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BLOOD TRANSFUSION ERRORS, COULD BE ERADICATED? IMPROVING TRANSFUSION SAFETY; A CASE REPORT

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ABSTRACT

Background: Blood bank stands as one of the essential sections of every hospital. Its significance emerged once blood products become crucial lifesaving treatment. Errors are a ubiquitous accompaniment in all humans involvement. Despite the advanced techniques used in blood testing and issuing, transfusion errors still existed. Nearly 200 units of red blood cell units and other blood components are being issued every month at Ibri Regional Hospital Lab. An old practice was carried on that allows nurses to go inside the lab to get the blood units, where blood issuing services was an attached unit with blood bank crossmatching, and other essential testing procedures on the same working bench. Therefore it comes essential to establish something that creates more safe and confusion free transfusion process. **Study design and methods:** Four tools have been utilized; Spaghetti diagram, 5S Audit, 8 types of waste, and a survey. The first three tools provided a holistic view of the current lab deficiencies so problems can be, detected, traced, and solved. The Survey circulated to test the degree of satisfaction among lab and nursing staff. **Result:** After the goals of the initiation are being fulfilled, blood bank issuing services now are physically separated near the lab's reception without going inside the lab and with that its allow a sustainable plan. This allows a rapid and confusion-free issuing process, biohazard related contact of external staff is reduced to the minimum, more spaces are spared and hence lab can upgrade and expand services. **Conclusion:** Our evidence emphasizes the importance of continuous development, operational training,

compliance to instructions of all health care workers in the complex pathway of blood delivery, and the attempt to create a safe environment even with the limited resources despite the advanced technologies that are meant to streamline transfusion practices.

Background and case report (Near miss)

Blood transfusion is ordinarily very safe, due to the fact that the denoted blood is cautiously tested, handled, and stored. However, the body might have a mild to a severe reaction to the transfused blood. Complications can be fever, alloimmunization, and serious rare reactions that allow the denoted white blood cells to attack the recipient's body. Transfusion related-viral infections like hepatitis and human immunodeficiency virus have reduced significantly. Mostly proposed to the introduction and availability of highly sensitive nucleic acid testing (NAT). Based on a large national survey (National Blood Collection and Utilization Survey) done in the united states of America, 11,349,000 red blood cell units were transfused in 2015.[1] Not a single case of transfusion related-HIV infection was reported to Centres for Disease Control and Prevention(CDC), with the exception of one case that was traced to the year of 2008.[2] It has been estimated that the rate of having HIV-related transfusion infection is 1 case per 1.5 million (the estimation was based on data collection between 2007 and 2008).[3] Scientific types of research, and strict medical controls facilitate the supply of blood to be safe.

Despite the strict regulations and advanced molecular testing, mistakes could exist at any stage; from the moment of blood collection to the moment of blood transfusion. Blood bank plays a vital role in providing patients with the most proper and safe blood products. Blood transfusion is one of the most common life-saving procedures that is done in Ibri Regional Hospital. Nearly 200 units of red blood cell units and other blood components are being issued on a monthly basis covering all hospital departments.

We report a case where an incident of wrong blood collection was noticed and fortunately rectified. Blood bank issuing services and other services like crossmatching were done on the same working bench. Such practice is prone to more confusion and raises the potentials of acquiring mistakes. Lab staff was doing crossmatch for patient A, blood units to be prepared for this patient were indeed placed in the bench for further testing; taking segments of blood bags, indirect Coombs test, crossmatch the patient plasma with the donor red blood cells, and finally registration bags of interest. The bags still on the bench as they were not yet registered. During that, a nurse came to collect blood for patient B. Lab staff checked the

patient B ID and brought the correct bag from the fridge and record the issuing process but during the handling of the bag to be submitted to the nurse, not intentionally submit blood bag of patient A. The nurse left with the wrong bag, and fortunately lab staff started the process of registering blood bags of patient A, were noticed that one of the bags was missing and replaced with another. A rapid response was initiated where the nurse was traced and to get the bag back.

The current condition can be described simply in these points; the blood bank refrigerator that stores blood bags located far away from issuing area which make Nurses and other staff to be exposed to unnecessary infectious hazards by entering the main lab to collect blood, the blood bank staff need to travel 22 meters to bring the blood unit, and no space available for new blood bank equipment (platelets agitators as an example). In other words, the blood issuing facilities are located in a scattered pattern and occupying different spaces as a total figure of the lab's entire area.

METHOD

The pathway of blood delivery is a bit complex and it is inherently was like that all the time. It involves several patients' care departments. The main goal of this pathway is to ensure the delivery of the right blood to the right patient and at the right time. This pathway represents the central dogma of transfusion system infrastructure and can be summarized into these three bold points; identification of a patient with at least two identifiers, correlate the identifiers with patient's lab samples, tests, and blood components, and the third point emphasizes the delivery of the right blood products to the right patient at the right time and to confirm the identifiers again and finally before initiating the blood transfusion. These three steps are deep in its essence and involve many processes, each has its own risk of failure. Based on the literature, the frequency of failure is higher in outside lab practices.[4]

In order to fulfil the initiative goals, Ibri Lab had utilized four tools. Three of them are more involved in the implementation of the idea; Spaghetti diagram, 5S audit, and 8 types of waste, and the fourth tool was mainly to test the degree of satisfaction of nurses and lab staff. Spaghetti diagram is a visual representation of data that applies continuous flow lines of the activities executed in a particular area. It can provide a holistic view of intersections, redundancies, and hence provide opportunities that could not be noticed otherwise. The utilization of 5S Audit allows the lab to sort or prioritize things, where things in doubt are moved out. To set things in order, standardize or in other words making up the rules to be

followed, and finally sustain the implementation. Also, 8 waste tool was applied to detect flaws in the issuing process and the lab in general. The 8 waste tool includes the detection or the highlight of defects, overproduction, waiting, non-utilized talent, transportation, inventory, motion, and extra-processing. The fourth tool was a survey that was circulated to all lab staff and nurses. The survey aimed to test the degree of satisfaction with the new place of issuing blood in simple questions. Implementation outcomes were recorded in the form of diagrams to highlight the difference before and after the initiation.

RESULTS

Spaghetti diagram, 5S Audit, and 8 types of waste:

The utilization of the applied tools; Spaghetti diagram, 5S Audit, and 8 types of the waste tool just shed the light on hidden problems that were not noticeable at all. Previously, the blood bags storing refrigerator was located far away from the blood bank section which triggers the unnecessary movement of lab staff by 22 meters. Besides, it creates a blood issuing delay. Nurses who collect blood are exposed to several biohazards. And finally, having scattered issuing facilities, allow no chance to arrange new spaces to establish new services.

Tools outcomes before the implementation of the initiation are exasperated in the following Fig 1-3.

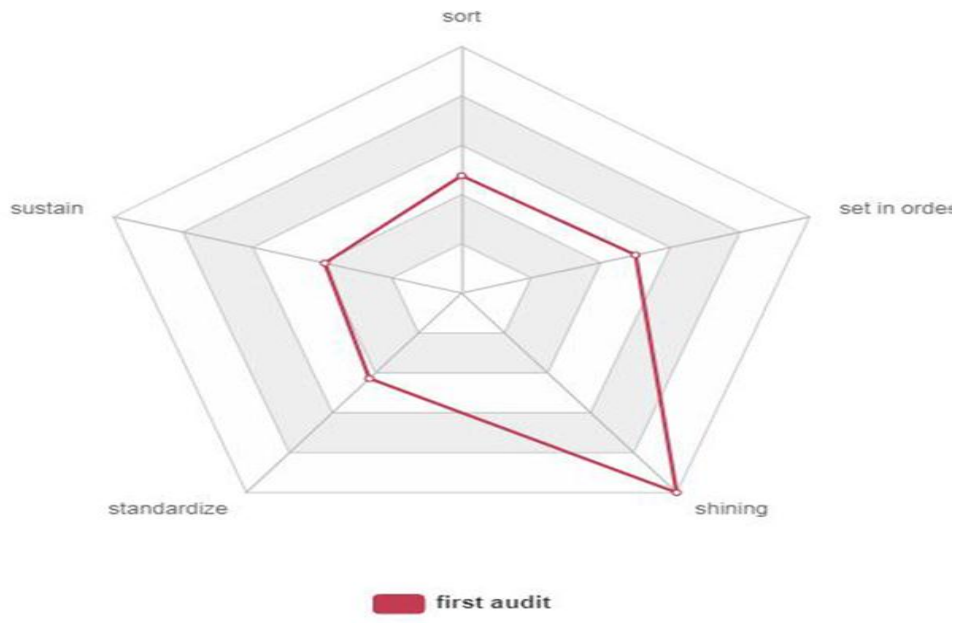

Fig. 1: 5S audit.

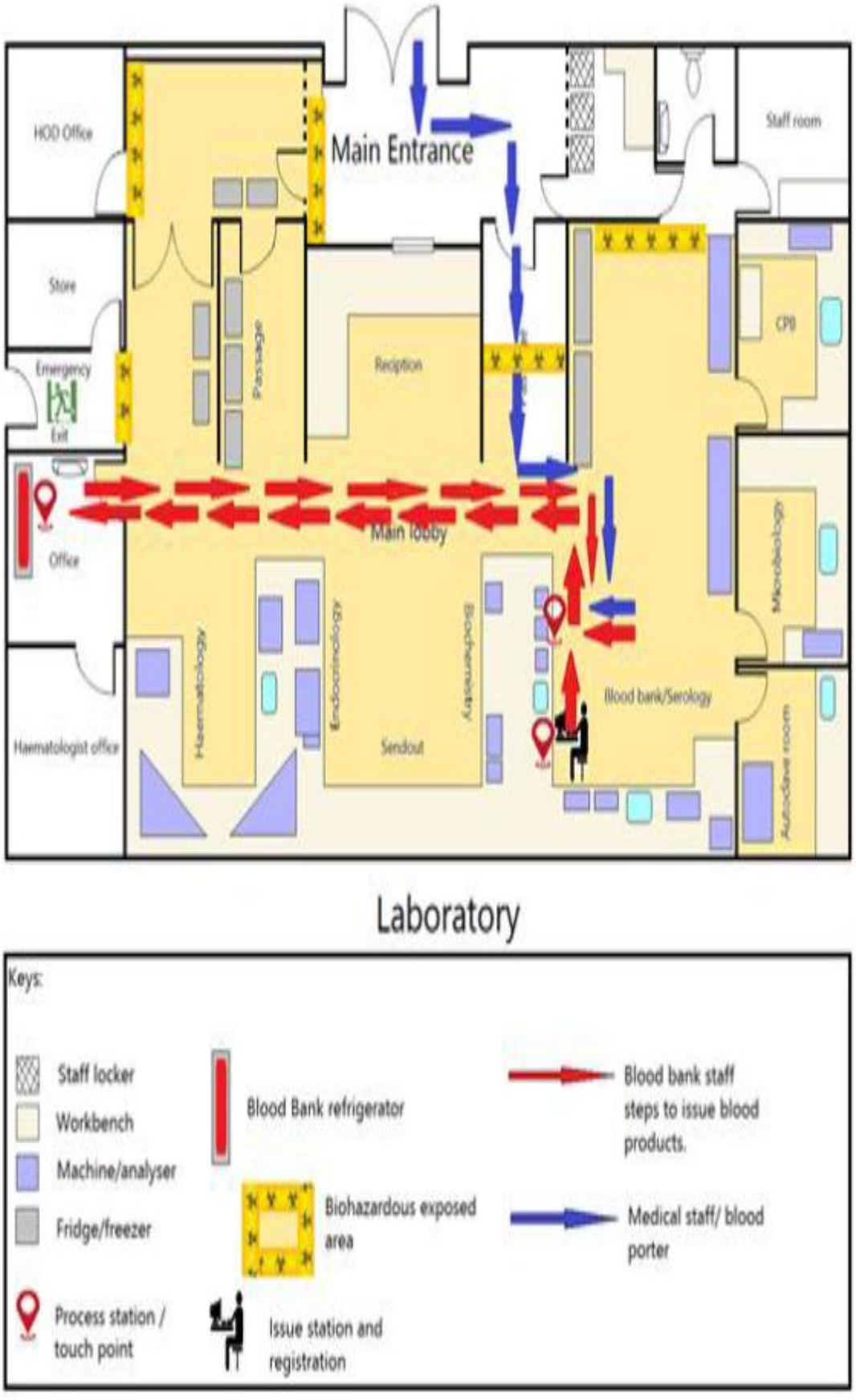

Fig. 2: Spaghetti diagram.

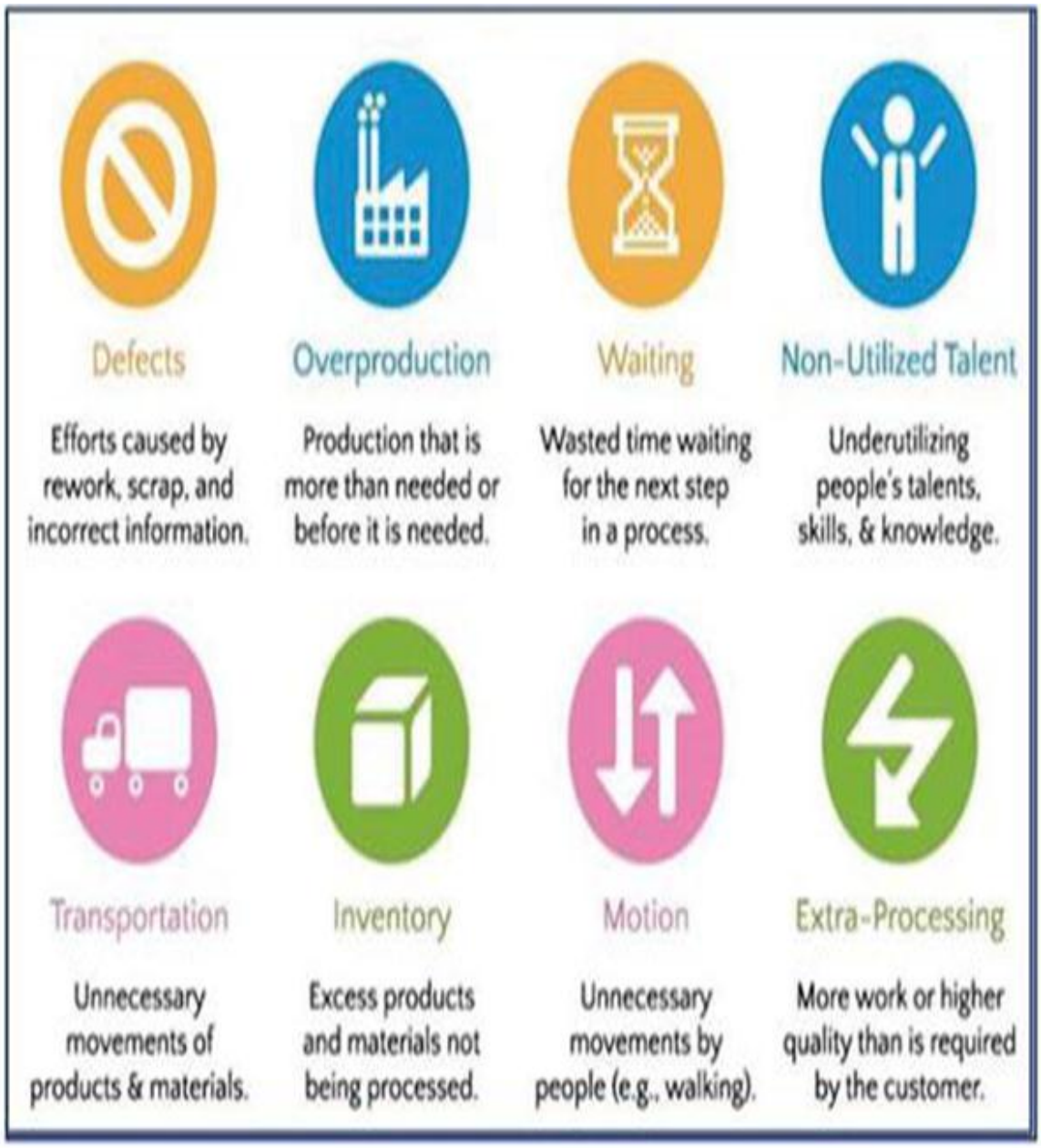

Fig. 3: 8 Types of waste, general figure.

After the implementation of the initiation, all flaws have been eliminated. The new blood bank arrangement makes new areas available for other lab services by 1.7 Mx 3.7 M (=6.3M^2) and it created 2.4M^2 extra space for blood bank section. The unnecessary movement was reduced by 22 meters. Those who collect blood for transfusion from the lab are now protected with almost no potential of being in contact with the lab's biohazards. Having a separated issuing room, near the lab's main entrance allows a more rapid issuing process which sometimes time could be the only barrier against saving a suffering patient who in high need of blood transfusion.

Tools outcomes after the implementation of the initiation are illustrated in the following Fig 4-5.

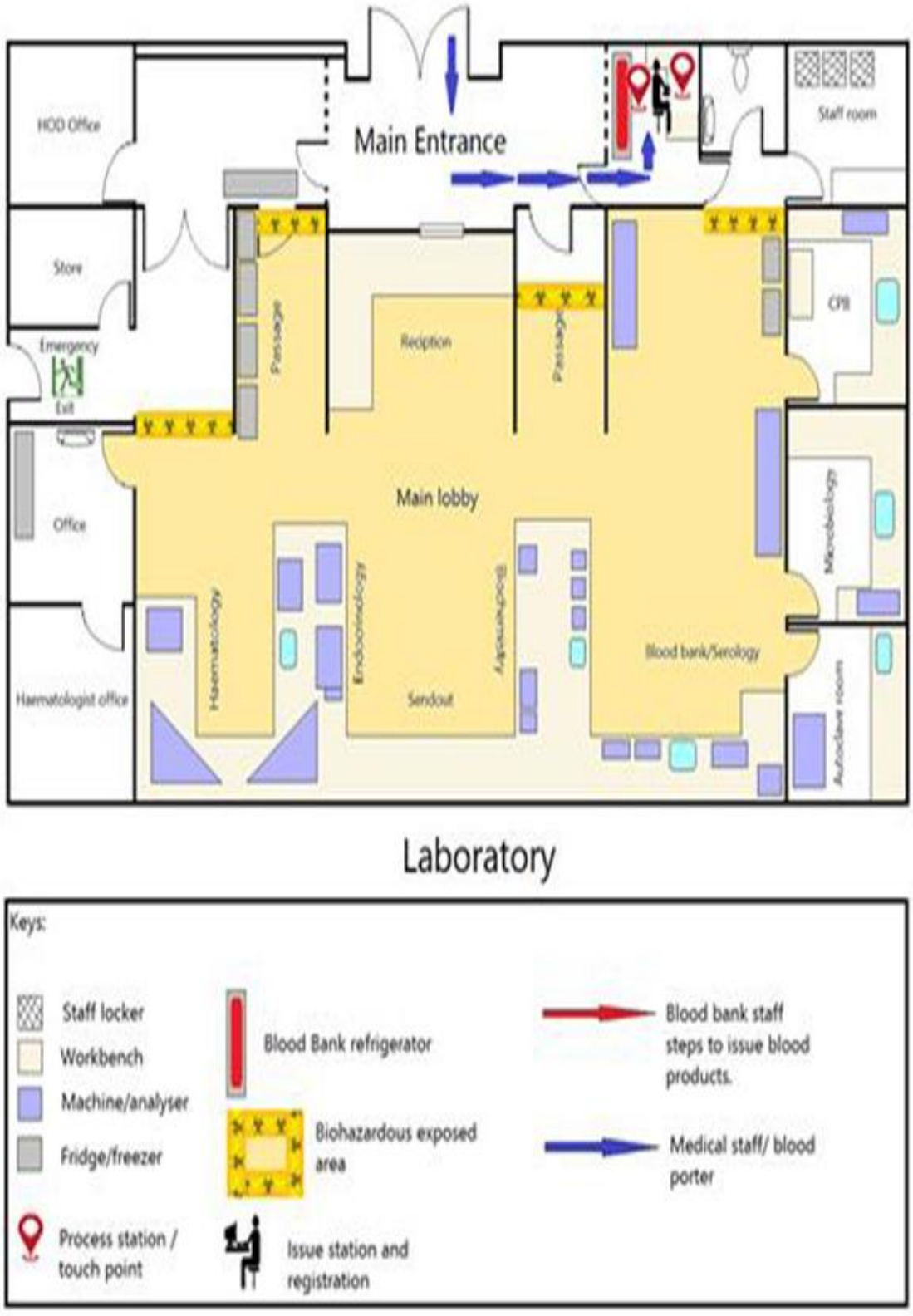

Fig. 4: Spaghetti diagram.

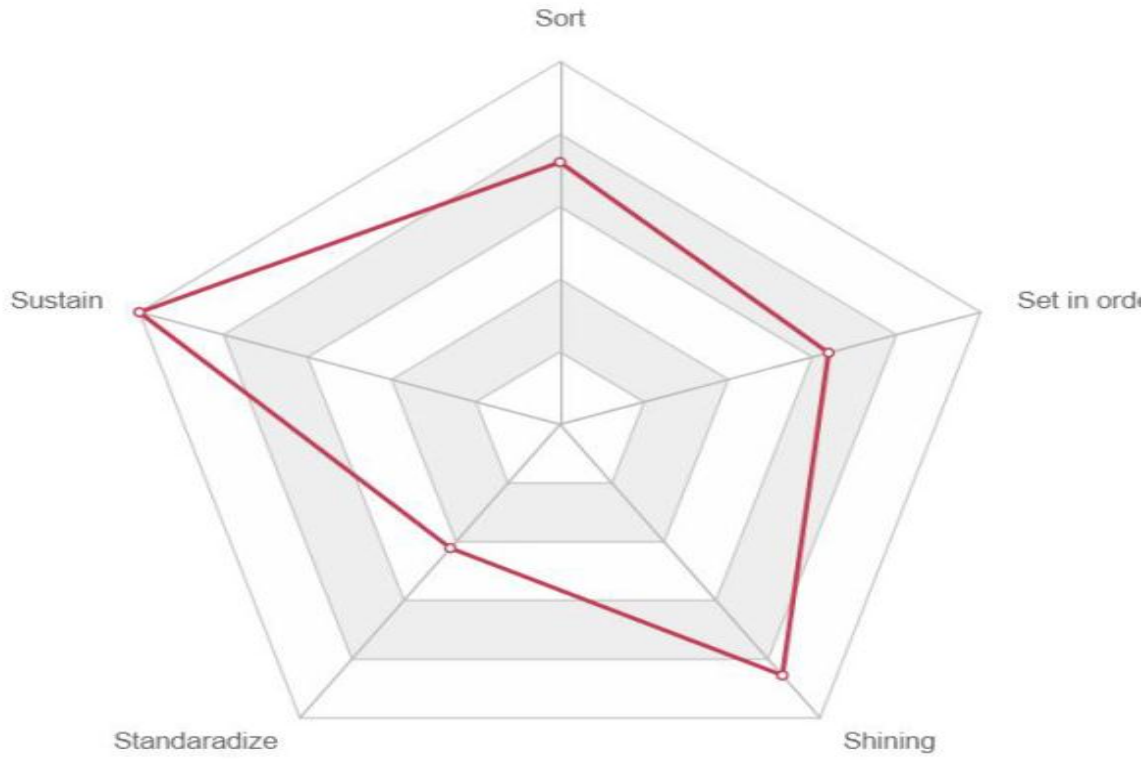

Fig. 5: 5S audit.

Satisfaction survey

The survey was circulated to lab and nursing staff where 58 responses were received, indicating a high rate of satisfaction. The survey consisted of two questions placed in a scale option mode and a third descriptive question for additional feedback. The first question was about the degree of satisfaction that ranged between (not satisfied)0-5(fully satisfied). The results were 1.7%, 3.4%, 8.6%, 8.6%, 34.5%, 43.1% respectively. The second question allows lab staff and nurses to share their Impressions and whether the initiation fulfils the patient safety initiation goals or not. This creates a transparent and honest way of discussing thoughts between staff and not to meet the aims of interest where the answers were wide-ranged (Yes, NO, Irrelevant) and never directs audience answers. 86. 2% (50 participants) agreed that it fulfils the initiation goals, while 13.8% (8 respondents) equally distributed, and highlighted NO and Irrelevant correlation.

DISCUSSION

Error is an imminent, intrinsic by-product, and deep-rooted in every activity that carried by humans. The tendency to err might be philosophically one of the unique traits that define human beings. Blood transfusion-related errors start to exist as blood products become an

essential part of medical treatments. Blood transfusion errors have existed at all times and it is not a new emergence. A detailed study done from 1953 to 1957, in New York City at a large hospital reported 30 cases that received wrong blood out of 81 392 transfusions. Out of the 30 patients, 7 death cases. Although two of them were due to pre-existing health conditions.[5] In the new era, a total of ABO-incompatible blood transfusions was 307 between 1996 and 2018 with 15 death cases reported in 2018 annual SHOT(Serious Hazards of Transfusion) reports of the united kingdom, Manchester Blood Centre.[6] Nevertheless, the rhymed acknowledgment, discrimination and applying analysis of these errors are thought to be a more recent phenomenon.[7]

Our case report highlights a realistic scenario in which mistakes could be generated unintentionally and can lead to catastrophic unwanted conditions if not an immediate recognition and rapid solution if applied. Such a mistake did help us to recognize a major flaw. This mistake does not reflect Ibri hospital lab only, it just one example out of thousands of incidents (all genera) that happened all over the world and reported clearly in the scientific literature.[8-12] Sometimes, mistakes could be identified but cannot await resolutions of discrepancies in the blood delivery pathway. This will trigger the use of the emergent, uncross matched blood, that could potentially cause universal blood shortage (O negative) for a future patient who is truly in need. The idea of having a physically isolated room for issuing blood is what made the initiation to be sustainable and not being affected by any type of variables. A survey in our initiation can be a strong point and at the same time regarded as a limitation. Although surveys are highly prone tools to bias, the way it is designed will lessen the degree of bias. The survey was created in a scale option questions to not direct the answer of the target subjects. More strict systems need to be established and more attention must be given for blood banks for the tremendous and sensitive work encountered. In light of this, our next initiation is to send a survey to all blood banks in Oman, to gather information for all incidents related to transfusion errors that have been reported in all Ministry of Health hospitals. The work will be under the directorship of Ibri hospital and the aim is to detect or estimate the burden of blood transfusion errors in Oman as the current status is not yet known. With that, the voice will be loud, clear, and significantly audible.

CONCLUSION

The evidence reported here and elsewhere presents errors to be eminent, and cannot be easily eradicated. The situation demands Increased training, Standard operating procedures, more

strict regulations, and protocols, increased awareness in all staff about their vulnerability, the high pressure in the surroundings, importance of proper teamwork and communication between all hospital departments, more resilience, and create a just culture away from the blame.

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Conflict of interest

The authors declare that they have no conflicts of interest relevant to the manuscript submitted to WJPR.

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