitute a barrier to the most basic rules of haemovigilance and overall good transfusion practices. The distribution of labile blood components (LBC) is either nominative, or, since 2011, as blood banking in three hospitals [Hôpital National de Lamordé (HNL), Centre Hospitalier Régional Poudrière (CHR/P) and Maternité Issaka Gazobi (MIG)].

Blood units which are not transfused are retrieved by the BTC only under certain conditions of transport and storage. Because of this situation, coupled with the chronic shortage of blood and medical emergency, clinicians tend to use these units for patients to whom they were not originally intended. Moreover,

the majority of services using LBC for transfusion purposes do not have a “transfusion registry”.

It should however be pointed out that, in 2005, the Ministry of Public Health of Niger issued a decree on the establishment of hospital transfusion committees (HTC) in reference hospitals and maternity wards, and in regional hospitals. But only two institutions [Hôpital National de Niamey (HNN) and MIG, the two largest consumers of LBC] actually set up these committees in 2007–2008, though they are still not functional. Under these conditions, top-down and bottom-up transfusion investigations remain very often uncertain if not illusive. The same applies for post-transfusion infectious or immunological follow-up on short-, medium- or long-term patients.

This is the context in which, and the reason why, this study was designed: to identify ways of improving the management of LBC recipients. Its objective is to analyze the degree of knowledge in transfusion practice, clinical attitudes and practices of LBC prescribers, especially regarding prescription of blood components, transfusion rules, traceability, rational use of blood and haemovigilance. The conclusions drawn from this analysis will probably lead to solutions aimed at improving transfusion practice in Niamey.

2. Materials and methods

2.1. Study population

An individual questionnaire was submitted to prescribers of blood components working in public or private care facilities (CF) in Niamey.

Sampling was done according to a non-probability technique. Participation in the study was voluntary and anonymous. All institutions that use transfusion were enrolled: pediatrics, maternity wards, medicine, surgery, intensive care and emergency rooms. Respondents interviewed between March and July 2011, were from 18 different CF.

2.2. Assessment tool

To achieve the objectives of the study, an individual questionnaire was developed.

In the first part of the questionnaire, items were related to the socio-professional characteristics of the subject: gender, occupation, facility, unit, specialty, seniority, training in blood transfusion practice. The questionnaire then focused on issues related to the knowledge of certain rules of good transfusion practices including: conservation and transportation of LBC, knowledge of blood types ABORHD, compatibility rules in

the ABO system, transfusion-related errors and hazards, compatibility concept, ABO control at the patient's bedside, and haemovigilance.

Another chapter of the questionnaire addressed issues related to transfusion attitudes and practices: transfusion of a blood unit to a patient to whom it was not originally intended, patient monitoring during transfusion, traceability of the transfusion process (and data recording including notification and reporting of transfusion-related incidents/accidents), and measures considered for the rational use of blood.

The last part of the questionnaire was devoted to difficulties experienced by physicians during their transfusion practice, solutions to deal with them, as well as suggestions to improve relations between CF and BTC.

Poorly filled questionnaires have been removed so that a total number of 180 valid questionnaires were analyzed.

2.3. Statistical analysis

This was a cross-sectional study. After the data collection process, answers received on the questionnaire were coded and entered into a database set up in Excel. They were then analyzed using SAS 9.3 version.

A descriptive analysis of the population was first performed. Association between the percentages of correct answers and socio-professional characteristics of respondents was then measured.

The relationship between two qualitative variables was investigated using the Chi² test for contingency tables. The relationship between a qualitative variable and a quantitative variable was studied using a one-way analysis of variance (ANOVA) for independent samples and the nonparametric Kruskal-Wallis test. Results were considered significant at a level of uncertainty of 5% ($P < 0.05$).

3. Results

3.1. Description of the study population

The sample consisted of 180 respondents: 51 physicians (28.3%) including 38 general practitioners and 13 specialists, 10 medical students (5.56%), 84 nurses (46.7%), 15 anaesthesiologist-assistants (8.3%) and 20 midwives (11.1%). The respondents worked mostly in the public sector (75.6% in six CF) and in the private sector (24.4% in 13 CF). In terms of gender, 40% were male and 60% female. Of the respondents, 7.2% were unaware of a BTC in Niamey. About a fifth of the subjects (22.2%) reported having received training on blood safety and rational use of blood.

3.2. Knowledge

3.2.1. Storage of blood components

For 26.1% of respondents, whole blood bags can be stored in a conventional household refrigerator. Of the 63.9% who knew the whole blood should be stored in a refrigerator with a temperature control system, only 20% knew the whole blood [or concentrated

erythrocyte (CE)] storage temperature (+2 to +6 °C). About 11% of respondents knew platelets storage temperature. Fresh frozen plasma (FFP) storage temperature is less well known (only 8% of respondents). Overall, 87.8% of respondents did not know the shelf life of whole blood.

3.3. Immuno-hematology concepts

With regard to ABO blood system, 40.6% of respondents did not know why O-type is known as “universal donor”. Furthermore, 73.9% of respondents did not know the existence of blood group systems other than ABO. Only two out of the 180 respondents (1.1%) named, together with ABO, the five most immunogenic systems: RH, Kell, Duffy, Kidd and MNSs.

Among prescribers, 4.4% did not know that a compatibility test is performed before a blood bag is delivered to a patient. Less than a third of respondents (29.4%) knew what a compatible transfusion is. A similar percentage (30%), however, believed that a compatible transfusion is a transfusion with an iso-group and/or iso-Rhesus blood.

According to our study, 82.8% of respondents were unaware that two blood units of the same ABO-type may be incompatible; and 36.7% did not know that two different blood types (ABO) can be compatible.

3.3.1. Transfusion risk

One in six respondents (16.7%) did not know that transfusion can be risky for the patient. For 8.3% of respondents, transfusion involved no risk for the recipient; and 68.3% of respondents knew that most of transfusion accidents due to ABO incompatibility occur within 15 minutes after the initiation of the transfusion.

3.3.2. Definition of haemovigilance

To define haemovigilance, the following proposals must be checked: “transfuse blood into a patient only when a compatibility test was carried out”, “monitor incidents occurring in donors and/or blood recipients”, and “transfuse a patient only if absolutely necessary”. Positive responses were collected in quite similar proportions: 32.8, 33.3 and 33.9%, respectively. The proportion of respondents who checked two proposals was 8.9% and 5.6% of respondents checked the three proposals at once.

3.4. Attitudes and practices

3.4.1. Transfusion errors

One in five (20%) claim to have transfused blood to a patient other than that for whom the blood was intended. Half of those respondents reported performing this act regularly i.e., more than once a month. The majority (97.2%) mentioned an emergency to explain this practice and a minority (2.8%) mentioned a transfusion error.

3.4.2. Immediate monitoring of transfusion

In our study, 45% of respondents do not stay at the bedside after initiating a transfusion. Their unanimous explanation for

this was a lack of time due to understaffing. Among them, two (a nurse and a midwife) also said they used to delegate this task to the person assisting the patient.

3.4.3. Traceability and haemovigilance

Each blood components issued by the BTC is delivered with a transfusion sheet. The sheet, which must be returned to the BTC once the transfusion is completed, is always (75%), sometimes (7.8%) and never (17.2%) filled by respondents. Even if filled, 23.9% are never returned to the BTC. A transfusion registry was available in 39.4% of respondents' departments. For 16.9% of them, the registry was not appropriately filled (up-to-date). In these registries, there was no field for the notification of potential transfusion adverse events or reactions. Observed reactions to transfusion have not been reported in 52.8% of the cases. Otherwise, only 10.3% of the notifications of reactions to transfusion were sent to the BTC.

3.4.4. Rational use of blood

Our study showed that 28.9% of respondents answered “no” to the following question: “Are all blood units issued by the BTC transfused?” For 34.6% of them, these unused units are returned to the BTC within a suitable period of time (< 1 hour). Otherwise (65.4% of the cases), these blood bags are kept in the hospital refrigerator, waiting to be destroyed or transfused to another patient without pre-transfusion compatibility. Nearly 2/3 of respondents declared they did not know which method to use if transfusion alternative had to be considered.

3.4.5. Indications for transfusion

To the question “what are the major indications for the transfusions you perform?” Anemia, mentioned by 80% of respondents, topped the list. Hemorrhage (10.9%) and surgery (9.1%) were also mentioned.

3.4.6. Difficulties and prospects

The respondents mentioned the main challenges they face in transfusion practice. Most of them (84.4%) lamented the non-availability of blood. Other problems were related to inadequate training, unfair distribution of blood bags, etc. (Table 1). The respondents have subsequently made recommendations to deal with those difficulties (Table 2).

3.5. Measures of association

3.5.1. Training in blood transfusion

The study showed a significant difference between subjects who received transfusion training and those who have not. Indeed, the quality of responses (percentage of correct answers) was higher in the first group ($P < 0.0001$, Table 3).

3.5.2. Profession

There is a significant difference ($P < 0.0001$) between the quality of responses and occupation, and the quality of responses was better in the physicians group compared to non-physician prescribers (Table 3).

Table 1

Problems identified during transfusion practice as expressed by survey participants.

Rate	Wording
84.4% (principal problem)	Non-availability of blood, sometimes leading to death
10.2% (other problems)	Inadequate training
	Deadline for receipt of blood units is too long
	Unfair distribution of blood bags (BTC's parents and acquaintances are privileged)
	No hospital blood bank
	Clot in the blood units
	Blood type errors
	Transfusion-related accidents (without any specification)
	Communication problem (telephone)
	Lack of time for patient monitoring
	Accessibility issues and remoteness from the BTC
	Not enough specialists (BTC) to contact in case of problems
	BTC staff not understanding
	Poor quality of the reception (BTC), lack of respect
	Lack of transfusion sets and gloves
	Poor coordination of activities BTC/CF
2.5%	No problem
2.9%	No answer

BTC: Blood Transfusion Centre; CF: care facilities.

3.5.3. Gender

The study results also showed that the overall quality of responses is better in men than in women ($P = 0.0306$, Table 3). Among non-physician prescribers, men were also the best responders ($P = 0.0329$).

3.5.4. Number of years prescribing blood products

Considering all issues, the quality of responses (proportion of correct answers) was not influenced by seniority (number of years in the profession) or experience in the field (number of years as a LBC prescriber). However, considering each question individually, for some items, the quality of responses is better

Table 2

Some recommendations made by respondents.

Train, retrain and supervise blood prescribers as well as the BTC staff
Rationalize blood orders
Raise awareness for blood donation and improve blood availability
Set up a blood bank in hospitals
Treat any demand for blood without discrimination
Improve the reception at the BTC
Provide transfusion sets and gloves
Listen to blood prescribers' complaints
Establish a communication framework, ensure better collaboration between BTC and CF
Hold periodic and regular meetings between BTC and CF
Establish an HTC in institutions conducting transfusion practices
Ensure better management of transfusion sheets at both levels (BTC and CF)

BTC: Blood Transfusion Centre; CF: care facilities; HTC: hospital transfusion committees.

Table 3
Percentage of correct answers according to occupation, training in transfusion and gender.

Percentage correct answers	Occupation				Training in transfusion				Gender				Total prescribers	
	Doctor		Other		Yes		No		Male		Female		n	%
	n	%	n	%	n	%	n	%	n	%	n	%		
< 50	12	6.7	70	39.1	15	37.5	67	48.2	20	27.4	62	58.5	82	45.8
50–75	45	25.1	46	25.7	21	52.5	70	50.4	50	68.5	41	38.9	91	50.8
≥ 75	5	2.8	1	0.6	4	10.0	2	1.44	3	4.11	3	2.83	6	3.4
Total ^a	62	34.6	117	65.4	40	22.4	139	77.6	73	40.8	106	59.2	179	100
P value	<0.0001 in favour of doctors				<0.0001 in favour of trained				0.0306 in favour of men				NA	

NA: not applicable.

^a One missing data.

($P < 0.05$) in subjects with more seniority or experience in the field. These items are: definition of haemovigilance, storage of whole blood or CE, pre-transfusion compatibility for each blood unit, and the occurrence of transfusion accidents due to ABO incompatibility within minutes following initiation of the transfusion.

4. Discussion

This survey is instructive with regard to the weakness of knowledge about transfusion among caregivers in Niamey. Blood transfusion acts require the supervision of a physician; but, given the lack of clinicians in Niger in general, physicians, nurses and midwives are blood prescribers. Thus, discussion of our survey results will reflect the overall quality of responses without group distinction.

4.1. Transfusion indications

The results of the study were consistent with data from existing literature regarding indications for transfusion in developing countries. Indeed, up to 80% of transfusions that are performed in Sub-Saharan Africa are a result of anemia or haemorrhage [9].

4.2. Blood units storage

Inadequate knowledge of the LBC storage conditions partly explains the conservation of the blood units in a household refrigerator. This unsafe practice can lead to the development of infectious agents (especially bacteria) in the blood bag or to an inefficient transfusion. Given that all clinical departments do not have adequate refrigerators for blood bags storage, the best alternative would be that the unused blood bags are returned to the BTC within one hour after receipt, in accordance with a written procedure developed for this purpose.

4.3. Basics of immunohaematology

Consequences of an incompatible transfusion (especially ABO error) are the most dangerous in transfusion practice. Indeed, besides being inefficient, ABO incompatibility is universally recognized as a major cause of morbidity and mortality [10]; CE volumes of greater than 50 mL are associated with a

lethality of 20% [11]. Although knowledge in immunohaematology is particularly significant with the blood bank staff who LBC prescribers often blindly trust, medical staff, especially nurses who administer blood, should also definitely be acquainted with transfusion rules. Disregard for these rules as proved by our investigation remains unquestionably a major concern, given that ABO compatibility rules are the basis of any transfusion.

4.4. Transfusion errors and close supervision of transfusion

Transfusion without any compatibility test and, in addition, to patient for whom it was not intended, still considerably increase the immunological transfusion risk. This may lead to the death of the recipient, especially for ABO-incompatible transfusion. Knowing that, in most cases, the signs related to ABO-incompatible transfusions occur in the first minutes following the initiation of the transfusion, close monitoring for clinical signs at the bedside is indicated. It is indeed frequently within this short period of time that can be observed signs of intolerance with potential harm to the blood recipient. These signs are justification for stopping the transfusion [12]. Unfortunately, in this survey, almost half of respondents reported not being able to take the right approach due to a lack of staff in the CF.

4.5. Transfusion risk

With 8.3% of the respondents for whom transfusion is never dangerous and 16.7% who claimed not to know that transfusion may be risky, 25% (one quarter) of blood prescribers are unaware that blood transfusion may be associated with adverse reactions. This proportion is lower than that (36.4%) recorded in Mali by Diakit  et al. in 2010 [13]. Thus, as the potential hazards of transfusion are largely misunderstood, the precautionary measures necessary to ensure transfusion safety might not be observed.

4.6. Traceability and haemovigilance

This study also reveals that haemovigilance is relatively unknown to respondents. It will then be up to the BTC to

integrate this concept and its implications for future training in blood transfusion safety targeted to LBC prescribers.

The non-availability of a transfusion registry in many departments defeats the traceability concept since it is difficult or even impossible to connect the LBC with the recipient and vice versa. Removal of outdated blood bags from hospitals are not recorded, reinforcing our concern regarding traceability and the rational use of LBC. Thus, it becomes clear that identification, allocation and monitoring of transfusion risks are not feasible, and the side effects associated with transfusion cannot be appreciated. Such settings, combined with the difficulty of monitoring a patient after admission, make it almost impossible to investigate any incident or accident occurring at any step of the transfusion chain.

4.7. Difficulties encountered (by respondents) and rational use of blood

Although the large majority of respondents has lamented about blood shortages, our survey showed that for approximately 30% of the respondents; blood units issued by the BTC were not used, pointing out unnecessary blood demands. This practice only makes the situation worse as the BTC faces difficulties to meet the blood requirements with only 45% of the demand met in 2012 and 2013 and 58% in 2014 (BTC data). This is a vicious circle where prescribers, because of the shortage, tend to order more than necessary in order to either keep a little stock for the department, or to have one or two additional blood units for the patient. According to Tinmouth et al. [14], increased knowledge of clinicians in transfusion practice would benefit a more rational use of LBC. Note that, with about four blood donations per 1000 inhabitants in 2010 [8] (compared to 36.8‰ in more developed countries [15]), blood shortage is persistent in low-income countries, and barely half of the requirements can be met [8]. Failure to return unused unit (to the BTC) could be justified by the remoteness of some CF, which therefore cannot meet the prescribed period of one hour to return unused blood bags as recommended by the related procedure.

Further difficulties have also been cited but to a lesser extent. However, they are matters of great importance when one knows for instance, that the reputation of poor reception attributed to the BTC staff is legendary in the public health institutions in Niger (and Africa in general [16]) where it represents an impediment for the use of public services. These difficulties are wide-ranging: organizational, behavioral, cognitive and technical/operational.

Given the difficulties mentioned by respondents, we realize that both the BTC (mainly) and the CF are responsible for transfusion shortcomings.

4.8. Outlook (according to respondents)

Creating a framework for knowledge sharing between BTC and CF, including the establishment of HTC, place high on the list of recommendations made by prescribers. It should be pointed out that 10 years ago, the Ministry of Health issued a decision establishing these committees within hospitals and to

date, none is functional. This is mainly due to the high turnover rate of staff (reassignments, departure for other more financially attractive structures, transfer of CF managers to other institutions), and leads to an endless cycle and often restarting over. There may be potential explanations for these committees not being functional; however, we know very little about them.

To overcome unfairness in delivering blood components, respondents suggested that there be no more discrimination. This aspect, although unethical, is probably related to the shortage of LBC causing some of the demand for blood components cannot be met by the BTC. Respondents also suggested expanding training for the BTC staff citing their incompetence.

4.9. Training in blood transfusion and gender

The proportion of subjects who received training in blood transfusion (22.2%) in our study is comparable to that (29.1%) recorded in Mali in 2010 [13] and the Democratic Republic of Congo in 2011 (25.5%) [17] in relatively similar surveys. Unlike Diakité et al. [13] and similarly to Kabinda et al. [17], the results of our study showed that the quality of responses was better among prescribers who received training in blood transfusion. Thus, as already shown by Tramalloni et al. [18], transfusion practice in hospitals could be improved if training is widely provided/strengthened to blood prescribers. Female health workers should also be sensitized because, although we were not able to establish the reasons, they were found to be less efficient than male workers. Therefore, training sessions organized by the BTC should more than ever be encouraged. Since 2006 and with the support of partners (European Union, WHO, Global Fund), the BTC has organized several training sessions in blood safety and rational use of blood for the LBC prescribers. Then, the BTC made available in hospitals guidelines in good practices for transfusion practice (Clinical guide to transfusion). In light of these assessments, in order to improve transfusion practice in hospitals and ensure sustainability, follow-up to these training courses is useful through field-based assessments and retraining when required. The establishment or strengthening of a quality approach in health services should also be encouraged [19,20]. All these actions would help guide the choice of corrective action in order to adopt the best approach towards transfusion.

4.10. Profession

Although predictable, the highest scores recorded in the physicians' group showed that their presence at the bedside would be beneficial when a transfusion is considered or initiated. In the study by Diakité et al. [13] in Mali, nurses and midwives, also had the most inadequate knowledge. Similarly, for Kabinda et al., doctors were the best responders for some items [17]. Our survey showed that, unfortunately, monitoring of transfusion is often delegated to nurses and midwives as a result of a lack of practitioners. This option is completely possible but these professional caregivers said they were themselves overworked (burned out). In 2012, the Niger doctor to population ratio was 1:16,307 (1:6774 in Niamey), nurse to patient ratio was 1:3765 (1:1266 in Niamey) and there was a midwife

for 3710 women of childbearing potential (1:832 in Niamey); the standard recommended by WHO is 1:10,000 for doctors; 1:5000 for nurses and midwives [21]. From a professional and ethical point of view, the attitude to be condemned is the delegation of patient monitoring to a relative assisting the patient. However, as it is very likely that the latter is not a health officer or is not educated, he might not recognize life-threatening signs in the blood recipient.

4.11. Seniority

Not surprisingly, our results also showed that seniority is a factor promoting the quality of responses, although there is much to be done.

4.12. Expected impact

The results of this survey could strengthen the BTC strategy implemented to improve the traceability of blood components and to establish haemovigilance in Niamey. Indeed, the National Policy for Blood Transfusion of Niger advocates to ensure the traceability of all blood components, thereby linking donor to recipient and vice versa in order to adopt adequate measures in case of incident/accident (national blood transfusion policy Niger, 2006). This will only be possible through training of involved staff and improving coordination of CF/BTC activities. To this end, implementation of transfusion committee in hospitals is more relevant than ever. Unlike Sub-Saharan Africa, many studies have been conducted in developed countries [22–25] or in Maghreb countries [26–28] to assess knowledge and practices (of hospital staff) in medical transfusion practice. These studies have identified shortcomings (regarding knowledge, attitudes and practices) and recommended strengthening training and monitoring or implementation of other appropriate measures (quality assurance, audit. . .). On this basis, we strongly encourage surveys to measure the knowledge on medical transfusion practice in Sub-Saharan Africa.

4.13. Study limitations

Our study has limitations. The participation rate could not be determined because the questionnaires have not been quantified at the time the survey was distributed. Respondents had considered the questionnaire lengthy (10 pages); and response times were particularly long. Exhaustive sampling was intended but few (two) clinics did not participate in the study.

5. Conclusion

The study highlighted weaknesses in knowledge and shortcomings in transfusion practice in hospitals in Niamey. The need for training was expressed by the respondents themselves and was felt through their answers. Nevertheless, to be effective, training should be supported by measures to consolidate the achievements. Indeed, it would be illusory to think that training, as a stand-alone strategy, may be sufficient to ensure blood safety in hospitals. Thus, to ensure the effects and impacts of initiatives

carried out to promote safety at all levels of the transfusion chain, audits should be conducted regularly, and appropriate corrective actions should be implemented.

Disclosure of interest

The authors declare that they have no competing interest.

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References

- [1] World Health Organization. Blood safety and availability, fact sheet No. 279; 2015 [Available at: <http://www.who.int/mediacentre/factsheets/fs279/en/>, Accessed on 15/06/2015].
- [2] Delbosc A, Weiller J, Dussert P. L'hémovigilance à l'aube du XXI^e siècle. *Presse Med* 2000;29:1066–71.
- [3] Salmi LR, Hervé P. L'organisation de l'hémovigilance en France. *Transfus Clin Biol* 1994;1:252–6.
- [4] Faber JC. Revue des principaux systèmes d'hémovigilance dans le monde. *Transfus Clin Biol* 2009;16:86–92.
- [5] IHN (International Haemovigilance Network). Definition of Haemovigilance from International Hemovigilance Network; 2010 [Available at: <http://www.ihn-org.com/about/definition-of-haemovigilance/>, Accessed on 13/07/2015].
- [6] Articles R. 666-12-11 et R. 666-12-13 du Code de la santé publique. Circulaire DGS/DH n° 40 du 7 juillet 1994 relative au décret n° 94-68 du 14 janvier 1994 sur l'hémovigilance pris pour application de l'article L. 666-12 du Code de la santé publique; 1994 [Available at: http://ansm.sante.fr/var/ansm_site/storage/original/application/4cf777a3baf517ffae58785a0abd996a.pdf, Accessed on 31 mars 2015].
- [7] Tagny CT, Mbanya D, Tapko JB, Lefrère JJ. Blood safety in Sub-Saharan Africa: a multi-factorial problem. *Transfusion* 2008;48:1256–61.
- [8] Tapko JB, Toure B, Sambo LG. Status of blood safety in the WHO African region. Report of the 2010 survey. Brazzaville; 2014 [Available at: <http://www.afro.who.int/en/clusters-a-programmes/hss/blood-safety-laboratories-a-health-technology.html>, Accessed on 08/04/2015].
- [9] Allain JP, Owusu-Ofori S, Bates I. Blood transfusion in sub-Saharan Africa. *Transfus Altern Transfus Med* 2004;6:16–23.
- [10] David B. Bilan et perspectives du fonctionnement de l'hémovigilance française et des données recueillies sur 9 ans. *Transfus Clin Biol* 2003;10:131–9.
- [11] Janatpour KA, Kalmin ND, Jensen HM, Holland PV. Clinical outcomes of ABO-incompatible RBC transfusions. *Am J Clin Pathol* 2008;129:276–81.
- [12] Andreu G. Du bon usage des produits sanguins. *Presse Med* 2015;44:165–77.
- [13] Diakité M, Diawara SI, Tchogang NT, Fofana DB, Diakité SA, Doumbia S, et al. Connaissances et attitudes du personnel médical en matière de transfusion sanguine au Mali. *Transfus Clin Biol* 2012;19:74–7.
- [14] Timmouth A, Macdougall L, Fergusson D, Amin M, Graham ID, Hebert PC, et al. Reducing the amount of blood transfused: a systematic review of behavioral interventions to change physicians' transfusion practices. *Arch Intern Med* 2005;165:845–52.
- [15] World Health Organization. 10 facts on blood transfusion; 2015 [Available at: http://www.who.int/features/factfiles/blood_transfusion/blood_transfusion/en/, Accessed on 14/08/2015].

- [16] Jaffré Y. Une médecine inhospitalière : les difficiles relations entre soignants et soignés dans cinq capitales d'Afrique de l'Ouest. KARTHALA Éditions; 2003.
- [17] Kabinda JM, Miyanga SA, Donnen P, Van den Ende J, Dramaix MW. Knowledge, attitudes and practices of medical and paramedical staff in blood transfusion in the Democratic Republic of Congo. *Open J Prev Med* 2014;4:672–80.
- [18] Tramalloni D, Aupérin A, Oubouzar N, Lapierre V. Implication du personnel infirmier dans la sécurité transfusionnelle : évaluation des connaissances et de la pratique à l'institut Gustave-Roussy. *Transfus Clin Biol* 2005;12:427–32.
- [19] Le Drezen L, Lepiouf L, Léostic C, Barra JA, Le Niger C. Démarche qualité en hémovigilance : analyse du processus transfusionnel. *Transfus Clin Biol* 2004;11:138–45.
- [20] Hergon E, Guez P, Lopez R, Cabaud JJ, Garnerin P, Rouger P. Amélioration de la sécurité transfusionnelle dans un établissement de santé par le développement d'une démarche qualité. *Transfus Clin Biol* 1996;3: 305–14.
- [21] République du Niger, Ministère de la Santé Publique. Annuaire des statistiques sanitaires pour 2012 (ratio personnel de santé par région p22); 2013 [Available at: http://snis.cermes.net/download/Ann_stat_2012_Niger.pdf, Accessed on 08/04/2015].
- [22] Le Cosquer P. Enquête sur les pratiques des médecins anesthésistes-réanimateurs en transfusion sanguine et en hémovigilance. *Ann Fr Anesth* 2000;19:485–91.
- [23] Salem-Schatz SR, Avorn J, Soumerai SB. Influence of clinical knowledge, organizational context, and practice style on transfusion decision making: implications for practice change strategies. *JAMA* 1990;264:476–83.
- [24] Salem-Schatz SR, Avorn J, Soumerai SB. Influence of knowledge and attitudes on the quality of physicians' transfusion practice. *Med Care* 1993;31:868–78.
- [25] Rock G, Berger R, Pinkerton P, Fernandes B. A pilot study to assess physician knowledge in transfusion medicine. *Transfusion Med* 2002;12:125–8.
- [26] Letaief M, Hassine M, Bejia I, Romdhane FB, Salem KB, Soltani MS. Connaissances et pratiques du personnel soignant en matière de sécurité transfusionnelle. *Transfus Clin Biol* 2005;12:25–9.
- [27] Salah NB, El Borgi W, Skhiri HA, Lakhel FB, Mouelhi H, Zoueri B, et al. Connaissances médicales en matière de sécurité immunologique en transfusion érythrocytaire en Tunisie : évaluation d'un CD-ROM d'auto-enseignement. *Transfus Clin Biol* 2013;20:448–53.
- [28] Lahlimi FZ, Tazi I, Sifsalam M, Bouchtia M, Mahmal L. Évaluation de la pratique transfusionnelle : enquête au sein du personnel infirmier du centre d'oncologie-hématologie du CHU Mohammed VI de Marrakech, Maroc. *Transfus Clin Biol* 2015;22:12–6.