Research partnerships between blood services and public health authorities: An international, cross-sectional survey

Running title: Blood services/public health partnerships

Antoine Lewin[1*], Carla Osiowy[2], Christian Erikstrup[3,4], Brian Custer[5,6], Christian Renaud[1], Pierre Tiberghien[7,8], Alton Russell[9], Ryanne Lieshout-Krikke[10], Sheila F O'Brien[11] & the Surveillance, Risk Assessment, Policy Sub-group of the ISBT Transfusion Transmitted Infectious Diseases Working Party

[1]Héma-Québec, Medical Affairs and Innovation, Montreal, Canada

[2]National Microbiology Laboratory, Public Health Agency of Canada, Winnipeg, Canada.

[3]Department of Clinical Immunology, Aarhus University Hospital, Aarhus, Denmark

[4]Department of Clinical Medicine, Aarhus University, Aarhus, Denmark

[5]Vitalant Research Institute, San Francisco, USA

[6]Department of Laboratory Medicine, University of California, San Francisco, USA

[7]Établissement Français du Sang, La Plaine Saint Denis, France.

[8]UMR RIGHT 1098, Inserm, Etablissement Français du Sang, University of Franche-Comté, Besançon, France.

[9]School of Population and Global Health, McGill University, Montreal, QC, Canada,

[10]Department of Medical Affairs, Corporate staff, Sanquin Blood Supply Foundation, Amsterdam, Netherlands

[11]Epidemiology & Surveillance, Canadian Blood Services, Ottawa, ON, Canada

Corresponding author:
Antoine Lewin, PhD
Manager
Medical Affairs and Innovation
Héma-Québec
4045 Blvd. de la Côte-Vertu,
Saint-Laurent, QC H4R 2W7
Tel: +001 514 832-5000 #5490
Email: Antoine.Lewin@hema-quebec.qc.ca

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Abstract

Background and objectives: The COVID-19 pandemic has brought to the fore how blood services can partner with public health (PH) authorities to inform decisions. Yet the scope of partnerships between blood services and PH authorities is inadequately documented. We explored how blood services partner with PH authorities outside the scope of COVID-19.

Materials and methods: On January 19, 2022, survey was sent to employees of blood services located throughout the world. Survey questions mainly pertained to partnerships with PH authorities, including how blood specimens are used and collected.

Results: Twenty-seven recipients — 4 (14.8%) in Africa, 3 (11.1%) in Asia, 9 (33.3%) in Europe, 6 (22.2%) in North America, 2 (7.4%) in Oceania, and 3 (11.1%) in South America — completed the survey. Fifteen (55.6%) indicated their blood service was directly or indirectly supervised by PH authorities. Twenty-four (88.9%) indicated currently using or planning to use blood donor data or samples for PH research or pathogen surveillance. A substantial proportion of respondents reported using samples or results from non-routine tests for the surveillance of non-TTID pathogens (n=13 [48.1%]); samples or results of non-routine tests for PH research unrelated to pathogens (n=10 [37.0%]); donor data for PH research unrelated to pathogens (n=12 [44.4%]); and donor data for PH research unrelated to transfusion safety (n=11 [40.7%]). Fourteen (51.9%) had established (or planned to establish) longitudinal cohorts and 19 (70.4%) biobanks.

Conclusion: The majority of responding blood services were already involved in or planned to be involved in PH research or pathogen surveillance.

Keywords: Blood collection; Blood donation testing; Donors; Public health; Transfusion-transmitted infectious diseases

Highlights (max: 3 bullet points)

- Nearly 90% of blood services that participated in this international survey indicated currently using or planning to use blood donor data or samples for public health (PH) research or transfusion-transmissible pathogen surveillance.
- Most participating blood services had established or planned to establish a longitudinal cohort or biobank from blood donors.
- The pandemic has revealed potential for expanded scope of partnerships between blood services and PH authorities.

Introduction

Blood services primarily collect blood for recipients in need of transfusions, but the SARS-CoV-2 pandemic has brought to the fore a secondary (yet important) role: partnering with public health (PH) authorities to inform decision making.

For years, blood donations have been leveraged to study transfusion-transmitted infectious diseases (TTIDs) and emerging pathogens in collaboration with PH authorities [1, 2]. For example, the population-based Scandinavian Donations and Transfusions (SCANDAT) database holds several decades of complete donor and recipient data from Sweden and Denmark, allowing for the study of TTIDs and the impact of donor and recipient characteristics on transfusion safety, among other research goals [3]. Another example is the West Nile virus outbreak that occurred in the early 2000s, for which blood services and PH authorities rapidly developed seasonal testing to protect blood recipients and inform PH decisions on this emerging pathogen [4]. Blood donations have also been used to estimate the seroprevalence associated with emerging pathogens, such as *Babesia microti* [5], Hepatitis E [6], Zika [7] or *Coxiella burnetii* [8]. Blood services regularly report positive results to PH authorities, often required as part of reportable disease laws, and also share samples containing strains of various pathogens to understand the genotype distribution and molecular epidemiology.

Although less common, blood donations have also been leveraged to address research questions related to PH outside the scope of TTIDs, emerging pathogens, and blood donation. For example, the Danish Blood Donor Study (DBDS) is a large, prospective blood donor cohort initially set up to understand donor health and determinants of donation frequency [9]. However, the DBDS also aims to provide a platform to explore many other research questions [10], such as the association between obesity and infection [11], and the genetic determinants of human health [12]. The Danish Blood Donor *S. aureus* Carriage Study (DBDSaCS) has established a prospective cohort and biobank investigating the colonization of *S. aureus* among healthy individuals for research into the health consequences of

colonization [10]. Other large studies, such INTERVAL from the UK, was a randomized controlled trial designed to answer a relatively narrow research question (i.e., what is the optimal frequency of whole-blood donation?) [14, 15], but participant data and samples were later used to study coronary heart disease [16], congenital heart defects [17], schizophrenia [18], and primary sclerosing cholangitis [19]. Blood donors were also used as a data source to study the association of blood group with coronary heart disease, cerebrovascular disease, and peripheral vascular disease [20].

The SARS-CoV-2 pandemic likely expanded the scope of these partnerships with PH authorities. Throughout the pandemic, blood services have collaborated with PH authorities to document a population's history of COVID-19 infection, fatality rates, high-risk subgroups, correlates of protection, and the immune responses to infection and vaccination [21]. In a previous international survey, 73% of countries had ongoing or planned seroprevalence studies, most of which aimed to inform PH policies [22].

Yet the scope of partnerships between blood services and PH authorities is not well documented, particularly for projects unrelated to SARS-CoV-2. Therefore, we conducted an international survey among blood services to explore how they engage in partnerships with PH authorities outside the scope of SARS-CoV-2.

Methods

Participating blood services

Survey recipients were members of the International Society of Blood Transfusion – TTID Working Party and the European Blood Alliance – Emerging Infectious Disease Monitoring Working Group. All recipients were senior employees of blood services located anywhere throughout the world. No eligibility criteria were otherwise applied.

Survey

The link to the survey was e-mailed on January 19, 2022, and one reminder was sent on March 23, 2022 (after 71 days). Survey questions focused on the following themes: (1) donations and donor characteristics in 2019 (i.e., before the pandemic); (2) partnerships involving PH authorities, including how blood specimens are used and collected for these partnerships; (3) specific research initiatives involving PH authorities, including longitudinal cohorts and biobanks; (4) sharing of data and samples with PH authorities; and (5) consent and ethical considerations. Respondents were instructed to focus on non-SARS-CoV-2-related partnerships. They were free to skip certain questions if they could not or did not want to answer them. The full survey is available in the supplemental material (**Supplemental Methods**). Ethical review was not needed for this study, because it did not involve human participation nor collection of personal data and there was no secondary use of data.

Results

Participating blood services

Of the 79 targeted blood services, 27 (34.2%) completed the survey. Respondents were well distributed across the world with 4 (14.8%) in Africa, 3 (11.1%) in Asia, 9 (33.3%) in Europe, 6 (22.2%) in North America, 2 (7.4%) in Oceania, and 3 (11.1%) in South America (**Table 1**). On median (interquartile range), respondents reported 101,538 (13,706 – 433,450) blood donors in 2019 (i.e., before the pandemic), of which 49.0% ± 20.7% were females.

Partnerships between blood services and public health authorities

A majority of blood services are supervised (directly or indirectly) by PH authorities. Irrespective of PH supervision, a clear majority of blood services collaborate to some extent with PH authorities Fifteen (55.6%) blood banks were directly (n=6 [22.2%]) or indirectly (n=9 [33.3%]) supervised by PH authorities, and 12 (44.4%) were not supervised by PH authorities (**Figure 1).**

Twenty-two (81.5%) blood services indicated currently using blood donor data or samples for PH research or transfusion-transmissible pathogen surveillance, and 2 (7.4%) planned to do so in the future. However, only 5 (18.5%) reported receiving external or joint funding to initiate those projects.

Surveillance for TTID in the general population was the most common research activity conducted by participating blood services. Approximately 75% of blood services used routine donor screening test results and/or samples or non-routine donor screening test results for surveillance of TTID in the general population. From 37% to 48.1 % of respondents collaborated to some extent with PH authorities on studies of non-TTID-related pathogens or on other questions of public health interest. Examples include assessments of iron deficiency or anemia, blood pressure, pulse, phthalate and cholesterol levels in donors as proxies for general population health [23, 24].

Longitudinal cohorts and biobanks based on blood donors

Six (22.2%) blood services have established longitudinal cohorts of blood donors, and eight (29.6%) were planning to do so (**Figure 3**). Donors included in these cohorts were mainly TTID- or SARS-CoV-2-positive donors, established with the intent of investigating rates of infection, reinfection, and immunological markers of disease progression.

Furthermore, 10 (37.0%) blood services have established a biobank based on blood donors, and nine (33.3%) were planning to do so later. Donors included in pre-existing biobanks were also mainly TTID- or SARS-CoV-2-positive donors.

Data and sample sharing

Twenty-three (85.2%) respondents reported sharing donor data with PH authorities at least occasionally, whether as required by law (n=10 [37.0%]), by a collaborative agreement (n=5 [18.5%]), or both (n=8 [29.6%]). Among these respondents, 16 (69.6%) shared only aggregate data and 20 (87.0%) shared aggregate data or de-identified, individual-level data. Twelve (44.4%) blood

services reported (at least occasionally) sharing samples with PH authorities, 9 (33.3%) of which de-identified samples before sharing them.

Consent and ethical considerations

Eighteen (66.6%) blood services indicated that their routine donor consent form, at the time of donation, included a statement on the use of donor data and samples for PH research. Nineteen (70.4%) blood services also reported having an ethics advisory board that approves research activities outside the scope of routine TTID screening and public health emergency responses to pathogens such as SARS-CoV-2. Finally, six (22.2%) blood services have a data sharing agreement with public health agencies.

Discussion

The results of this survey indicate that blood services collaborate extensively with PH authorities on a wide variety of research goals. The vast majority of respondents (i.e., 88.9%) currently use or were planning to use blood donor samples for PH research or pathogen surveillance. Furthermore, most respondents have already established or were planning to establish a longitudinal cohort or biobank from blood donors. However, we do not know if process has been started or if it is only in concept planned.

The participation of blood services around the world in seroprevalence studies to inform public health policy for SARS-CoV-2 was unprecedented. Our survey highlights the collaborative role that blood services play for other pathogens and health issues, and provides insights into the potential for expanding the scope of collaborations between blood services and PH authorities post-pandemic. More than a third of respondents have indicated using samples, test results, or data to conduct PH research unrelated to pathogens or transfusion safety. The DBDS is one of the few examples of a systematic effort to establish such initiatives before the pandemic, and may be viewed as a model on how blood services can collaborate with PH authorities to further our understanding of infectious and non-

infectious health conditions [9, 10]. Notably, donor data collected by the DBDS include questionnaire data, data from public health registries, and genetic data, thus enabling the sharing of comprehensive data from consenting donors [9, 10]. Moreover, a French longitudinal biobank using paired plasma specimens from blood donors has the ability to estimate the impact of influenza A (H1N1) and implementing appropriate prevention and response strategies [25].

Although not evaluated in our survey, the many logistic advantages of blood services probably helped spur collaborations with PH authorities. Blood services have pre-existing infrastructures, trained personnel, and quality-control mechanisms, thereby substantially alleviating the start-up costs associated with setting up prospective cohort research initiatives that are typically resource-intensive [10]. Blood donors also facilitate the study of large cohorts as questionnaire and laboratory data are readily available at minimal cost [10]. Notably, longitudinal analyses are feasible, since a large proportion of donors are repeat donors [10, 26]. Furthermore, minimal recruitment efforts are necessary, since the pool of eligible participants (i.e., repeat donors) that present at blood drives can trigger the collection of longitudinal data. Finally, blood donors are generally willing to give blood for biomedical research [10, 27], preferably in the form of a small, extra-blood sample collected at the same time as their regular donation [27]. Therefore, participation rates are expected to be high (e.g., >95% in the DBDS) [11].

Blood donors are broadly representative of the healthy, adult population, but researchers must be aware of possible selection bias when using them as a data source for PH research. First-time donors provide a better approximation of the health status of the general population. Nonetheless, researchers have found that low-income, ill, and less educated persons, as well as minorities and females may be underrepresented among blood donors [28, 29]. Other groups are excluded by eligibility criteria (e.g., persons with sexual exposure risk or who have traveled to areas with endemic infections known to be TTID). Certain geographic regions within a country or blood collection agency’s service area may also be

underrepresented, depending on the presence of fixed collection centers and whether blood drives are organized in rural regions. However, most of these factors can be accounted for using statistical adjustments techniques, such as reweighting- and regression-based techniques. Furthermore, alternative data sources — such as establishing a prospective cohort from scratch — may not meaningfully reduce some of these biases in addition to being resource-intensive. For example, participants in the UK Biobank cohort tend to be older, to include more females, and to live in more affluent neighborhoods [30]. Relative to the general population, they also included a lower proportion of persons with obesity, smokers, and daily alcohol users [30] — consistent with a “healthy volunteer” bias similar to that observed among blood donors. These selection biases may be reduced as blood collectors strive to make blood donation more inclusive, for example through outreach efforts to recruit donors in underrepresented groups.

This study is subject to some limitations. First, the respondents’ ability to understand English was not assessed, and translations of the survey in local or national languages were not available for respondents from non-English-speaking countries. This may have hindered the participation of some respondents or their understanding of survey questions, particularly those in non-English-speaking countries. Furthermore, the rate of participation (i.e., 32.9%) was relatively low compared with previous surveys of blood collection agencies [22, 31]. This low participation rate may be related to the fact that the questionnaire was sent during a surge of COVID-19 infections in many countries or because of the comprehensiveness/size of the questionnaire. Blood services with established public health partnerships may have been more enthusiastic about participating in our study, leading to response bias. Regardless, respondents were well-distributed throughout the world.

Donors’ perspective on PH research would also be interesting to further investigate [32]. While collaboration between blood services and PH seems obvious for some donors, others may be more reluctant to share their information. As donors may already be regularly solicited for blood donation, additional emails or onsite

questionnaires might be perceived as too intrusive and turn down some of them. Finally, an extensively detailed consent form might create confusion with the donation process itself.

This survey also highlights a broader limitation revealed by the findings reported herein: in many jurisdictions, there are already established working relationships between blood services and PH authorities, yet these relationships are not widely known. This lack of knowledge and awareness represents missed opportunities for collaborative research between blood services, PH, and other health service researchers. As part of an effort to document available data and resources, the TTID SRAP subgroup is developing a communications toolkit to provide an information resource for researchers and/or blood centers who want to gain PH commitment for new research or surveillance programs and to increase awareness about the role of blood donors in public health.

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Tables

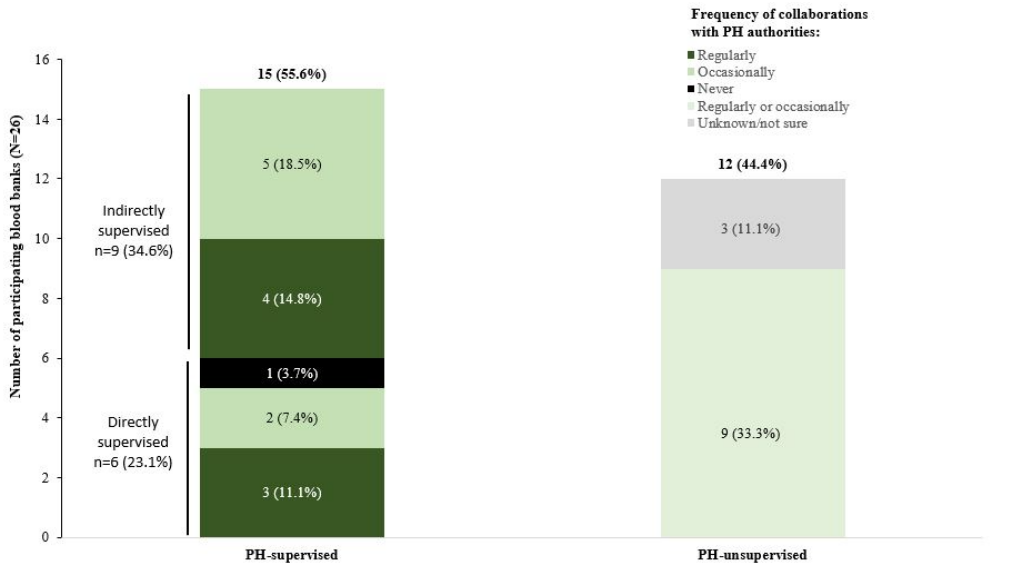
Table 1. Characteristics of participating blood services

	N=27
Region, n (%)	
Africa	4 (14.8%)
Asia	3 (11.1%)
Europe	9 (33.3%)
North America	6 (22.2%)
Oceania	2 (7.4%)
South America	3 (11.1%)
Number of donors,[1] mean ± SD (range)	367,109 ± 661,404 (2130 – 2,950,579)
Proportion of female donors,[1] mean ± SD (range)	49.0% ± 20.7% (20.0% – 95.2%)
Proportion of new donors,[1] mean ± SD (range)	28.6% ± 25.2% (1.4% – 99.0%)
Number of donations,[1] mean ± SD (range)	656,524 ± 1,125,602 (1912 – 4,793,467)

Abbreviation: SD = standard deviation

Note: [1]In 2019

Figures



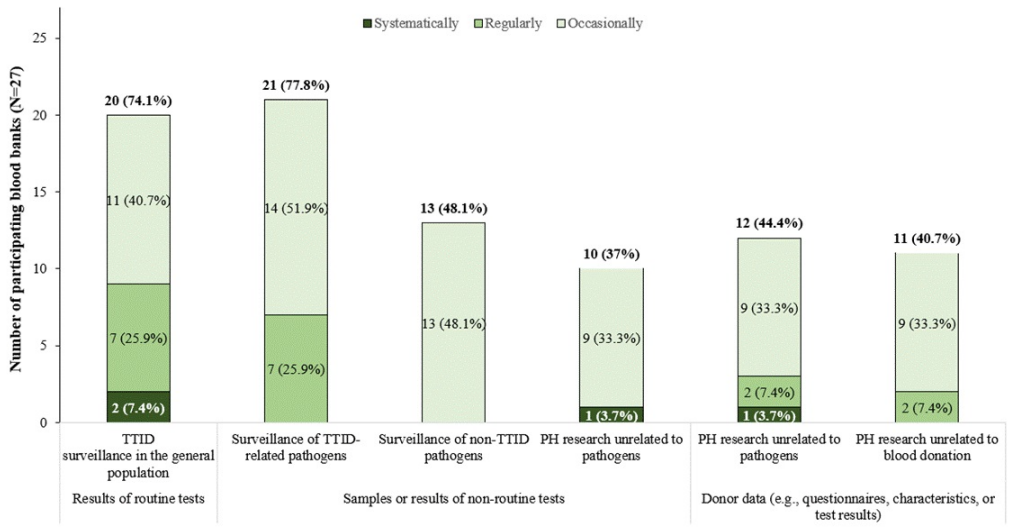
Abbreviation: PH = public health

Note: 'Regularly or occasionally' refer to whether they work collaboratively with public health (i.e. yes or no), irrespective of whether this collaboration is regular or occasional

Figure 1. Supervision of blood banks by public health authorities and frequency of collaborations with public health authorities

Abbreviation: PH = public health

Note: "Regulatory or occasionally" refer to whether they work collaboratively with public health (i.e. yes or no), irrespective of whether this collaboration is regular or occasional.



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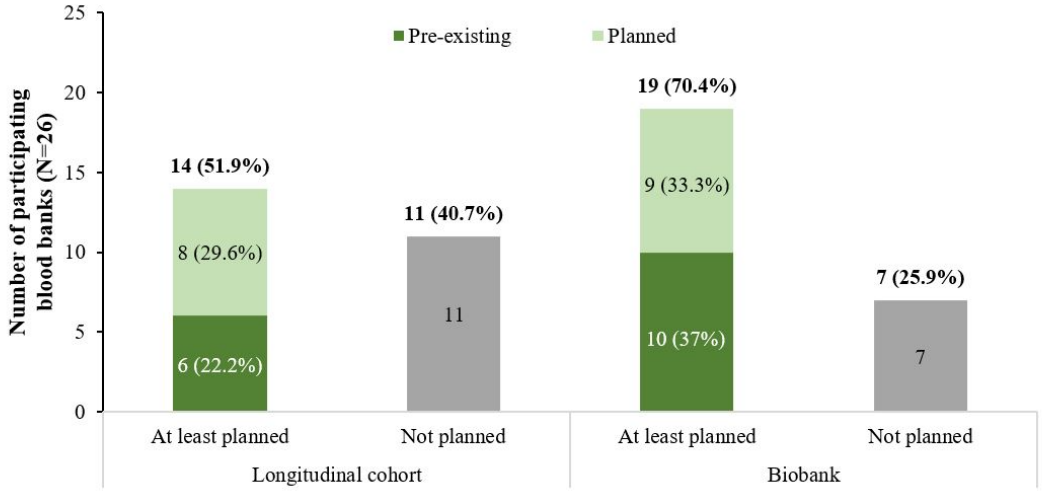
426 **Figure 2. Use of donor data, samples, and test results**

427 **Abbreviations:** PH = public health; TTID = transfusion-transmitted infectious
428 disease

Figure 3. Participants who had established or planned to establish a longitudinal cohort or biobank



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430 **Figure 3. Respondents who had established or planned to establish a**

431 **longitudinal cohort or biobank**