



THE BLOOD DONOR OF THE FUTURE: DEMOGRAPHIC PREDICTIONS

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1.0 Introduction

Prediction is a risky business, even for those who devote their careers to it. In his best-selling book *The Signal and the Noise: Why So Many Predictions Fail – but Some Don't*, the statistician and political analyst Nate Silver notes that, when the Survey of Professional Forecasters issued guidance in November of 2007 for 2008 – the year when the U.S. went into recession and the economy shrank by 3.3% – the forecasters “assigned only a 3 percent chance to the economy’s shrinking by any margin over the whole of 2008. And they gave it only about a 1-in-500 chance of shrinking by at least 2 percent, as it did.”¹ Was this a fluke? Anything but. According to Silver, “one actual statistic is that in the 1990s, economists predicted only 2 of the 60 recessions around the world a year ahead of time.”²

Predicting changes that could transform the blood collection industry, including the potential for changes among blood donors themselves, is no less subject to the risk of consequential errors.

On the one hand, certain characteristics of the voluntary non-remunerated blood donor have been quite stable over time. The following profile of the “committed blood donor,” developed by Canadian Blood Services (CBS) sometime before 2008, would be broadly familiar to the blood services in many developed countries today:

I donate whole blood about two to three times a year. I started donating when I was in my late teens/early 20's. I am a man or woman (evenly split), 35 – 55 years of age (bulls' eye target 35 – 45 years of age). My first language is English (although, if I live in New Brunswick or the Ottawa area, I appreciate having the choice of French or English in communications). I live in the suburbs. I tend to donate blood through work (during work hours) or at the permanent blood donor clinic, which is rather close to where I live. I feel fortunate for the opportunities I have had and my current situation (I am financially secure and well-educated) and I feel it is important to share my good fortune and health by 'giving back'. My key priorities in life are my family, my career and my community. I try to be involved in my community, e.g., attending church, participating in activities for my kids (e.g., soccer, Boy Scouts, swim lessons, etc.), etc. Given everything that I have going on in my life, I am very busy and often pressed for time. Although, I do find a way to 'make time' for things that are important to me.³

On the other hand, the blood collection industry and those who study it do not have an exceptionally strong track record with respect to predicting the changes that have occurred in recent decades. For example:

- Attempts to forecast the demand-supply relationship have not been very reliable. In 1999, for example, the U.S.'s National Blood Data Resource Center (NBDRC) offered projections based on a 1998 analysis of data from 1994 and 1997: “Linear extrapolation of the data results in the estimate that demand will exceed supply some time in the year 2000.”⁴

The author gratefully acknowledges the permission of America’s Blood Centers (ABC) to make this paper available. Previous versions were prepared as part of ABC’s contribution to “The Blood Donor of the Future” report issued in October, 2014, by the Alliance of Blood Operators, Donor Engagement and Relationship Group (ABO DERG).

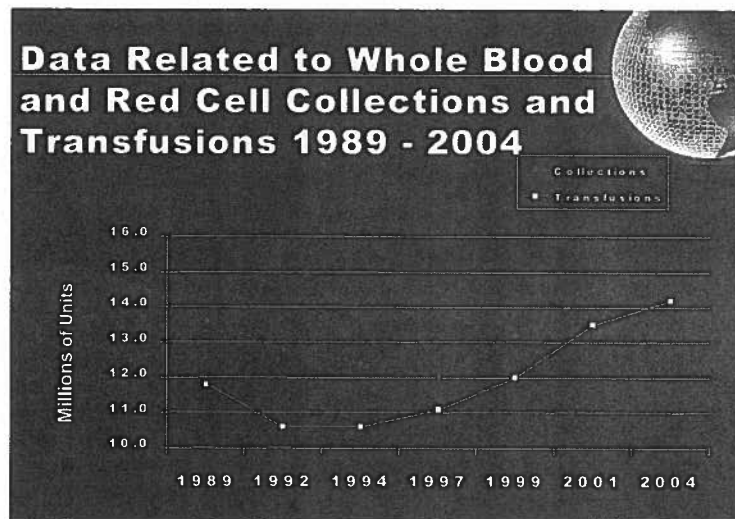
- Canada also had concerns about the impending inadequacy of the Canadian blood supply:

Although 75 per cent of Canadians are willing to give blood and 50 per cent are eligible, only three per cent do, says Michelle Van Vliet of Canadian Blood Services in Ottawa.

If that number doesn't increase to five per cent, Canadian Blood Services expects a serious shortage by 2005.⁵

- Even researchers who eschewed Malthusian-like conclusions studied the apparently narrowing gap between supply and demand in charts like the one below and concluded that a “critically low margin . . . exists between the demand for blood components and blood collections.”⁶

Figure 1. Trends in Blood Supply and Blood Usage, 1989 to 2004



Data from National Blood Data Resource Center (NBDRC) and Committee on Blood Safety and Availability (Jerry Holmberg, 2004)⁷

- Few, if any, U.S. observers predicted that a major turning point would occur in the 2006–2008 period, when the U.S. blood supply began to increase more rapidly than demand. Even after the change was under way, it initially appeared to be “cause for optimism,”⁸ rather than the beginning of what has been referred to, behind closed doors, as a “blood glut” that has imperiled the business models of many U.S. community blood centers.

A factor contributing to the difficulty of forecasting changes in the Canadian and U.S. blood collection industries has been an absence of the sorts of longitudinal datasets needed to develop and test predictive models. Because CBS assumed stewardship of the Canadian national blood system only in 1998,⁹ it has had very limited access to detailed statistics from prior years. In the U.S., the fact that responsibility for blood collection resides with competing nonprofit organizations, rather than with a national health service, means that nationwide data gathering has been subject to unpredictable funding and incomplete reporting. AABB has been able, since 1989, to conduct the National Blood Collection and Utilization Survey (NBCUS) at two- or three-year intervals and even, in recent administrations, to expand the types of information gathered. Nonetheless, NBCUS has not included a number of items that could aid in predicting the demographic characteristics of the donor of the future – for example, the distribution of male vs. female donors and complete, detailed data on donors by race and ethnicity.¹⁰



Acknowledging the cautionary history of and limited data resources for blood collection forecasting, and mindful of Nate Silver's recommendation that those aiming for better predictions and decision making should cultivate "a little bit more humility,"¹¹ the remainder of this section will attempt to

- Identify some of the forces that have influenced and may continue to influence blood donors' demographic profiles.
- Look for patterns of change affecting specific donor characteristics.
- Offer a few hypotheses and possible future scenarios.

The observations will focus on the U.S. and Canada, informed where possible by examples from other countries.

2.0 Drivers of Blood Donor Demographics

Predictions about the future supply-demand ratio for blood have typically drawn attention to macro-level trends, and, in particular, to the aging of the Canadian¹ and U.S.² populations, the projected consequences of which include an increased demand for blood to meet the medical needs of the elderly and a decrease in the number of young, healthy individuals available to donate.

The focus on this issue has tended to obscure other important factors that drive donor demographics. Shining light on three of these factors is a useful way to begin developing our perspectives on the blood donor of the future.

1 – Blood donors are not born. Blood centers make blood donors.

Community blood centers in the U.S. typically hold nonprofit status, but they operate as businesses. As businesses, they decide, based on the needs of their hospital customers and their own financial imperatives, how many potential donors to recruit, which types of donors to target and which to avoid, and whether to invest in retaining certain donors.

The following examples illustrate the extent to which the blood centers themselves determine the donor population's characteristics:

- The 2009 NBCUS reported that, in 2008, the U.S. "supply of available Whole Blood (WB) and Red Blood Cell (RBC) units . . . exceed[ed] transfusions of allogeneic WB/RBCs . . . by a margin of . . . 13% of available supply."³ Three years later, the margin had shrunk to 5.2% of available supply, leading the 2011 NBCUS Report to remark that "the oversupply reported in the 2009 NBCUS Report was adjusted by blood collectors over the intervening three years."⁴ The "adjustment" evidently resulted from the **blood centers' decision to recruit 1.6 million fewer donors in 2011** than they had in 2008.⁵ This decision created the appearance of a "drop"⁶ in the incidence of blood donors in the U.S. population, whereas, in reality, the blood centers deliberately restricted their collection activities to avoid excess inventories.



- In the political arena, blood centers advocate to expand the criteria that make individuals eligible to donate blood. Such advocacy has eliminated the upper age limit in the U.S.⁷ and Canada⁸ and has lowered the age threshold to 16 in most parts of the U.S.⁹ U.S. blood collectors are aware of developments in the U.K., which has a waiting period after tattooing of four months instead of 12 months.¹⁰ Recently, they have also followed the lead of other countries' blood services by lobbying to eliminate the lifelong ban on blood donations by men who have sex with men (MSM).¹¹
- Analyses of first-time donors' subsequent donation histories have demonstrated that Rh-negative donors are significantly more likely to return than are Rh-positive donors.^{12,13} The difference is not due to a greater innate propensity among Rh-negative individuals to give blood. Rather, since Rh-negative blood is both uncommon and widely compatible,¹⁴ blood systems make special efforts to persuade Rh-negative donors to return.¹⁵

[An] aspect of providing excellent customer service to our hospitals is to understand their product needs and to concentrate our efforts in providing those products. For the last several years, we have seen a concentrated rise in demand for O-negative red blood cells – or the “universal blood type” – which can be used in emergencies to treat patients of any blood type. With only seven percent of Canadians having type O-negative blood, Canadian Blood Services has been conducting research and **focusing some of its recruitment activities toward these donors** so as to better meet hospital demand for this product [emphasis added].¹⁶

2 – Economic and societal changes affect donor characteristics.

Economic and societal changes can have rapid impacts on blood donation patterns and thus affect blood donor profiles. Some examples:

- In noting that “US WB/RBC transfusion rate in 2011 . . . approach[e]d the rates reported in the 1990s,” the 2011 NBCUS Report commented that “it is possible that this decline in transfusion rate is a residual of the recession, but more likely it is an indication of the growing adoption of blood management practices.”¹⁷ Underlying both of these possible causes are economic and social policy factors. The economic recession in the U.S. has left more consumers without health insurance, contributing to a reduction in health care utilization. The actual impacts of reduced utilization and the anticipated impacts of health care reform on hospitals' budgets have been motivating them to cut costs by limiting their purchases of blood. In combination, these factors have reduced the demand for blood, leading to the apparent “drop” in the incidence of U.S. blood donors.¹⁸
- U.S. blood centers rely on blood drives at government agencies for a significant share of their collections. Accordingly, austerity measures that shut down government offices¹⁹ or shrink the work force oblige the centers to collect elsewhere, altering the occupational mix among the centers' blood donors.



In the longer term, economic and social changes create complex dynamics that are difficult to observe and model.

- If high unemployment rates among young people in some European countries ²⁰ persist, leading to a “lost generation” of employees, blood services may lose collections from the young donors who would otherwise have donated at workplace blood drives – unless these blood services compensate by, for example, increasing their collections from students, which might necessitate lowering their countries’ minimum donation age, as has happened in the U.S.
- Based on extensive research, Robert Putnam has posited that the increase in diversity that occurs in societies with growing immigrant populations initially reduces the social capital that underpins voluntary blood donation by “bringing out the turtle” ²¹ in all social groups. ²² Yet, over time, Putnam contends, these groups can weave a new web of social connections and moral responsibility, reconstituting the social capital that underpins voluntary blood donation:

In the short run . . . immigration and ethnic diversity tend to reduce social solidarity and social capital. New evidence from the U.S. suggests that in ethnically diverse neighbourhoods residents of all races tend to ‘hunker down’. Trust (even of one's own race) is lower, altruism and community cooperation rarer, friends fewer. In the long run, however, successful immigrant societies have overcome such fragmentation by creating new, cross-cutting forms of social solidarity and more encompassing identities. ²³

3 – Scientific, technical, and policy changes affect donor characteristics.

Blood operators are well aware that, in recent decades, scientific advances and policies favoring increasingly stringent blood safety standards have reshaped the blood donor profile by substantially narrowing the donation eligibility criteria. ²⁴

What may be less apparent are the ways in which new technologies may influence the donor profile. For example, since the introduction of RBC collection via apheresis in the late 1990s, its use in the U.S. has become increasingly prevalent. By 2011, RBC apheresis collections constituted 12.6% of total collections, ²⁵ with “almost all [RBC apheresis collection] procedures yield[ing] double red cell products (e.g., two units).” ²⁶

The ability to collect two RBC units in a single donation may help to explain why the ratio of first-time blood donors to repeat donors in the U.S. appears to be changing. While the survey-to-survey changes may not be statistically significant, data extracted from the NBCUS reports suggest that the percent of first-time donors has been trending upward: from 28.5% (2006) ²⁷ to 29.3% (2008) ²⁸ to 30.9% (2011). ²⁹ Concurrently, the average number of donations from repeat donors underwent a statistically significant drop, from 1.7 ³⁰ to 1.5 ^{31,32} donations per repeat donor. Taken together, these results imply that U.S. blood centers may be “running lean” by maximizing their collections from first-time donors and reducing their investment in donor retention efforts.



In addition to influencing the ratio of first-time to repeat donors, apheresis technology has been affecting U.S. blood centers' decisions with respect to recruiting and retaining multicultural blood donors. ³³

U.S. blood centers have been increasingly **targeting multicultural donors for double red blood cell (2RBC) donation:**

[Certain groups of] people of color . . . have a higher [percent] of [the] population who are O blood type (compared to Caucasians), therefore making them particularly attractive to convert to 2RBC technology. If you do not include 2RBC you will get a distorted "trend line," as 2RBC technology has "taken off" within the blood industry since 2003, and O blood type is the target group converted to this technology for all blood centers in the USA. Approximately 20% [to] 25% of our Latino donors donate via 2RBC. ³⁴

Persuading a first-time donor to make a 2RBC donation not only doubles the blood center's yield; it also effectively halves the center's cost to recruit that donor. This benefit-to-cost calculation makes 2RBC donation especially attractive to centers that are recruiting first-time multicultural donors, in view of the above-average costs of collecting in these populations.

Yet the true benefit-to-cost ratio must factor in the impact, if any, of an initial 2RBC donation on the donor's future donation behavior. A recently published study has reported that, compared to whole blood (WB) donors, **double red cell donors have lower rates of return:**

On average, WB donors were less likely to react and more likely to donate again and returned more quickly to donate than 2RBC donors, even after accounting for differential delays in eligibility. ³⁵

Anticipating that multicultural donors will not return in any case, blood centers have tended to discount the possibility that **encouraging initial 2RBC donations may reduce multicultural individuals' lifetime value as blood donors.** ³⁶

3.0 Changes in Donor Demographics

3.1 "Donors": Issues of Definition and Measurement

Over the past 50 years, marketing as a discipline has become increasingly reliant on market segmentation to increase its effectiveness. Since the era of mass marketing, when brands, products, and services could succeed by being "all things to all people," companies and organizations have applied segmentation techniques and tools to engage in ever more precise targeting of their highest-potential customers.

Blood donation, however, has been different. Because anyone may need blood, blood centers have historically sought to recruit donors from across the population. Indeed, some U.S. centers have made this mission explicit by using the marketing tagline "It takes all types."

In accomplishing the mission to mass-market blood donation, U.S. blood centers have been highly effective. Proof of their success is the fact that nearly half of U.S. adults – in the range of 40% ¹ to 50% ² – have reportedly donated blood at least once in their lives.

This fact bears reiterating. Having donated blood at least once in their lives, **roughly half of U.S. adults are "ever donors."**

Designating the ever donor as the focus of any "blood donor of the future" initiative would have important implications for demographic analyses (raising the possibility, for instance, that we should make the



demographic profile of the average adult our starting point) and for the initiative overall. For this discussion, however, we will elect not to profile ever donors or other donor categories, for instance “repeat donors” or “regular donors.”³ Instead, we will define the “donor” in “donor of the future” as an individual who is eligible to donate blood and who makes one or more actual blood donations in a given calendar year.

The common wisdom has been that the incidence of U.S. blood donors, as just defined, is now dangerously low after a long decline attributable to multiple factors, including the aging of the population,⁴ a decrease in civic engagement with the loss of the Greatest Generation,⁵ and the reduction in the eligible donor base due to increasingly stringent donor exclusion criteria.⁶

Surprisingly, the two most recent NBCUS reports challenge this conventional wisdom. The challenge is explicit in the 2009 report, which observes that “although there has been discussion that the potential donor base may be smaller than previously assumed, the rate of donations per 1,000 persons of eligible age . . . has remained more or less constant since 2000.”⁷ The 2011 report’s announcement of a “large drop”⁸ in blood donor incidence might have altered that conclusion had the detailed data not revealed that the blood centers were themselves responsible for the 2011 “drop” (see section 2.0, page 3).

Taking account of these findings makes it possible to perceive the U.S. supply-demand relationship in a quite different light. The latest chart of this relationship⁹ shows that, over the past 15 years, the U.S. blood collection industry as a whole has been able to maintain a margin of supply over demand, and that, over time, it has become more efficient in managing the size of that margin. Even as it has experienced successive unprecedented, “black swan” events – the introduction of apheresis technology, the most severe economic downturn since the Great Depression, a major restructuring of the hospital market in anticipation of health care reform – the industry has taken effective actions to restore equilibrium.

Having observed that the U.S. blood collection industry has been resilient in the face of unforeseen challenges and has acted with a goal of equilibrium, we will apply those perspectives as we consider how the blood donor of the future might compare to the donor of today in terms of specific demographic characteristics.

3.2 Recent and Potential Changes in Specific Demographic Characteristics

Age. With no upper age limits for donating blood and with at least 40¹⁰ of the 50 states having reduced the minimum age to 16, the U.S. blood collection industry now recruits within an age window that, in the foreseeable future, is unlikely to widen.

Since the lowering of the age threshold, the industry seems to have become increasingly reliant on young donors. Donors aged 16 to 24 provided 19.3% of allogeneic collections in 2008¹¹ and 20.5% of the collections in 2011, with high school-aged donors, those aged 16 to 18, alone responsible for 10.5% of all 2011 collections.¹²

In its dependence on young donors, the U.S. is not dissimilar to Canada (individuals aged 17 to 24 were 20% of the blood donor base across Canada, excluding Québec, as of 2007)¹³ or to a number of other countries, such as Hong Kong (student donors accounted for over 20% of the Hong Kong Red Cross Blood Transfusion Service’s annual blood collection as of 2008).¹⁴ What makes the U.S. potentially more vulnerable than some other countries is that, having generally adopted the 16-year-old age threshold, it will have less of an opportunity to expand eligibility by further lowering the threshold. Moreover, in light of the increased incidence of adverse donation reactions among very young donors,¹⁵ U.S. blood collectors are exposed to the risk¹⁶ of being restricted in or barred from collecting at high schools – developments that would have serious negative consequences for the blood supply and for centers’ collection costs.



Anthropometric and physiological characteristics. If it wished to expand its recruitment of young and multicultural blood donors, the industry could lobby for changes in SOPs (Standard Operating Procedures) that would accommodate more of these donors: for example, permitting individuals who do not meet the current height and weight requirements to donate 250cc (half size) bags of blood, as Taiwan does,¹⁷ or establishing a different hemoglobin threshold for persons of African descent, who, for largely genetic reasons, have hemoglobin levels that are typically lower than Caucasians'.¹⁸

Although it has been proposed that the difference in hemoglobin levels [between persons of African and European ancestry] might be due primarily to socioeconomic and nutritional factors, most studies have suggested that there are other causes, very possibly genetic, that account for the difference. Quite specifically, Perry *et al.* have provided evidence that the hemoglobin difference is not due to iron deficiency. Elevated serum ferritin levels have been found in African-Americans in previous studies. While the cause for this difference between African-American and white subjects is not fully understood, it is likely to have a genetic basis. . . .

Our data show that even after elimination of patients with iron-deficient erythropoiesis, 16.2% of African-American women were found to have hemoglobin levels of less than 12 g/dL, whereas only 3.9% of white women were in this range.¹⁹

Because such anthropometric or physiological adaptations would increase the complexity and costs of collecting, it seems unlikely that U.S. blood centers would proactively seek approval for them unless major demographic changes made them unavoidable or the price of blood rose to the point where it was financially worth the centers' while.

The fact that U.S. centers are increasingly interested in using apheresis for 2RBC collection, which has higher height, weight, and hemoglobin requirements²⁰ than manual donation does, further militates against future relaxations of the anthropometric and physiological eligibility criteria – unless the apheresis equipment manufacturers devise breakthrough technologies or processes.

Behaviors. In recent years, the expansion of exclusion criteria based on behaviors – for example, having lived in or traveled to foreign destinations deemed to pose risks; getting a tattoo or a piercing; being a man who has had sex with a man – has considerably restricted the behavioral profile of individuals eligible to donate blood. To the extent that blood centers' lobbying efforts in favor of modifying or removing certain restrictions is successful (see section 2.0, page 4), it is likely that donors of the future will have broader behavioral profiles in certain respects. It is also likely, however, that new exclusions will emerge over time, resulting in the ongoing redefinition of donors' behavioral profiles.

Birthplace. Multiple factors, including the challenges of acclimating to a new environment,²¹ limited points of connection to the larger society and its social capital,²² typically little previous experience with voluntary non-remunerated blood donation,²³ and, in some cases, national origins and language barriers that block donation²⁴ make those who were born outside a country less likely to donate blood²⁵ and, even if they do donate, less likely to return.^{26, 27} The dynamics that make birthplace outside the country a predictor of non-donor status are unlikely to change over time.

Blood donation history. As discussed above (section 2.0, page 5), the percent of all blood donors who are first-time donors seems to be trending upward. While many factors may be contributing to this trend, the key driver appears to be U.S. blood centers' calculation that recruiting new donors is more cost effective than investing to increase donor retention. As this calculation is likely to remain operative as long as the price of blood stays low and U.S. centers can continue recruiting large numbers of high school students inexpensively, we can expect that, in the foreseeable future, the percent of first-time blood donors will probably continue to rise.



Blood type. As the U.S. population becomes increasingly diverse, blood centers will likely find it necessary to make their recruitment and retention efforts more targeted to minimize mismatches between collections of and requirements for blood types whose incidence varies by race or ethnicity. For example, as the Caucasian population continues to decline in proportion to the overall U.S. population, U.S. blood centers will find it increasingly challenging to recruit blood donors with Rh-negative blood types.

The high frequency of the RHD silent allele in Europe tells us that the mutation that generated the non-functional RHD silent allele arose in Europe. Analyses of European populations tells us that this allele is found at the highest frequencies in western European populations, especially in Spanish and French Basques, suggesting that this allele arose long ago in some western European population. In the United States, about 15% of the general population is Rh negative; almost 20% of European Americans are Rh negative (because many Americans have western European ancestry), and approximately 5-10% of African Americans are Rh negative (because of the flow of European genes into the African American population). Fewer than 1% of Asian and Native Americans are Rh negative.²⁸

On the other hand, it may be that, if the ongoing research on glycosidase enzymes is successful in producing a safe and cost-effective antigen-stripping system, a donor's blood type may eventually become a more or less irrelevant profiling characteristic.²⁹

Education. U.S.³⁰ and Canadian³¹ blood donors have tended to have above-average educational attainment, not only because the sponsors of many blood drives – colleges and universities, government agencies, and corporations – are environments in which well-educated people are concentrated, but also because blood donors with lower educational attainment are less likely to become repeat donors.³² Accordingly, we can project that the future donor base will continue to have a high level of educational attainment, although the increasing representation of young people who are still in high school will reduce the average somewhat

Gender. Although historically a majority of all U.S. blood donors have been men,^{33,34} a 2007 analysis of registered blood donors found that women constituted the majority of whole blood donors.³⁵ Conflicting trends make it challenging to predict the female-to-male ratio among future blood donors overall. On the one hand, the projected rise in the percent of first-time blood donors suggests that, in the future, women will make up a greater share of the donor population than they do now.³⁶ On the other hand, U.S. blood centers might still choose to focus disproportionately on recruiting and retaining men – not necessarily because their more robust hemoglobin levels make them physiologically more capable of becoming frequent and persistent donors, but because their greater average height and weight make them more likely to qualify for 2RBC donation. Other considerations motivating a continued preference for male donors could include the need to minimize the risk of TRALI (Transfusion Related Acute Lung Injury), which has led to “continued international efforts to reduce the use of plasma for transfusion prepared from female donors,”³⁷ and the influence of the National Marrow Donor Program, which offers financial incentives to blood centers to recruit for the marrow donor registry and which has determined that men make better marrow donors.³⁸

Geography. Although blood centers operate in many different geographies, the blood collection industry in the U.S. and Canada has tended to concentrate its recruitment in the suburbs.³⁹ In light of recent U.S. Census data affording evidence of depopulation in the rural U.S.⁴⁰ and slowing growth in the suburbs – areas that have tended to overindex on blood donation – as well as indications of a resurgence in the growth of cities,⁴¹ blood centers will have the long-term challenge of recruiting more urban residents as blood donors.

Health status/markers. It seems plausible that the trend established in recent decades, when the list of blood-borne pathogens deemed to compromise blood safety⁴² has expanded, will continue into the future. As pathogens added to the list will be difficult to remove in light of liability risks, the definition of who is a “healthy” blood donor is likely to narrow over time.



Occupation. As suggested above (section 2.0, page 4), long-term austerity may alter the occupational distribution among future blood donors by, for example, changing the proportions of students versus employees and by decreasing the share of donors employed by government agencies as opposed to private corporations.

Organizational affiliation. Because U.S. blood centers concentrate on recruiting blood donors in groups, it is logical that blood donors tend to be members of organizations. In fact, research conducted for America's Blood Centers' proprietary ABC-D Program found that donors who had donated blood in the past 12 months and who were likely to donate again belonged to an average of **3.4 different types of organizations**. Future blood donors will likely continue to be affiliated with multiple organizations, but individuals with this characteristic may become harder to find as organizational membership continues to decline.⁴³

Race/ethnicity. For years, U.S. blood collectors have maintained that the U.S.'s expanding multicultural populations, particularly African Americans and Hispanics, are targets for growth. However, the available data, although imperfect and not sufficiently detailed, tell a different story. Since the beginning of the millennium, when the American Red Cross estimated that 10% of those giving blood in a year were African Americans or Hispanics,⁴⁴ multicultural blood donors' contributions to the blood supply do not appear to have increased appreciably. The most recent NBCUS reports indicated that African American, Asian, and/or Hispanic blood donors provided 10.7% of the units collected in 2008⁴⁵ and 11.1% in 2011.⁴⁶ Because multicultural units are especially expensive to collect, we predict that, unless the economics of the U.S. blood business change to improve cost recovery, achieving greater racial and ethnic diversity in the pool of future blood donors will be a very gradual process.

4.0 Hypotheses and Scenarios

4.1 Near-Term Hypotheses

The blood collection industry is naturally risk averse and, consequently, conservative. As a result, it is reasonable to project that the blood donors of the near future will generally resemble the blood donors of today.

Following are some hypotheses regarding characteristics of the donors of the near future:

- **Incidence:** The percent of the total U.S. population that is eligible to donate will decline somewhat, but the percent of the eligible population that donates blood in a given year will fluctuate within a narrow range.
- **Age:** The percent of donors at the lower and upper ends of the age spectrum will increase, although the increase will be greater among young donors.
- **Gender:** Among all who donate blood in a given year, the ratio of female donors to male donors will trend slightly upward.
- **Occupation:** The percent of donors who are students will increase relative to those who are employed in government or the private sector.
- **Race/ethnicity:** The racial and ethnic make-up of the donor pool will remain very similar to what it is today.
- **Blood type:** Blood centers will continue to invest disproportionately in retaining O-negative donors.



4.2 Disruptive Scenarios

The most profoundly disruptive changes to the blood industry's business model might originate with the blood community itself. Artificial blood may resemble a mirage – always on the horizon, never reached – but it is worth noting that the University of British Columbia's Centre for Blood Research, funded in part by CBS, has a stated goal of helping to make Canada a blood donor-free society by 2025. ¹

It is possible to imagine catastrophic scenarios that would endanger not just the blood industry, but entire societies, even global order. Among such possibilities are rolling, coordinated attacks on the North American electric grid and communications infrastructure; a major nuclear accident; a fast-moving pandemic; widespread, persistent famines in areas currently responsible for a disproportionate share of the blood supply; or societal upheavals triggered by climate change.

However, the most useful scenarios for planning purposes may not be those cited above. Rather, while acknowledging that the U.S. blood collection industry has been resilient in responding to a series of "black swan" events, we should consider what could happen if a flock of black swans came together, creating the type of "out of sample" problem to which Nate Silver attributes the forecasting failures leading up to the global financial crisis in 2007 and 2008. ²

In the U.S. blood collection industry, a "flock" scenario might unfold like this:

- After several years of downward pressure on blood prices brought about by hospitals' consolidation, giving the survivors unprecedented buying power, and by a plummeting demand for blood, a reduced number of blood collectors remain.
- The remaining centers, operating with extremely tight margins and having slashed their investment in recruitment and retention, have become increasingly dependent on first-time high school donors.
- A pandemic emerges and sweeps the globe. Somewhat like the 1918 Spanish flu, it disproportionately targets and kills healthy young adults. ³
- Having previously abandoned efforts to maintain updated contact information for lapsed donors, a safer resource than members of the general public, ⁴ and being unable to collect from young donors, the U.S. blood industry cannot respond rapidly enough to avoid severe shortfalls in collections.

Other "flock" scenarios might include political components, such as a successful national movement spearheaded by school nurses and parents to prohibit high school donation; medical evidence that giving blood creates previously unsuspected, long-term health risks; and/or a critical hemovigilance failure.

4.3 Challenges and Opportunities

Beyond the inherent difficulty of attempting to foresee the unforeseeable, the U.S. blood collection industry's "just-in-time" operational mindset makes forecasting and planning particularly challenging. Appropriately resourcing forecasting and planning efforts is also challenging, all the more because the responsibility for blood collection does not reside with a national health service.

Irrespective of its specific conclusions, a "blood donor of the future" initiative affords opportunities for U.S. blood collection agencies and their counterparts elsewhere to coordinate more closely and, potentially, to advocate for common data resources. We hope that such an initiative will have these positive outcomes.



FOOTNOTES

1.0 Introduction

- 1 Silver, Nate. *The Signal and the Noise: Why So Many Predictions Fail – but Some Don't*. New York: Penguin Press, 2012. Page 181.
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