



Solving shortage in a priceless market: Insights from blood donation



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ABSTRACT

Shortage is common in many markets, such as those for human organs or blood, but the problem is often difficult to solve through price adjustment, given safety and ethical concerns. In this paper, we study two non-price methods that are often used to alleviate shortage for human blood. The first method is informing existing donors of a current shortage via a mobile message and encouraging them to donate voluntarily. The second method is asking the patient's family or friends to donate in a family replacement (FR) program at the time of shortage. Using 447,357 individual donation records across 8 years from a large Chinese blood bank, we show that both methods are effective in addressing blood shortage in the short run but have different implications for total blood supply in the long run. We compare the efficacy of these methods and discuss their applications under different scenarios to alleviate shortage.

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1. Introduction

When market supply falls short of market demand, economists often recommend price adjustment to clear the market. However, due to safety and ethical concerns, many markets prohibit price adjustments or do not allow a market price to exist at all (Roth, 2007; Titmuss, 1970). Organ, tissue, and blood donations are prominent examples. A stream of research has examined how matching mechanisms can increase the number of kidney transplants conditional on a pool of people who have already expressed an intent to donate (Roth et al., 2004, 2005). However, the number of donors is still low relative to the increasing demand, which highlights the importance of recruiting new donors (Kessler and Roth, 2012, 2014). Economic incentive (Lacetera et al., 2012, 2013) and alternative allocation policies (Kessler and Roth, 2012) have been proposed to increase donations. While effective, much uncertainty and many restrictions still remain in implementing these proposals (WHO,

2009, 2010; Lacetera et al., 2013). Thus, recent research has called for studies on alternative methods to induce donations (Lacetera et al., 2014; Goette et al., 2010).

To answer this call, we study the impact of non-price methods in addressing shortage. Specifically, we are interested in three questions. First, can market designers utilize “shortage” as a tool to encourage more donation from donors and therefore increase market supply? Second, even if shortage-based methods lead to greater supply in the short run, will the effect last? Third, in the long run, can shortage-based methods help recruit and retain new donors? To address these questions, we study two shortage-based non-price methods that practitioners often consider in blood donation.

Shortage is common and frequent in the human blood market (Slonim et al., 2014). World Health Organization (WHO) estimates that blood donation by 1% of the population is a general minimum needed to meet a nation's most basic requirements for blood; and such a minimum requirement is higher in countries with more advanced health care systems (WHO, 2009). Fig. 1 presents a WHO map of donation rate as of 2007. Countries that have low donation rate per capita are often poor and suffer from long lasting blood shortage. In contrast, mid-to-high income countries have relatively high donation rates and are more likely to experience seasonal or type-specific shortage due to unexpected attritions or emergency events. Mostly driven by quality concerns, the WHO advocates for 100% unpaid voluntary donation for all medical use

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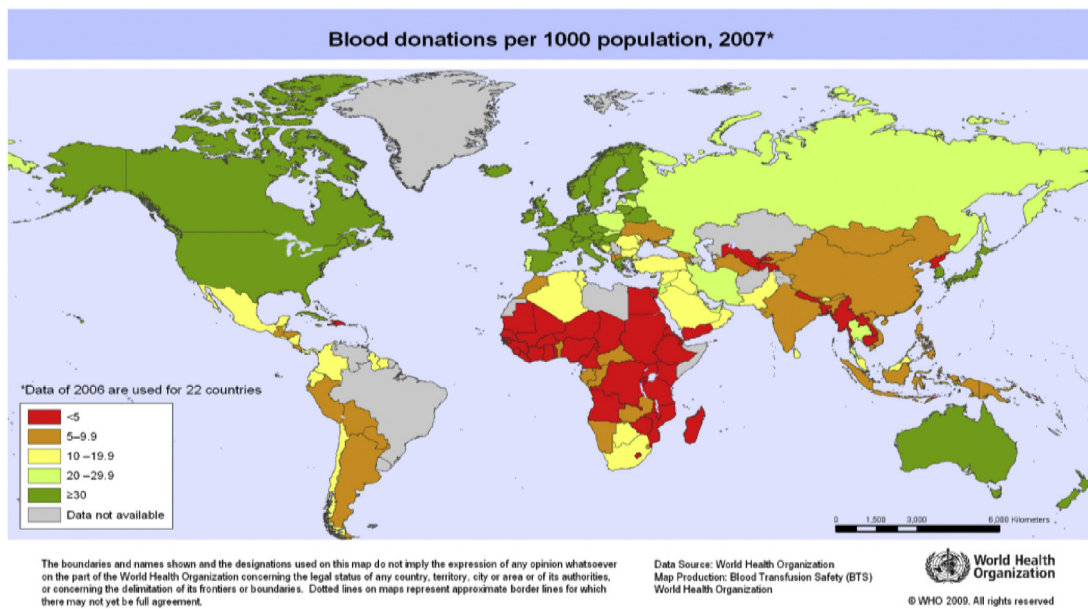


Fig. 1. World map of donation rate.

of human blood.² But this goal is hard to reach in many countries. As of 2012, 73 countries collected over 90% of their blood supply from voluntary unpaid blood donors; however, 72 countries collected more than 50% of their blood supply from family replacement or paid donors (WHO, 2014).

Facing shortage and a ban on monetary incentive, blood banks often resort to two non-price methods to meet their needs. First, they strive to recruit more unpaid voluntary donors by sending shortage message (SM) to past donors. However, if shortage is too severe or too frequent, donor recruitment via SM alone may not be sufficient to close the gap. Another method is implementing a family replacement (FR) program. At the time of shortage, a patient in need of blood can be given the option to recruit her family or friends to donate blood so that she can use the blood immediately. In practice, because not all blood types can be transfused safely between individuals, the blood bank swaps FR donation with the same amount of blood from the inventory for the dedicated patient.

This paper evaluates the effect of SM and FR on blood supply, using a unique dataset from China. Our data come from a large blood bank located in a major Chinese city with over 8 million population as of 2012. Since 2009, the city has faced increasing blood shortage, and used both SM and the FR to address the shortage.

For both methods, it is not easy to quantify the tradeoffs facing the blood bank because individual motives are often unobservable. Fortunately, our data contain over 330,000 individual donors and their donation history from 2005 to 2013, which allows us to find control individuals that are closely matched with individuals who either received the shortage message or donated via FR. As detailed below, the effect of SM is clearly identified because sometimes the blood supply is short for only certain blood type(s), which gives us exogeneity in terms of who received a SM specific to the blood type in short supply. The variation in FR and non-FR donation is less clean, because individuals may self-select into FR donation through an unobserved process. We articulate the implication of such

selection and find a way to separate the causal effect of the FR program from potential selection.

Comparing treated and control individuals, we find that SM leads to more donations among existing donors within the first six months but no significant effect afterwards. This effect is stronger for donors who donated more times before receiving the shortage message, suggesting a greater warm glow effect for donors who donate more in the past.³ In comparison, FR donation encourages existing donors (who donated before the FR) to donate more blood voluntarily after their FR donation, but discourages no-history donors (whose first donation is FR) from donating in the long run. This is consistent with findings on SM and suggests that, for donors who have donated before, warm glow dominates the potential negative effects of substituting today's donation for future donation (referred to as “substitution” hereafter) or becoming more reluctant to contribute because other people do not contribute enough (referred to as “conditional cooperation”). In the meantime, our results suggest that the substitution or conditional cooperation effects are more prevalent for donors who donated less in the past. In addition, we do not find evidence that SM or FR leads to worse blood quality. Overall, the effect of SM and FR on blood supply is large and comparable to the effect of high-stake economic incentives reported in recent literature (Lacetera et al., 2014; Iajya et al., 2013; Goette and Stutzer, 2008).

Because neither treatment worsens blood quality, the efficiency comparison between the two methods is largely dependent on level of control, targeted audience, cost of implementation, and the effects of treatment in the short and long runs. Back-of-envelope calculation suggests that SM can be used in places where the donor population is large and the shortage is less severe and type-specific, while FR could be more useful in generating a significant blood

² WHO (2009) stated that “more than 30 years after the first World Health Assembly resolution (WHA28.72) . . . family replacement and paid donation continue in many countries even though there is convincing evidence that they are both less safe and that their use can inhibit progress to a safer system based on 100% VNRBD.” VNRBD stands for 100% voluntary non-remunerated blood donation.

³ By ‘warm glow’, we mean both pure altruism and warm feeling of doing good for other. In the economics literature, individuals with pure altruism gain utility from increasing the welfare of others, while individuals motivated by the warm feeling of doing good can only receive such utility from their own contributions directly (Andreoni, 1989, 1990). Studies in the lab and the field have confirmed the importance of warm feelings (Crumpler and Grossman, 2008; DellaVigna et al., 2012), and find that donations connected with a greater sense of need or deservingness also create more warm feelings (Konow, 2010). In our context, it is difficult to distinguish pure altruism from warm feelings, so we refer to both as the ‘warm glow’.

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