

A summary of the Transfusion Transmitted Injuries Surveillance System: 2006 - 2012

Mouchili A^{1*}, Leduc S¹, Archibald C¹, Miller J¹, Hyson C¹

¹ Centre for Communicable Diseases and Infection Control, Public Health Agency of Canada, Ottawa, ON

* Correspondence: aboubakar.mouchili@phac-aspc.gc.ca

Abstract

Background: The Transfusion Transmitted Injuries Surveillance System (TTISS) is a pan-Canadian surveillance system established by the Public Health Agency of Canada (the Agency) in partnership with the provinces and territories to capture non-nominal data on adverse transfusion reactions in Canadian hospitals providing transfusion services with the overarching goal of improving patient safety.

Objective: To summarize transfusion-related adverse reactions reported to the TTISS between 2006 and 2012.

Methods: Hospitals from 10 provinces and two territories participated in the TTISS by collecting and submitting data on all transfusion-related reactions or injuries to the provincial / territorial blood coordinating offices. This data was sent to the Agency where it was consolidated, cleaned, validated and analyzed by type of reactions or outcome. Corresponding rates were also calculated using the total number of units of blood components transfused as a denominator.

Results: From 2006 to 2012, a total of 3,957 adverse reactions were reported to the TTISS, excluding minor allergic reactions. Of these, 2,920 (73.8%) were related to transfusion of blood components and 1,036 (26.2%) were from the transfusion of blood products. Among reactions related to the transfusion of blood components, the most common were: transfusion-associated circulatory overload (n = 1,242, 42.5%), severe allergic / anaphylactic / anaphylactoid reactions (n=411; 14.1%) and hypotensive reactions (n=298; 10.2%). Among those related to transfusion of blood products, close to one-half were intravenous immunoglobulin (IVIg) headache (n=295; 28.5%) or delayed hemolytic reaction (n=175; 16.9%). Death definitely attributable to transfusion was extremely rare: only one case diagnosed with transfusion-related acute lung injury was identified between 2006 and 2012.

Conclusion: The majority of reactions attributable to transfusion resulted in minor or no sequelae. Strengthening the TTISS will improve the monitoring of adverse transfusion reactions which is one of the key components of an overall patient safety strategy. Current initiatives to improve data quality include the development of transfusion-associated circulatory overload / transfusion-related acute lung injury recognition algorithm and the collection of appropriate denominators for the calculation of the rates of adverse reactions from the transfusion of blood products.

Introduction

The Transfusion Transmitted Injuries Surveillance System (TTISS) is a voluntary nationwide ongoing surveillance system established in 2001 by the Public Health Agency of Canada (the Agency) to monitor serious, moderate and selected minor transfusion-related adverse reactions occurring in Canadian healthcare settings. The TTISS collaborates with both the Canadian blood manufacturers (Canadian Blood Services and Héma-Québec) and Health Canada's Marketed Health Products Directorate to reconcile the data collected and to ensure comprehensiveness and accuracy in reporting.

The TTISS collects data on adverse transfusion reactions related to the transfusion of blood components (red blood cells, granulocytes, platelets, plasma and cryoprecipitates) and blood products (plasma derivatives such as

albumin, immune globulin, coagulation factors, etc.). Reactions are reported by an extensive network of hospitals throughout the country, covering all provinces and two territories. Hospitals in most provinces and territories are also mandated to report transfusion-related adverse events to their respective provincial / territorial blood coordinating offices, blood manufacturers (Canadian Blood Services and Héma-Québec) and the Marketed Health Products Directorate at Health Canada. The program is governed by the national TTISS Working Group and the National Working Party for Data Review which is composed of provincial and territorial members (mainly the provincial / territorial blood coordinating offices), as well as experts in public health, hematology, infectious diseases and transfusion medicine including front-line healthcare workers. This is a summary of a recent [TTISS Report 2006 - 2012](#) (1).

Methods

Adverse transfusion reactions are defined as undesirable and unintended occurrences during or after the administration of blood, blood components or blood products (plasma derivatives) whether or not they are considered to be related to the administration of these products. The TTISS utilizes standardized case definitions outlined in the *TTISS User's Manual* and a standardized data collection form used by field surveillance staff. It should be noted that frequent minor reactions such as febrile non-hemolytic transfusion reactions, minor allergic reactions and delayed serological transfusion reactions are not reportable to the TTISS. Adverse reactions considered by the TTISS included severe allergic / anaphylactic / anaphylactoid reactions, transfusion-associated circulatory overload, transfusion-related acute lung injury, hypotensive reactions, post-intravenous immunoglobulin (IVIg) headache, acute and delayed hemolytic reactions.

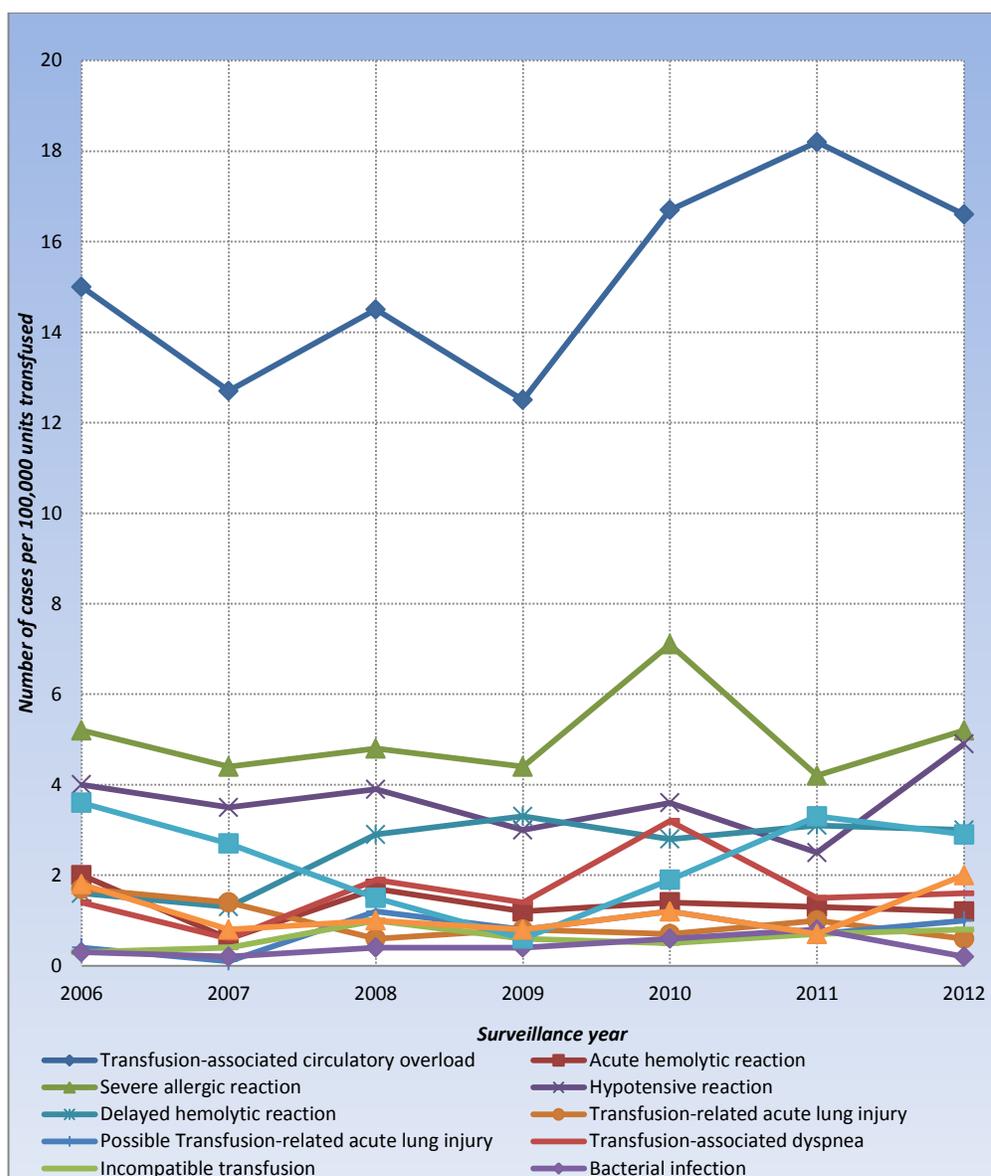
Cases of adverse transfusion reactions were investigated and categorized by their level of severity (non-severe, severe and life-threatening) and their impact on the recipient's health which ranged from minor / no sequelae to death. Severe cases were defined as cases where prolonged hospitalization was directly attributed to the adverse reaction; or cases that resulted in persistent or significant disability / incapacity; or the adverse event necessitated medical or surgical intervention to preclude permanent / significant damage or impairment of body function. Life-threatening cases referred to cases requiring major intervention (i.e., vasopressors, intubation and transfer to intensive care) following the transfusion. Cases resulting in death were fully investigated at the hospital site to determine whether transfusion played a role and if so, to what degree.

All the cases identified at participating hospitals were compiled and sent to the provincial / territorial blood coordinating offices where non-nominal data on serious, moderate and selected minor adverse transfusion reactions were extracted and transferred electronically to the Agency as per provincial / territorial / federal agreement. This transfer occurred on a quarterly basis where three-month data were sent to the Agency with a maximum delay of six months. The data from all the participating provinces / territories was reviewed, validated and consolidated into one file for analysis. In addition to cases of adverse transfusion reactions, provinces / territories provided the number of hospitals that participate in the TTISS for each surveillance year as well as the total number of units of blood components transfused.

Results

Between 2006 and 2012, the TTISS recorded 3,957 adverse transfusion reactions of which 2,920 (73.8%) were from the transfusion of blood components. The most common reactions from the transfusion of blood components were transfusion-associated circulatory overload (n=1,242) which occurred at a rate of about 15 cases for every 100,000 units of blood components transfused (**Figure 1**). Among those that resulted from the transfusion of plasma derivatives, the most common were post IVIg headache (n=295) and delayed hemolytic reactions (n=175) which accounted for approximately 28.5% and 16.9%, respectively.

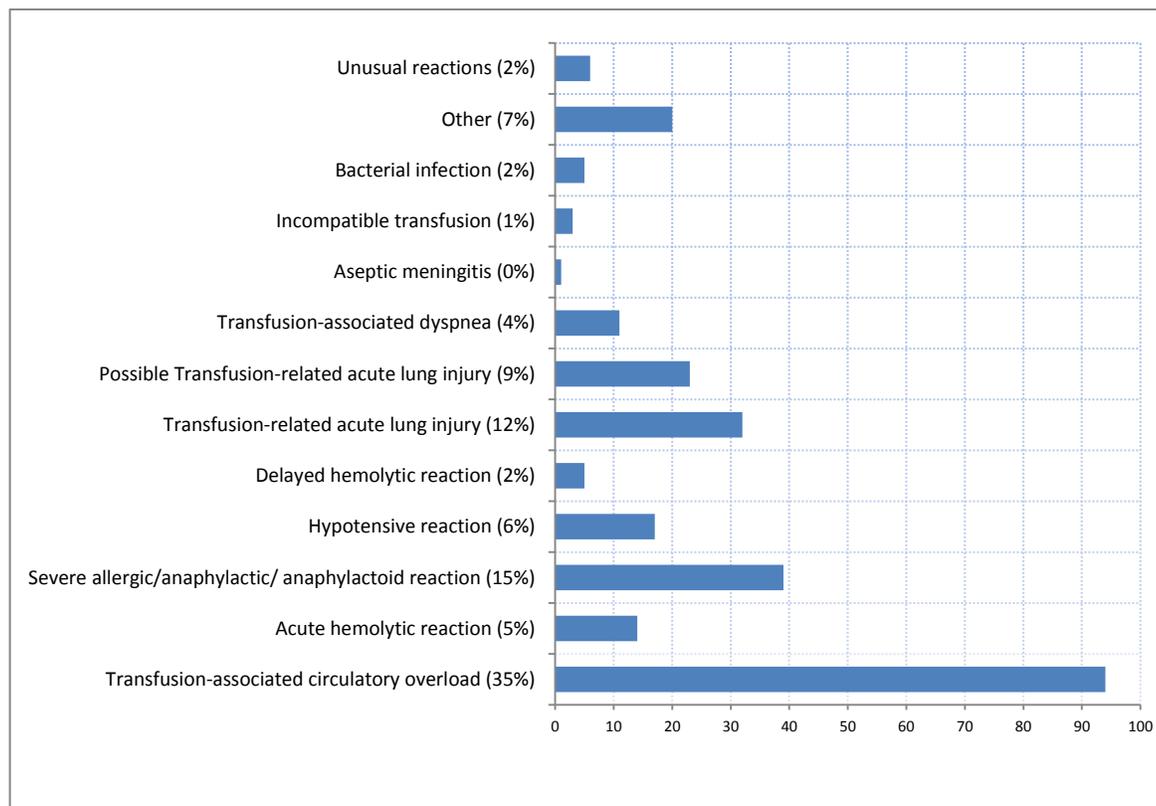
Overall, 1,835 reactions were severe or life-threatening (1,505 related to transfusion of blood components and 329 related to transfusion of blood products).

Figure 1: Annual rate of adverse reactions from transfusion of blood components, TTISS¹ 2006 – 2012

¹ TTISS= Transfusion Transmitted Injuries Surveillance System

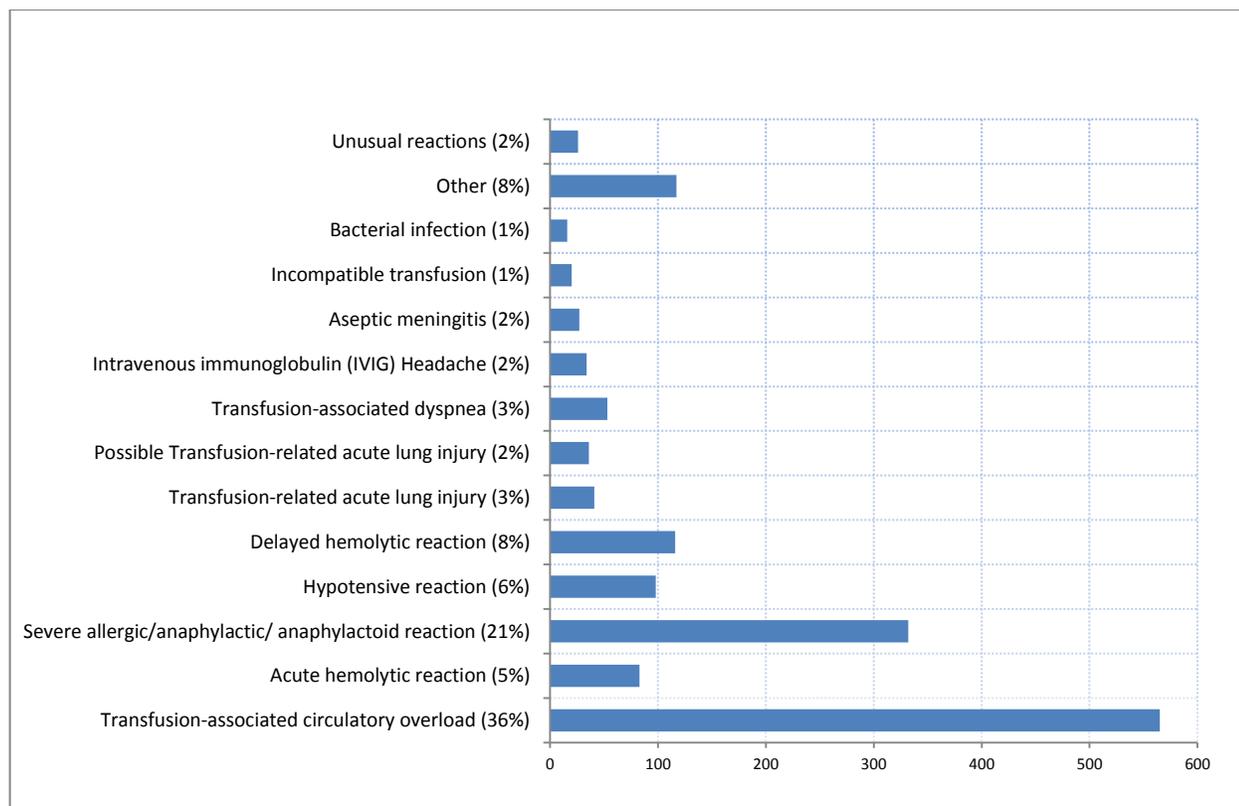
Among the 1,693 severe or life-threatening cases where patient outcome data were available, the majority (1,573; 92.9%) resulted in minor or no sequelae and 79 (4.7%) resulted in major or long term sequelae. From 2006 to 2012, a total of 41 deaths were reported as definitely (n=1), probably (n=11) or possibly (n=29) related to transfusion. One-half of these were classified as transfusion-associated circulatory overload (n=13) or possible transfusion-related acute lung injury (n=12).

Life-threatening adverse reactions represented 7% (n=270) of adverse reactions recorded from 2006 to 2012 and the majority of these (92.2%) resulted from the transfusion of blood components. The most commonly reported adverse transfusion reactions were transfusion-associated circulatory overload (n=94) and severe allergic / anaphylactic / anaphylactoid reactions (n=39) (**Figure 2**).

Figure 2: Life-threatening adverse transfusion reactions, TTISS¹ 2006 – 2012

¹ TTISS= Transfusion Transmitted Injuries Surveillance System

The large majority (96%) of transfusion-related adverse reactions captured by the TTISS between 2006 and 2012 resulted in minor or no sequelae. Blood transfusion was reported to have contributed to the death of 41 individuals for the 2006 - 2012 periods, but definitive evidence was established only for one case that developed transfusion-related acute lung injury. The evidence of the relationship between death and transfusion for the other cases was deemed at best to be probable (n=12) or possible (n=28). With over one-million units of blood components transfused annually, the case fatality rate amounted to about five per million (**Figure 3**).

Figure 3: Severe adverse transfusion reactions, TTISS¹ 2006 – 2012

¹ TTISS= Transfusion Transmitted Injuries Surveillance System

Conclusion

The TTISS is a truly pan-Canadian system that captures the bulk of adverse transfusion reactions that occur in Canadian hospitals. Several initiatives are currently being carried out by the Agency-led National TTISS Working Group to improve not only the reporting system, but also the quality of the data reported. Efforts include the development of an algorithm to help differentiate between transfusion-associated circulatory overload and transfusion-related acute lung injury and to determine a way to standardize the denominator data for blood products. Continued partnership between the Agency, the blood manufacturers (Canadian Blood Services and Héma-Québec) and the provinces / territories and Health Canada is vital to ensure timely reporting of accurate surveillance data that will help the development of better policies and procedures for transfusion safety and ultimately enhance patient safety in all Canadian hospitals.

Acknowledgements

The development of the Transfusion Transmitted Injuries Surveillance System (TTISS) would not have been possible without the collaborative support and continued commitment of the provincial / territorial blood coordinating offices, transfusion medicine staff at participating hospitals, the Canadian Blood Services and Héma-Québec. Their dedication to reducing adverse transfusion reactions / injuries and increasing patient safety has led to the collection and analysis of the 2006 - 2012 TTISS data.

Conflict of interest

None

Funding

This work was supported by the Public Health Agency of Canada.

Reference

- (1) Public Health Agency of Canada. Transfusion Transmitted Injuries Surveillance System (TTISS): 2006-2012 Report. Ottawa: Centre for Communicable Diseases and Infection Control, PHAC; 2014. <http://www.phac-aspc.gc.ca/hcai-iamss/ttiss-ssit/index-eng.php>