

BLOOD DONOR CAREERS

a dynamic approach to donating blood



Tjeerd W. Piersma

BLOOD DONOR CAREERS
A DYNAMIC APPROACH TO DONATING BLOOD

Tjeerd W. Piersma

Research reported in this thesis was conducted at the Department of Donor Medicine Research of Sanquin Research and the Center for Philanthropic Studies at the Department of Sociology of the Vrije Universiteit, Amsterdam, the Netherlands, and the Department of Clinical Immunology of the Copenhagen University Hospital (Rigshospitalet), Copenhagen, Denmark.

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BLOOD DONOR CAREERS A DYNAMIC APPROACH TO DONATING BLOOD

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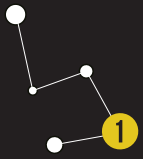
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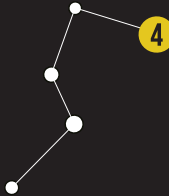
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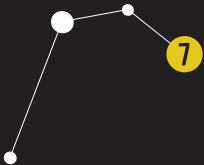
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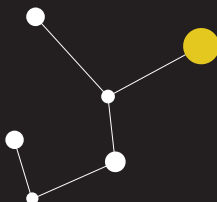
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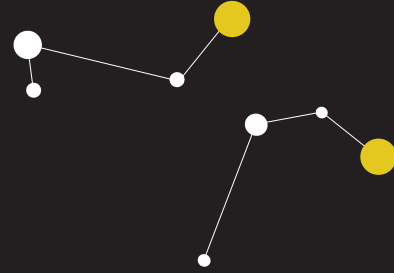
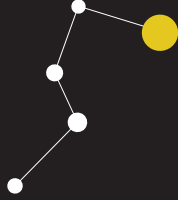
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GENERAL INTRODUCTION

GENERAL INTRODUCTION

Every day, hospitals are in urgent need for blood products to save lives. These products are used in emergency assistance after traumatic events and restoring blood shortages in cancer patients after chemotherapy, as well as in therapies for rare chronic diseases such as autoimmune disorders and hemophilia (Sanquin, 2019b). In performing these treatments, hospitals heavily rely on voluntary, non-remunerated and anonymous donations of numerous blood donors (WHO, 2019). At the same time, only three to four percent of all people eligible for blood donation is actually registered as a donor (i.e., a European Union-wide average of approximately 29 blood donors per 1000 inhabitants; Toumi & Urbinati, 2015), causing a vulnerable balance between blood supply and demand.

Moreover, the percentage of registered blood donors is slowly declining while the demographic composition of the donor population is subject to change over the past years. In several European countries, including the Netherlands, the ageing donor population shows a trend towards feminization while remaining ethnically homogeneous (Goldman et al., 2017; Laeijendecker, 2014). To match the future demand of all needed blood types, blood banks are challenged to work towards a sufficient and healthy blood donor pool, reflecting the diversity in the population (Merz & Van der Meer, 2018). Understanding (non-)donors is key in facing these challenges. What motivates and hinders people to donate blood? And how can these donors be more effectively recruited and retained?

For decades, such questions have been central to scholars studying antecedents of blood donation, or prosocial behaviour in general: “the non-coerced transfer of financial or human resources benefiting the collective good, without donors receiving remunerations that equal the originally transferred resources (Bekkers, 2013, p. 6).” As is the case with volunteer work and charitable giving, donating blood benefits an anonymous other while requiring personal costs without any remuneration equal to these initial costs – donating blood takes time and blood, and can lead to adverse events or stress (Hoogerwerf et al., 2018).

In trying to unravel the complexities of blood donor behaviour, economists, psychologists and sociologists have generally focused on various individual, social and contextual determinants, respectively (Ferguson, 2015). Despite a long tradition of blood donor studies – originated in the mid-1950s (Walsh & Clemens, 1956) – contradictory findings have been published on characteristics that define the ‘typical blood donor’, while lacking knowledge on whether and how blood donor behaviour is susceptible to change over the life course.

All these developments considered, a gap has emerged between practical questions on blood donor recruitment and retention, and theoretical answers on determinants of donor behaviour. On the one hand, blood donor populations are changing, with increasing demand for a better demographic balance and increasing ethnic diversity. On the other hand, systematically recruiting and retaining (non-)donors with specific socio-demographic

characteristics proves to be difficult in the absence of a multidisciplinary theory that guides research on blood donor behaviour over the life course (Devine, 2019). To provide a better understanding of blood donor behaviour across the donor career, the following research question will be central throughout this dissertation:

Which individual, social and contextual factors are associated with blood donor behaviour, and what influence do these factors have across the blood donor career?

Research data: combining longitudinal registers and surveys

In answering this research question, we need to stress the importance of our unique combination of longitudinal data. First, we use two waves of the Donor InSight study (DIS-I and DIS-II; Timmer et al., 2019), a large-scale survey among a representative sample of more than 30 thousand Dutch blood donors, registering socio-demographic characteristics, blood donor health and motivations to donate blood. Second, we use two national blood donor registers from the Netherlands and Denmark. The Dutch blood donor database (eProgesa; Sanquin, 2018a) contains register data on all Dutch whole-blood and plasma donors and their behaviour, such as number of donations, return rates, and deferral reasons. The same is true for the Scandinavian Donations and Transfusion database (SCANDAT; Edgren et al., 2015), which contains register data on all Danish blood donors who have been registered since the start of the computerized blood bank system in 1981. By linking these longitudinal surveys and blood donor registers – based on anonymous personal identification numbers, with informed consent of the study participants, and after permission from Sanquin and Danish Ethics Advisory Boards – we are able to map individual, social and contextual characteristics of approximately 500 thousand blood donors, hereby moving away from static donor behaviour to dynamic donor careers while examining actual blood donations instead of self-reported donation intentions.

The remainder of this introduction will further elaborate on the challenges of blood supply and demand and provides a theoretical background on previously identified individual, social and contextual factors associated with blood donor behaviour. Moreover, we will shortly describe the historical developments and current state of the blood collection system in the Netherlands to frame the study context, after which we present the outline of the different chapters of the dissertation and their respective data and research methods.

Challenges of blood supply and demand

The aforementioned decline of registered blood donors does not seem to pose an immediate threat to the overall blood supply, as the demand for blood products is declining at an even higher rate over the past years (Borkent-Raven, Janssen, & Van der Poel, 2010; Greinacher et al., 2017). This is due to new, innovative surgery techniques as well as the application of patient blood management principles, such as a more restrictive transfusion policy (Mueller

et al., 2019). Heightened attention for blood donor health in scientific studies, however, has increased the knowledge about potential negative side effects of blood donation (Williamson & Devine, 2013). For instance, repeat and frequent blood donations are negatively related to hemoglobin and ferritin levels (Devine, 2019), leading to donation-induced iron deficiency over time (Brittenham, 2011; Nasserinejad et al., 2015). To recover from these iron losses without providing donors with iron supplementation, the minimal donation interval should be increased from 56 to 180 days (Schotten et al., 2016). As a result, larger donor populations are needed to meet future blood demands despite decreased blood usage.

With regard to the aforementioned demographic developments within donor populations, mainly related to imbalance in age, sex and ethnicity, problems with availability of blood products on the long term may arise as well (Greinacher, Fendrich, Alpen, & Hoffmann, 2007; Williamson & Devine, 2013). Originally, typical blood donors in the Netherlands during the 1960s and 1970s were young men in military service, who were rewarded with a day off after they made a blood donation (Goldman et al., 2017). A lot of these young men registered as blood donors during their military service and became loyal donors over the years. However, as these men are now slowly approaching the maximum eligible donation age, a new generation of blood donors needs to be ready to compensate for the loss of a large group of loyal blood donors.

This new generation of blood donors in the Netherlands mainly consists of young women (Sanquin, 2018a). Yet, it is questionable to which extent they can compensate for the upcoming donor drop-out. Compared to men, women are generally allowed to donate less often, have a higher risk of adverse events after a blood donation (Fu & Levine, 2010), and are more likely to be deferred for medical reasons related to pregnancy, hemoglobin levels and blood pressure (Misje, Bosnes, & Heier, 2010). Frequency of deferrals and their respective deferral periods seem to be associated with a lower likelihood for subsequent blood donations (Custer et al., 2011; France, Rader, & Carlson, 2005; Hillgrove, Moore, Doherty, & Ryan, 2011), with this likelihood varying between deferral reasons and between donors who differ in their donation experience (Spekman, Van Tilburg, & Merz, 2019).

Moreover, blood donor populations in Western countries are generally characterized by their ethnic homogeneity. Yet, an underrepresentation of ethnic minority donors might pose a problem due to different blood type compositions compared to the Western majority population. This is particularly the case for Sub-Saharan African descendants (e.g., Ghana, Ethiopia and Suriname) who substantially differ in extended blood types compared with people of European descent, but are also more prone to blood disorders, such as sickle cell disease, demanding multiple blood transfusions (Miller et al., 2013; Reid, Lomas-Francis, & Olsson, 2002). Due to growing multiculturalism, a diverse blood supply is needed to match current and future transfusion demands (Lattimore, Wickenden, & Brailsford, 2015).

Since these developments are not limited to the Netherlands only, blood collection agencies worldwide are challenged to work towards larger donor populations which equally represent the general (patient) population. Despite efforts of many intervention-based blood donor studies, targeting a wide range of possible donation motivations (e.g., nonmonetary incentives, message framing and educational campaigns; Chou & Murnighan, 2013; Frye et al., 2014; Lacetera, Macis, & Slonim, 2014), recruiting new donors has proven to be challenging (Van Dongen, Mews, de Kort, & Wagenmans, 2016; Wevers, Wigboldus, De Kort, Van Baaren, & Veldhuizen, 2014a). For a vast majority of the population, the costs of donating blood do not seem to outweigh the benefits. What factors, then, influence the decision to donate blood across the life course?

Understanding blood donation: theoretical perspectives

Researchers across various disciplines (e.g., psychology, sociology, economics) are looking for theoretical explanations of prosocial behaviour, and more specifically blood donor behaviour. While their studies are all focused around one central question – ‘what motivates people to behave voluntarily for the benefit of others?’ – each of these disciplines chooses their own theoretical perspective (Evans & Ferguson, 2014). Psychologists usually approach this question from the individual perspective, examining internal, personal motivations and barriers in the donation decision. Are people driven by empathic concern and altruism towards recipients? Or is the donation decision based on self-regarding motives like warm-glow, that is giving blood to feel good about yourself? Economists would answer ‘yes’ to this question, with experimental studies increasingly showing how a model of pure altruism is insufficient in explaining prosocial behaviour such as blood donation (Ferguson, Taylor, Keatley, Flynn, & Lawrence, 2012b; Ottoni-Wilhelm, 2017). People are more likely to donate blood when they have sufficient resources to do so – available time and sufficient health – and get some personal benefit from the voluntary act. When costs and benefits are out of balance, economists would consider donating blood to be irrational. Sociologists take a broader perspective by examining the role of social and contextual factors in blood donation (Healy, 2000). How influential are donors’ social networks? Do social norms arising from these networks motivate people to make a donation? And what role do blood banks play in the donation decision?

As these theoretical perspectives significantly differ in the way they approach blood donation and underlying motivational mechanisms, a wide range of research findings have been published over the past ten years. To provide a comprehensive overview of all determinants examined in these studies we conducted a systematic literature review (Chapter 2; Piersma, Bekkers, Klinkenberg, De Kort, & Merz, 2017), showing that – if these previous studies have anything in common – blood donor behaviour cannot be fully explained and understood from the isolation of one of the aforementioned perspectives.

To get a better grip on factors driving blood donation, we might need to work towards an integrated, multidisciplinary model, investigating the role of individual, social and contextual factors as well as their mutual interactions.

Moreover, we need to start recognizing the dynamic nature of blood donation. The majority of previous blood donor studies used cross-sectional data and methods, investigating motivations to donate blood at one point in time. Human behaviour, however, is highly susceptible to change over the life course (Elder & Johnson, 2001). People who decide to register as blood donor will not necessarily become loyal donors over time. Every individual blood donor goes through his or her own blood donor career. Various factors such as socio-demographic characteristics, donation deferrals, satisfaction with the blood bank and the associated changing donation motivations influence behavioural change across the blood donor career (Piersma et al., 2017).

The life course perspective in understanding blood donor behaviour

Although we just emphasized the importance of a dynamic approach to blood donor behaviour and the blood donor career, the call for such longitudinal methods in social sciences was already made in the mid-1920s by William Isaac Thomas (Elder, Johnson, & Crosnoe, 2003). However, Thomas' recommendations remained unanswered until the 1960s, when societal and methodological developments (e.g., maturation of early child development samples, rapid socio-demographical changes in European and American populations) led to an accumulating interest in, among others, social pathways of human lives (Elder & Johnson, 2001). These societal and methodological developments marked the beginning of the emergence of 'life course theory', although we rather refer to it as the 'life course perspective' because it provides a framework for research: "a theoretical orientation that guides research on human lives within context" (Elder et al., 2003, p. 10).

The historical developments which led to the emergence of the life course perspective in the general social sciences, summarized in Table 1.1, show noticeable similarities to recent societal and methodological developments in the field of blood donor studies. On a methodological level, early child development studies in the United States matured in the 1960s, comparable to the relatively recent development of longitudinal blood donor samples such as Donor InSight (DIS; Timmer et al., 2019), the Scandinavian Donations and Transfusions database (SCANDAT; Edgren et al., 2015), and the Retrovirus Epidemiology Donor Study (REDS; Zuck et al., 1995), including up to 1,2 million donors across several decades. The maturation of child development studies led to a revolutionary growth in the interest in longitudinal studies on behavioural development and change. Developments of the aforementioned blood donor samples increased interest in longitudinal donor studies over the past ten years, although, to date, these developments have mainly taken place in epidemiological blood donor studies and less in the field of blood donor motivation and behaviour.

On a societal level, the interest in the life course perspective emerged as a result of the rapidity of societal change and changes in the composition of American and European populations in the aftermath of the Second World War. As mentioned earlier, changing compositions of blood donor populations with regard to sex, age and ethnic diversity might pose a threat to the long-term blood supply. Allegedly, these compositional shifts are associated with social change. Declining altruistic values and lower societal trust among the younger generations (Bekkers, de Wit, & Wiepking, 2017), as well as social segregation and mistrust in biomedical organizations among the migrant population (Tran, Charbonneau, & Valderrama-Benitez, 2013) make these specific subgroups feel less willing to commit to society.

Based on these societal and methodological developments, Elder, Johnson and Crosnoe (2003, pp. 11-13) defined five paradigmatic principles of the life course perspective, which serve as an conceptual outline for this dissertation: the principle of human agency, linked lives, time and place, life-span development, and timing (Figure 1.1). “These five principles steer research away from age-specific studies and towards the recognition of individual choice and decision-making. They promote awareness of larger social contexts and history and of the timing of events and role change. They also enhance the understanding that human lives cannot be adequately represented when removed from relationships with significant others (Elder et al., 2003, p. 13).” Using these paradigmatic principles as a common thread throughout, we examine to what extent individual, social and contextual factors are associated with blood donor behaviour and what influence these factors have across the blood donor career, given the aforementioned historical and societal timing urging for a better understanding of blood donors and their behavioural decisions. Since we are the first to choose this theoretical perspective as a framework for studying blood donor behaviour over the life course, we hope to lay a foundation for future in-depth, multidisciplinary studies on (blood) donor careers.

Table 1.1 Parallel societal and methodological developments which have led to the emergence and high applicability of the life course perspective in the general social sciences (left; adapted from Elder et al., 2003) and specifically in the field of blood donor studies (right).

Developments in EU and the US (+- 1960)	Developments affecting donor studies (+- 2010)
1 Maturation of early child development studies	Development of longitudinal donor samples
2 Rapidity of social change	Decreasing societal trust and altruistic feelings
3 Changes in population composition	Increasing ethnic diversity in the population
4 Changing age structure of society	Ageing blood donor population
5 Revolutionary growth of longitudinal research	Increased interest in longitudinal donor studies

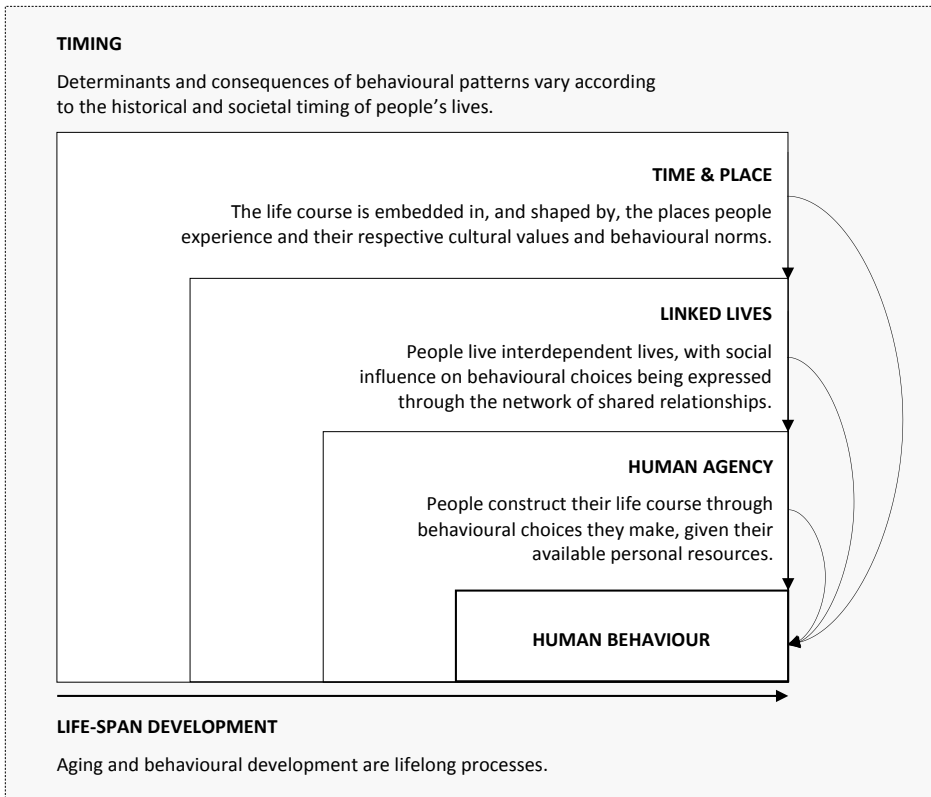


Figure 11 The five paradigmatic principles of the life course perspective in an integrated conceptual model, with its definitions based on Elder et al. (2003).

Human agency: individual factors across the blood donor career

Blood donor studies often focus on individual motivations and barriers to donate blood. Looking at motivations to start donating blood, the vast majority of blood donors reported that they started donating blood for idealistic and altruistic reasons, such as high empathic concern for unknown others and feelings of moral responsibility towards society (Piersma et al., 2017). At the other end of the blood donor career spectrum, reasons to stop donating blood are often more practical in nature. For instance, large numbers of donors report that they perceive themselves not to be healthy enough to keep on donating, or that a lack of time due to work, study or family responsibilities hinders future blood donations (Klinkenberg, Romeijn, De Kort, & Merz, 2018b).

These findings align with the human agency principle of the life course perspective, stating that people construct their life course through behavioural choices they make, given their available personal resources (Elder et al., 2003). In the case of blood donation, where sufficient time and health are needed to meet minimal blood donation criteria, this

means that donors make a rational choice to donate blood based on their available time and personal health (Bekkers, 2006; Musick & Wilson, 2008). Previous research showed that blood donation is indeed sensitive to the personal costs that donors have to incur (Schreiber et al., 2006). Individuals with more human capital – people’s individual assets or resources enabling certain behaviour such as available time and sufficient health – are more likely to donate blood (Bekkers, 2006). When these resources are subjected to change across the life course, for instance after the occurrence of life events, we expect this to subsequently influence future blood donation decisions. What exactly are these life events? And how would they be of influence across the blood donor career?

Life events are important occurrences in life, which can be either positive or negative (e.g., marriage and the death of a family member), normative or non-normative (e.g., getting your first job and winning the lottery), and be experienced individually or collectively (e.g., starting a study and natural disasters; Wrzus, Hänel, Wagner, & Franz, 2013). Depending on their nature, these events affect your personal resources and thus have far-reaching behavioural consequences.

Contrary to the intuitive assumption that positive events lead to positive behaviour and negative events lead to negative behaviour, Staub and Vollhardt (2009) showed that victimization and suffering can also lead to increased prosocial behaviour. Moreover, Frazier et al. (2013) reported how people who experienced more lifetime traumatic events subsequently engaged in more prosocial behaviour than those who experienced less traumatic events. ‘Altruism born of suffering’ and individual resilience might be more common than most people assume (Bonanno, 2004; Bonanno, Galea, Bucciarelli, & Vlahov, 2006; Vollhardt, 2009). On the other hand, not all positive events necessarily result in positive, prosocial behaviour. Studies have shown how childbirth, marriage and starting a new job reduce engagement in volunteer work (Lancee & Radl, 2014; Nesbit, 2012; Niebuur, Liefbroer, Steverink, & Smidt, 2018; Niebuur, van Lente, Liefbroer, Steverink, & Smidt, 2018; Oesterle, Johnson, & Mortimer, 2004). As a results of reduced time and health after the occurrence of these events, people are forced to select activities based on their available resources. Does this then also apply to blood donation and donation decisions across the blood donor career?

Based on experiences from previous collective, traumatic life events, we know that such events are very effective in mobilizing new blood donors. After the terrorist attacks at a popular gay bar in Orlando, Florida, hundreds of people lined up at the blood bank right after the attack (CNN, 2016). Empirical studies on collective, traumatic life events confirm these observations (Perisse, Pouget, Ragot, Bouzard, & Sailliol, 2017; Tian et al., 2010). Although the proportion of new donors also significantly increased after the terrorist attacks on 9/11, this was not the case for returning donors in the subsequent year, indicating that such emergencies only have a short-term effect on blood donor behaviour (Tran et al., 2010).

Whether these findings apply to normative, individual life events, and to what extent human agency is involved in the donation decision, is unclear. Yet it would be good to get a better understanding of the influence of changing personal resources across the blood donor career as the occurrence of specific normative, individual events is increasing. For instance, the number of registrations at Dutch universities yearly increases by four to five percent (VSNU, 2018), the number of people who start a new job or quit their current job grows due to the rise of temporary contracts and economic stability (CBS, 2019a), and people are more often confronted with serious diseases as a result of the ageing population (Blokstra et al., 2007). Increasing fluctuations of personal resources as a results of these life events (e.g., less available time after starting a new job or taking care of your family members) might affect individual donation decisions across the blood donor career.

Linked lives: social factors across the blood donor career

It is reasonable to assume that blood donation decisions are not made in social isolation. In their meta-analysis on self-reported determinants of blood donation, Bednall and Bove (2011) found that 11.2% of all blood donors from the combined study samples reported to donate blood as a result of perceived peer pressure of friends, family and colleagues – for instance after they were asked to register as blood donor (Misje, Bosnes, Gåsdaal, & Heier, 2005). In a subsequent meta-analysis, such subjective norms were indeed found to be related to actual blood donations (Bednall, Bove, Cheetham, & Murray, 2013).

We assume that linked lives are influential in blood donor behaviour, as people live interdependent lives with social influences being expressed through the network of shared relationships. With regard to the blood donation decision this means that, when donors are exposed to behavioural norms that encourage blood donation, their donation loyalty increases because the costs of not complying with these behavioural norms become higher (Lin, 1999). Individuals with more social capital – people's social connections within their social network and the behavioural norms that arise from them – are more likely to donate blood (Bekkers, 2006). When these social networks are subject to change across the life course, for instance decreasing perceived social norms, we expect this to subsequently influence future blood donation decisions. To what extent do social networks change across the blood donor career? And do such changes indeed influence donation decisions?

The size and composition of social networks is subject to change over the life course (Wrzus et al., 2013). In general, the size of networks increases during adolescence and young adulthood, when people are mainly focused on information acquisition by means of many diverse social contacts, and decrease in later parenthood and older age, when people start working towards more emotional intensive contacts (Carstensen, 1995). Such social network fluctuations are dependent on the strength of social ties. Global networks, usually consisting of colleagues and acquaintances, show the largest fluctuation rates, while close networks

consisting of family members and intimate friends remain relatively stable over the life course (Antonucci & Akiyama, 1987; Kahn & Antonucci, 1980; Wrzus et al., 2013). Changes in social networks after the occurrence of life events have the potential to subsequently increase the perceived social pressure to donate blood across the donor career, and vice versa.

Time and place: contextual factors across the blood donor career

So far we have discussed the central role of internal motivations and the influence of social networks in the decision to donate blood. Blood, however, cannot be donated without specialized organizations taking care of the collection and distribution of this gift (Healy, 2000). Yet, “the institutional underpinnings of the blood supply have been almost entirely overshadowed by the image of the individual altruist (Healy, 2000, p. 1634)”. From the few works on contextual differences in blood donor behaviour, we know that socio-demographic compositions of donor populations differ both between and within European countries over time (Wittock, Hustinx, Bracke, & Buffel, 2017). For instance, Bekkers and Veldhuizen (2008) found spatial variations in the proportion of registered blood donors between municipalities in the Netherlands.

These observations are in line with the life course perspective’s paradigmatic principle of time and place. Blood donor careers of individuals are embedded in, and shaped by, the places they experience and their respective cultural values and behavioural norms. A better understanding of the role of contextual factors in donor behaviour therefore provides useful insights for blood collection agencies as well, as “it is far more practical for blood centres to identify concrete instruments or management systems that are able to attract and retain blood donors than it is to induce or mobilise an altruistic motivation (Boenigk, Leipnitz, & Scherhag, 2011, p. 357).” This argument is in line with statements from Healy (2000), who argued that personal donation motivations such as altruistic values or empathic concern are difficult to influence. What contextual factors, then, are related to blood donor behaviour and to what extent do they shape the blood donor career?

Contextual factors between countries. In his comparative study on institutional differences between blood collection systems in Europe, Healy (2000) showed that the way blood collection is organized in a country relates to the diversity and loyalty of blood donors. For instance, blood collection via the Red Cross is likely to attract non-diverse but loyal donors due to their historical embeddedness in religious communities and the connectedness between the Red Cross and volunteer work. In contrast, blood collections ran by monopolist blood banking organizations are more likely to attract diverse but incidental donors, allegedly as a result of more non-systematic donor recruitment and retention. According to Healy, such institutional differences are fundamental in blood donor behaviour as they shape the social embeddedness of blood donation, that is the way in which people perceive the act of blood donation and its societal meaning. Although this statement is almost twenty years old, his

ideas on the importance of contextual factors are not outdated. More recent cross-European studies have shown that cultural differences (e.g., power difference; Hofstede & Hofstede, 2005) are associated with the perceived blood transfusion safety and the willingness to donate blood in the European Union (De Kort et al., 2010; Huis in 't Veld, de Kort, & Merz, 2019; Merz, Zijlstra, & De Kort, 2016). How is blood collection organized in the Netherlands? And how does this compare to other countries?

Blood collection in the Netherlands is centrally organized by Sanquin – with its name originating from 'sanguis' and 'sanguine', the Latin and French words for blood, respectively. Sanquin is a non-profit organization founded in 1998 after merging the countries' nine independent blood banks with the Central Laboratory for Blood Transfusion Services (i.e., part of the Dutch Red Cross). In 2017, approximately 320,000 registered blood donors made a total of slightly over 720,000 whole-blood and plasma donations (Sanquin, 2018b). In line with the recommendations of the World Health Organization (2019), all donors made a voluntary, non-remunerated donation to an anonymous recipient. When compared internationally, the Dutch collection regime in its current form is comparable to that of the United Kingdom, Belgium or Portugal, while it contrasts to those of other countries in certain aspects. In Germany and the United States, for instance, the Red Cross as well as local blood banks have their own guidelines for financially remunerating their donors. In various other countries, such as Argentina and Greece, replacement donations by family members of the transfusion recipient are used as a compensation to ensure a sufficient supply (WHO, 2017). Following the arguments from Healy (2000) and Gorleer and colleagues (2018), institutional differences between blood collection agencies are likely to be related with blood donor behaviour and underlying donation motivations, hereby subsequently shaping the blood donor career.

Contextual factors within countries. Next to international differences between blood collection agencies, spatial variations and blood bank policies on a national level also influence blood donation decisions (Ferguson, 1996; Merz, Zijlstra, & De Kort, 2017). The physical presence of a donation centre, for instance, seems to be an important factor in the decision to continue donating. Donors reported that they stopped donating blood because the donation centre was too far away or had inconvenient opening times (Klinkenberg et al., 2018b; Schreiber et al., 2006). Moreover, having a blood collection centre in a Dutch municipality was related to the proportion of blood donors within that municipality (Bekkers & Veldhuizen, 2008), and two Canadian studies showed that having a blood donation centre within a five kilometre radius was positively associated with the number of donors in that area and their donation frequency (Cimaroli, Páez, Newbold, & Heddle, 2012; Saberton, Paez, Newbold, & Heddle, 2009). As previous studies either used cross-sectional data or self-reported donation motivations, however, it is unknown to what extent these changes influence the donation decision across the blood donor career.

Further insight in placing and changing donation locations might prove to be useful, as Sanquin is constantly evaluating its operational processes to improve the effectiveness and efficiency of blood collection. Evaluations of geographical locations of donation centres over the past ten years, for instance, led to a large number of changes in terms of the number of blood donation centres and their opening times. Partly due to a large reorganization in 2013, merging four regional blood banks into one central blood collection agency, the number of donation locations decreased by 46% (i.e., from 252 in 2009 to 136 in 2018). This decision increased the distance to the nearest donation location for a large part of the blood donor population, hereby increasing the time commitment to donate blood. Decisions on the physical place of blood collection might also influence the donation decision over time.

Within-country differences in blood donation decisions can also be influenced by the way blood banks communicate with their (potential) donors, rather than its physical representation in the form of donation locations. As mentioned before, however, previous one-size-fits-all recruitment efforts have shown to be largely ineffective in motivating young men and ethnic diverse non-donors to sign up with the blood bank (Van Dongen et al., 2016; Wevers et al., 2014a). While we believe that these non-donors are generally willing to be involved in blood donation, previous studies have shown how donors with different demographic characteristics are differently motivated to donate blood (Bani & Strepparava, 2011; Glynn, Kleinman, & Schreiber, 2002). Due to motivational differences, one size does not fit all in recruiting new donors. Without thoroughly understanding motivational differences between diverse groups of (non-)donors, and without incorporating these insights into recruitment campaigns, the use of these campaigns might therefore not lead to desired recruitment outcomes.

Moreover, specific recruitment strategies may also influence how newly recruited donors interpret and appreciate their blood donor career. Direct recruitment attempts by the blood bank, for instance by using promotional teams, may make a potential donor feel pressured to sign up, hereby negatively influencing donor loyalty over the long term. Given the presence of social pressure, it is assumed that people are more likely to conform to perceived societal norms when confronted with a solicitation to become a donor (Steenkamp, De Jong, & Baumgartner, 2010). In the context of charitable giving it was shown that, after door-to-door recruits, lapsed donors were more likely than active donors to report feeling pressured to donate money (Sargeant & Hudson, 2008). Although these people are more likely to sign up, they are not more likely to become loyal donors over time. Decisions about the way blood banks communicate with their (potential) donors are therefore likely to influence donation decisions across the blood donor career.

Outline

In seven chapters this dissertation examines to what extent individual, social and contextual factors are associated with blood donor behaviour, and what influence these factors have across the blood donor career. Based on the various topics and results presented throughout

these chapters, related to the five paradigmatic principles of the life course perspective, we try to set the scene for a multidisciplinary, longitudinal understanding of blood donor behaviour (Figure 1.2).

In this first and introductory chapter we have described the societal and theoretical relevance of blood donor studies. Developments in donor populations, changing supply and demand of blood products, and advancing insights into donor health made clear how historical timing asks for a better understanding of blood donors and non-donors, and their life-span developments with regard to actual blood donation decisions.

Chapter 2 provides an overview of all scientific literature on individual, social and contextual determinants of blood donor behaviour published between 2009 and 2017. By means of a systematic literature review, based on a predefined PROSPERO protocol (Piersma, Merz, Bekkers, De Kort, & Klinkenberg, 2016), we identify gaps in current blood donor studies. Insights from the 66 included peer-reviewed papers are then used to formulate research questions in the following chapters.

Chapter 3 examines whether and how life events influence blood donation across the donor career. Using register data from the Dutch blood donor database, linked to large-scale longitudinal survey data from the Donor InSight study, we examined whether life events are related to blood donor lapse among 20,560 donors from the Netherlands (i.e., non-return – registered donors who made at least one blood donation but not in the last 24 months; De Kort & Veldhuizen, 2010). Moreover, this chapter shows how social and practical concerns explain donors' decisions to donate blood after the occurrence of life events, hereby discussing the role of human agency and linked lives throughout the donor career.

The results from Chapter 3 are about blood donor careers in the Netherlands, without taking into account potential contextual differences between countries. Chapter 4, therefore, examines the repeatability of our previous findings among 152,887 blood donors in Denmark, investigating the influence of life events on blood donor lapse using register data from Statistics Denmark linked to the Scandinavian Donations and Transfusions database. Moreover, by the sole use of register data we were able to provide more accurate estimates of true effect sizes compared to findings from the Dutch study relying on surveys (e.g., by eliminating false-positive self-reports as a result of recall bias).

Chapter 5 further explores the role of time and place, shifting the focus from the individual factors to the role of blood banks in the donation decision. Using register data on all blood donors and blood donation centres in the Netherlands over the past 10 years, we track closings of these donation centres and examine its association with blood donor lapse in the subsequent years. Second, we use this experimental design to examine whether the increased distance to the nearest donation centre explains the increased lapsing risk, and whether some blood donors are more altruistically motivated to give blood than others (i.e., donating blood despite the increased travel times).

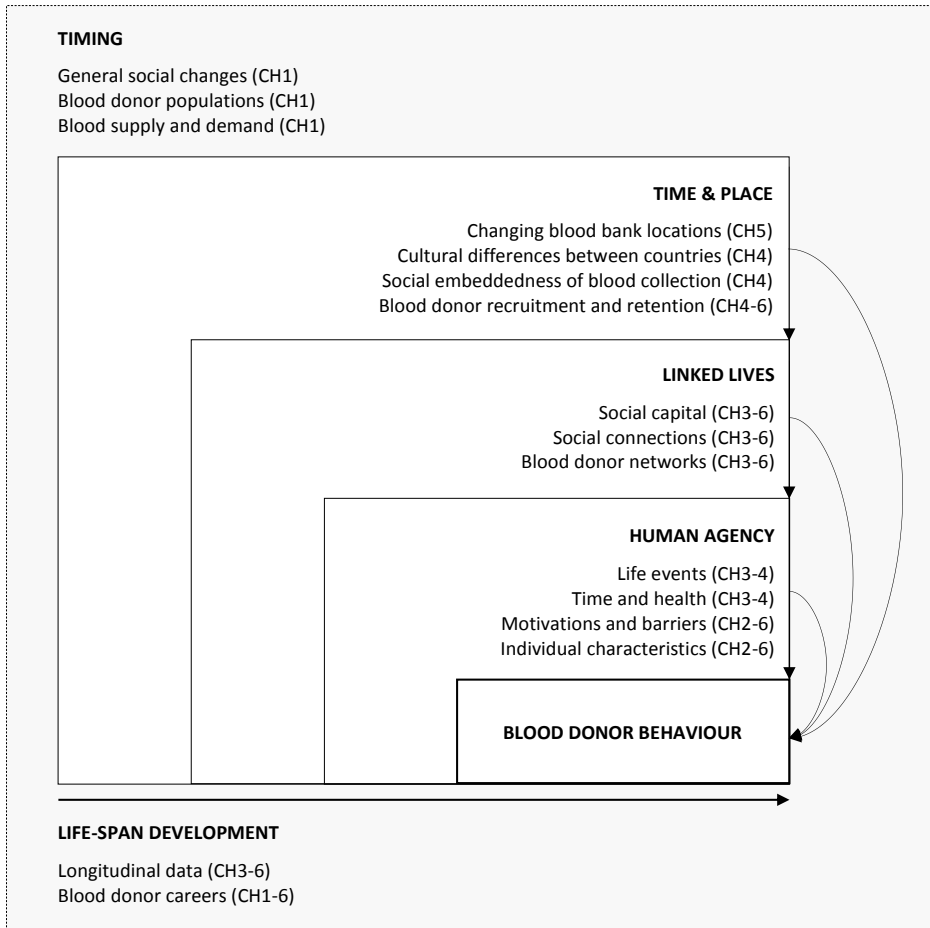
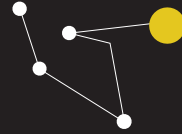


Figure 1.2 Overview of topics in this dissertation and their respective chapters, integrated in the life course perspective and ordered according to the five paradigmatic principles.

Chapter 6 further explores the role of blood banks in the donation decision, moving away from the physical presence of blood donation centres to the role recruitment strategies play in creating diverse and loyal donor populations. Based on register data from the Dutch blood donor database, including 155,054 donors and their respective recruitment methods, we examine to what extent the use of various recruitment methods is related to the recruitment of specific socio-demographic groups. Moreover, we study whether recruitment methods are associated with the length of the donor career.

In the seventh and concluding chapter, we reflect on the role of individual, social and contextual factors across the blood donor career by summarizing this dissertations' key findings. Moreover, we discuss its theoretical implications, describe methodological

considerations, make recommendations for future directions in blood donor studies, and conclude by elaborating on the practical applications these findings have for policy makers in blood collection agencies.





INDIVIDUAL, CONTEXTUAL AND NETWORK CHARACTERISTICS OF BLOOD DONORS AND NON-DONORS: A SYSTEMATIC REVIEW OF RECENT LITERATURE

This chapter is published as: Piersma, T.W., Bekkers, R., Klinkenberg, E.F., De Kort, W.L.A.M., & Merz, E.-M. (2017). Individual, contextual and network characteristics of blood donors and non-donors: a systematic review of recent literature. *Blood Transfusion*, 15(5), 382-397.

TP, RB, WK and EM contributed to the study design. TP performed the online literature search, after which TP and EK independently scored the quality of all included studies. TP wrote the paper with the help of RB, WK and EM. Appendices 2.1 – 2.3 are available online at: osf.io/pzhuv/.

ABSTRACT

The ageing population and recent migration flows may negatively affect the blood supply on the long-term, increasing the importance of targeted recruitment and retention strategies to address donors. In this chapter, we sought to identify individual, network and contextual characteristics related to blood donor status and behaviour, to systematically discuss differences between study results, and to identify possible factors to target in recruitment and retention efforts. The systematic review was conducted in accordance to a predefined PROSPERO protocol (CRD42016039591). After quality assessments by multiple independent raters, a final set of 66 peer-reviewed papers, published between October 2009 and January 2017, were included for review. Individual and contextual characteristics of blood donor status and behaviour were categorised along five main lines of research: donor demographics, motivations and barriers, adverse reactions and deferral, contextual factors, and blood centre factors. Results on donor demographics, motivations and barriers, and contextual factors were inconclusive, differing between studies, countries, and sample characteristics. Adverse reactions and deferral were negatively related to blood donor behaviour. Blood centre factors play an important role in donor management (e.g., providing information, reminders, and (non-)monetary rewards). No studies were found on network characteristics of (non-)donors. Although individual and contextual characteristics strongly relate to blood donor status and behaviour, mechanisms underlying these relations have not been studied enough. We want to stress the importance of longitudinal studies in donor behaviour, exploring the role of life events and network characteristics within blood donor careers. Increased understanding of donor behaviour will assist policy makers of blood collection agencies, with the ultimate goal to safeguard a sufficient and matching blood supply.

INTRODUCTION

In the Netherlands, approximately 2.5% of the population is registered as whole blood or plasma donor, accounting for 721,000 donations per year, including about 25 whole blood units per 1,000 inhabitants. However, the number of donors in the Netherlands has been decreasing from more than 400,000 donors in 2010 to about 340,000 donors in 2015 (Sanquin, 2016). Although this does not pose a short-term threat to the blood supply, due to an even larger decrease in blood demand influenced by advanced surgery techniques and a more restrictive transfusion policy (Carson et al., 2011; Verdecchia et al., 2016; Williams, 2013), certain demographic developments may negatively affect the blood supply on the long-term.

First, men in their 50s and 60s are overrepresented in the Dutch donor pool (Atsma, Veldhuizen, De Vegt, Doggen, & De Kort, 2011). Within one to two decades, these men will no longer be eligible to donate and a new generation of blood donors needs to be available. However, recruiting and retaining young donors is difficult (Wevers et al., 2014a). Second, due to recent migration flows, the diversity of the population is growing and with it, the diversity of patients in need for specific blood and tissue types., increasingly in need for specific blood and tissue types. Consequently, new and more donors with specific characteristics (e.g., male, ethnic minority) have to be recruited to safeguard a sufficient and matching blood supply.

The Netherlands is not the only country facing these developments (Lattimore et al., 2015). Hence, recruitment and retention of blood donors is an important study topic. Over the last 40 years, researchers have studied donor behaviour in trying to characterize the 'typical blood donor' (Glynn et al., 2002; Leibrecht, Hogan, Luz, & Tobias, 1976; Schreiber et al., 2006). However, findings are inconclusive, with results changing over time and varying within and between countries.

This systematic review provides an overview of the great variety of results on characteristics of blood donor status (e.g., first-time, novice, experienced) and behaviour (e.g., donation frequency, return behaviour). We update previous systematic reviews (Bednall & Bove, 2011; Bednall et al., 2013) and extend these by exploring the role of external factors in donating blood. For example, through studies showing how contextual and blood centre factors are related to willingness to donate and actual donor behaviour (Bekkers, Merz, Veldhuizen, & Prinsze, in progress; Mews & Boenigk, 2013).

Further, we try to shed a light on donor careers. If human behaviour would be static, all donors who ever started donating would continue to do so for the rest of their lives. In contrast, after people sign up as donor, some do not return after their first donation, while others continue to give blood until their maximum eligible age. These individual behavioural sequences and corresponding donor statuses are what we define as blood donor careers. We explore how blood donor careers play a role in previous study results.

From a practical perspective, this review is helpful in assisting policy makers of blood collection agencies (BCAs). By presenting and comparing recent findings, BCAs can design and implement evidence-based recruitment and retention campaigns to address (non-) donors in the most effective ways, convince first-time donors to become regular donors, and to guarantee a safe and sufficient blood supply in the future. The main goal of this systematic review is to answer the following question: Which individual, contextual and network characteristics are related to blood donor status and blood donor behaviour, and do these relationships change over time?

MATERIALS AND METHODS

This review is conducted in accordance to a predefined PROSPERO protocol (CRD42016039591; Piersma et al., 2016). For this review we searched for studies on individual, network and contextual characteristics of blood donor status and behaviour.

Literature search

Studies matching our search terms were collected using Google Scholar, PubMed, ScienceDirect, and Web of Science. Core keywords of the search were: (blood) AND (donor OR donation) AND (motivation OR attitude OR behaviour OR recruitment OR retention OR altruism OR centre OR network OR life event). To make sure we collected all possible relevant literature for review, we conducted a manual search in some of the most relevant journals on prosocial behaviour and blood transfusion published between October 2009 and January 2017 (e.g., *Transfusion*, *Vox Sanguinis*, *Nonprofit and Voluntary Sector Quarterly*).

We built on and extended two earlier systematic reviews and included studies published after October 2009, the last month of inclusion in one of these comparable reviews, to provide an up-to-date review without replicating former systematic analyses (Bednall & Bove, 2011). We decided not to further shift our inclusion date to February 2012 (last month of inclusion in the most recent systematic review; Bednall et al., 2013) because it would require us to exclude 20 relevant papers related to blood donor status and behaviour, not discussed yet in both former reviews. Additional details on the search strategy and review process can be found in the PROSPERO protocol (Piersma et al., 2016).

Study selection

As a first step in the study selection process, papers that matched our search terms were assessed on title and abstract, based on six inclusion criteria: 1) published in English, German or Dutch, 2) published in a peer-reviewed journal, 3) published after October 2009, 4) conducted in a Western country, 5) used quantitative methods, and 6) used blood

donor status or blood donor behaviour as an outcome measure. Of the 399 retrieved studies, 307 studies were rated as clearly ineligible. Thereafter, two reviewers (TP, EK) independently read and evaluated the full-text of the 92 remaining studies. Again, the selection was based on the six inclusion criteria. Disagreements on inclusion of specific studies were resolved by discussion. As a result of this critical evaluation, another 26 studies were excluded for review.

As a final step, we conducted a quality control of the 66 included studies using a combination of four open-access critical appraisal tools for quantitative research: Critical Appraisal Skills Programme (CASP UK, UK, 2014), Strengthening the Reporting of Observational Studies in Epidemiology (STROBE; Vandembroucke et al., 2007), Standard Quality Assessment Criteria (Qualsyst; Kmet, Lee, & Cook, 2004), and the Critical Review Form (Law, 1987). These tools have been designed by epidemiologists, methodologists, and statisticians to improve both the quality of reporting on individual studies and the critical evaluation of study reports. Each appraisal tool has its own strengths and focus, but none of them incorporated a rating scale of all study characteristics relevant to our review. Therefore, we combined questions from each appraisal tool to carefully rate the included studies and all of its subparts (see Appendix 2.1 for the individual scores on these items per included study and Appendix 2.2 for the items of the developed review form). The quality of all studies was assessed by one rater (TP), while four other raters (EM, RB, WK, EK) divided the studies among them. Weighted Cohen's kappa (K_w) showed a moderate to good agreement between the raters: K_w (95% CI) = .61 (.38, .83), $p < .001$. Major disagreements on the inclusion of specific papers were resolved by discussion to define the final set of 66 included studies (Figure 2.1).

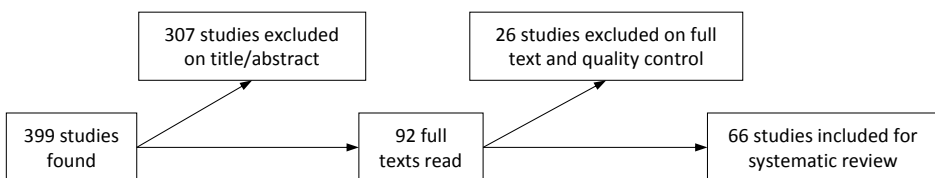


Figure 2.1 Overview of the inclusion and exclusion process during and after the systematic search.

RESULTS

Most of the reviewed studies stem from Northern-Europe (25) and Northern-America (24), while the remainder was conducted in Southern-Europe, Australia and New Zealand. Characteristics of these studies varied, with sample sizes ranging from 190 to 2.1 million,

consisting of a minimum of 24% to a maximum of 80% male participants. Also, study designs and methods differed, including field experiments, randomized control trials and descriptive studies based on register data (Appendix 2.3). We systematically summarize and discuss the studies' results, classified into two main categories: individual and contextual characteristics of donor status and behaviour (Figure 2.2).

Individual characteristics

Donor demographics. More than half (35) of the studies reported on socio-demographic characteristics of donors and non-donors, including sex, age, race and ethnicity, religion, education, employment, income, and demographic transitions.

The results on sex differences among donors and non-donors are mixed. Nine of the 21 studies reported that men were more likely to be donors than women (Abásolo & Tsuchiya, 2014; Bani & Strepparava, 2011; Garrett Whitney & Hall, 2010; Jóhannsdóttir, Gudmundsson, Möller, Aspelund, & Zoëga, 2016; Lacetera & Macis, 2013; Martín-Santana & Beerli-Palacio, 2013; Papagiannis et al., 2016; Politou et al., 2015; Vavic et al., 2012), ten studies reported the opposite (Atsma et al., 2011; Charbonneau, Cloutier, & Carrier, 2015, 2016; James et al., 2014; Lattimore et al., 2015; Misje et al., 2010; Shaz, James, Hillyer, Schreiber, & Hillyer, 2011; Sinclair et al., 2010; Van Dongen, Abraham, Ruiters, & Veldhuizen, 2013; Veldhuizen & Van Dongen, 2013), while two found no sex differences (Priller & Schupp, 2011; Shehu, Langmaack, Felchle, & Clement, 2015). After a first donation, men were more likely to return than women (Gemelli, Hayman, & Waller, 2017; Jóhannsdóttir et al., 2016; Kalargirou et al., 2014; Misje et al., 2010; Shaz et al., 2011; Volken, Buser, Holbro, Bart, & Infanti, 2015; Wiersum-Osselton et al., 2014). One study showed this relationship to be present at the short-term (6 months follow-up; Lattimore et al., 2015), while another study only found a long-term difference (25 months follow-up; Notari IV et al., 2009). Men donated more frequently (Bani & Strepparava, 2011; Cimaroli et al., 2012; James et al., 2014; Lacetera & Macis, 2010; Lattimore et al., 2015; Misje et al., 2010; Shaz et al., 2011; Wevers et al., 2014a) and were more often multigallon donors (more than 10 lifetime donations) compared to women (Wevers, Wigboldus, Van Baaren, & Veldhuizen, 2014b).

Studies on the relationship between age and donor status and behaviour showed mixed results too. Two studies indicated that the likelihood of donating increased with age (Charbonneau et al., 2016; Volken et al., 2013), while three others stated that younger people were more likely to donate (James et al., 2014; Priller & Schupp, 2011; Shehu et al., 2015). Four studies found a non-linear association, with older people being more likely to donate until a certain age, after which the propensity decreased (Atsma et al., 2011; Lattimore et al., 2015; Martín-Santana & Beerli-Palacio, 2013; Vavic et al., 2012). One study found no relationship between age blood donation (Abásolo & Tsuchiya, 2014). Younger people were more likely to be first-time donors than older people (Gemelli et al., 2017; Jóhannsdóttir et al., 2016; Wiersum-Osselton et al., 2014) and repeat donors were older than first-time donors (Gemelli

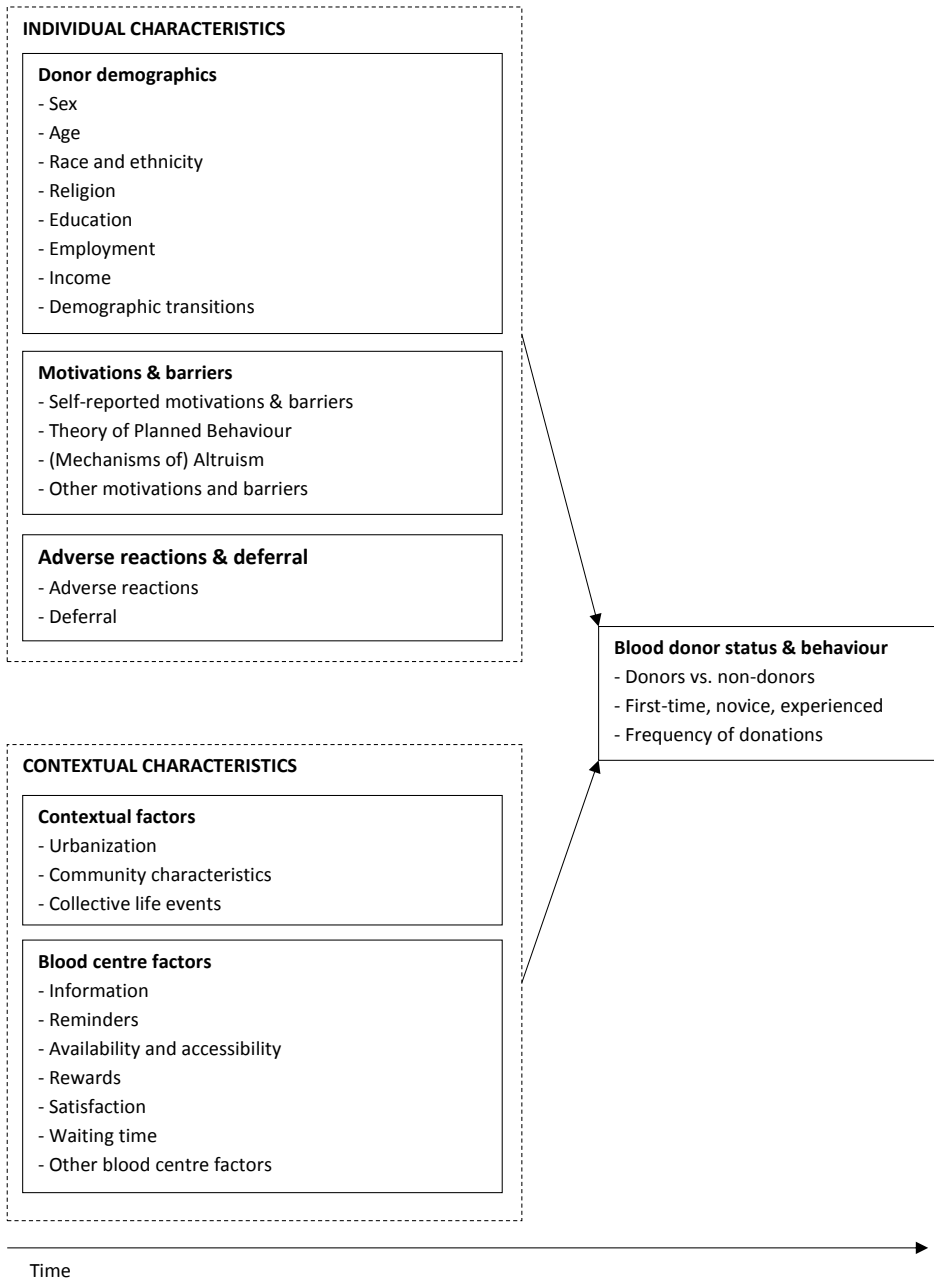


Figure 2.2 Categorization of the 62 included papers among the two main categories (individual and contextual characteristics) and associated subtopics.

et al., 2017; Lattimore et al., 2015; Wiersum-Osselton et al., 2014). The return rate of older donors was higher than that of younger donors (Notari IV et al., 2009; Volken et al., 2015; Wevers et al., 2014a). In the US, where the minimum eligible donor age is 16, the highest return rate was found for donors between the age of 16 and 18 (Notari IV et al., 2009). Older people were more likely to be frequent givers and multigallon donors, compared to younger people (Bani & Strepparava, 2011; Charbonneau et al., 2016; James et al., 2014; Wevers et al., 2014a).

Interactions between sex and age varied greatly in seven studies, but not in a systematic pattern (Bani & Strepparava, 2011; Gillum & Masters, 2010; Jóhannsdóttir et al., 2016; Lattimore et al., 2015; Misje et al., 2010; Prados Madrona, Fernández Herrera, Prados Jimenez, Gómez Giraldo, & Robles Campos, 2014; Shaz et al., 2011).

Regarding race and ethnicity, six studies from the US, Great-Britain and the Netherlands found higher rates of donors among US (non-Hispanic) whites, and people with a British or Dutch ethnic background respectively, compared to other race and ethnic groups (Atsma et al., 2011; Gillum & Masters, 2010; James et al., 2014; Lattimore et al., 2015; Shaz et al., 2011; Sinclair et al., 2010). Besides, (non-Hispanic) whites donated more frequently and were more likely to return than African Americans, Asians, and Hispanics (James et al., 2014; Shaz et al., 2011).

Three studies examined the relation between religion and donor status. No relation was found in Spain (Abásolo & Tsuchiya, 2014), while only limited evidence (positive relation for Catholic men aged 35-44) was found in the US (Gillum & Masters, 2010). In contrast, another US study reported a positive relation for both organizational and subjective dimensions of religion (church attendance and involvement in religious groups, and importance of faith in daily life, respectively; Beyerlein, 2016).

With regard to education, five studies found higher education to be related to a higher propensity to donate (Abásolo & Tsuchiya, 2014; Atsma et al., 2011; Charbonneau et al., 2016; Gillum & Masters, 2010; Kalargirou et al., 2014). Five others found an inverted U-shape relationship (Charbonneau et al., 2015; Martín-Santana & Beerli-Palacio, 2013; Priller & Schupp, 2011; Sinclair et al., 2010; Vavic et al., 2012), while one study found no relationship between education and donation (Shehu et al., 2015). Men with medium or higher education were more likely to have donated blood compared to men with a lower educational level, which did not hold for women (Volken et al., 2013).

In two studies, donors did not differ from non-donors in terms of their employment status (Priller & Schupp, 2011; Shehu et al., 2015), while one study showed that unemployed people were more likely to be non-donors (Kalargirou et al., 2014). Regarding donor status, Gemelli and colleagues (2017) showed that first-time donors were more likely to be students than returning donors, while the group of returning donors had higher numbers of retired people, professionals and tradespeople compared to the first-time donors.

Two studies found no relationship between personal income and donating (Bolle & Otto, 2010; Shehu et al., 2015), one study found a negative relationship (Sinclair et al., 2010), and two others concluded that people with a high (family) income were more likely to be donor than people with a low (family) income (Gillum & Masters, 2010; Priller & Schupp, 2011).

Among donors in the Netherlands, the proportion of those either married or never married was larger than in the general population (Atsma et al., 2011). Married people were also more likely to be donor in Canada (Charbonneau et al., 2015). In contrast, being married lowered the chance of being a donor in Germany and the US (Shehu et al., 2015; Sinclair et al., 2010). In Spain, people who were divorced or widowed had a 50 percent higher chance of donating blood (Abásolo & Tsuchiya, 2014). Gillum and Masters (2010) found that being married was positively related to the likelihood of being a donor for men, but not for women. Having children lowered the chance of being a donor (Shehu et al., 2015).

Motivations and barriers. Motivations and barriers to donating blood are widely studied, mainly along three lines of research: self-reported motivations and barriers, the Theory of Planned Behaviour (TPB; Ajzen, 1991), and (mechanisms of) altruism.

Five papers studied self-reported motivations (Bani & Strepparava, 2011; Charbonneau et al., 2015; Kalargirou et al., 2014; Politou et al., 2015; Veldhuizen & Van Dongen, 2013), and five papers studied self-reported barriers to donate blood (Charbonneau et al., 2016; Duboz & Cunéo, 2010; Kalargirou et al., 2014; Politou et al., 2015; Wevers et al., 2014a), displayed in Figure 2.3. Certain motivations to donate differed between members of socio-demographic groups (Bani & Strepparava, 2011; Charbonneau et al., 2015). Members of socio-demographic groups who are more likely to go through life events that might affect blood donation (e.g., studying, pregnancy) were more likely to cite motivations and barriers to donate associated with these events (Charbonneau et al., 2015, 2016; Duboz & Cunéo, 2010).

Six studies used the TPB to predict donor behaviour. Only the intention to donate was robustly correlated with donor behaviour. Other variables in the TPB model (self-efficacy, subjective and moral norm, affective and cognitive attitude, and role identity) explained little if any variance when intention was included (Conner, Godin, Sheeran, & Germain, 2013; Holdershaw, Gendall, & Wright, 2011; White, Poulsen, & Hyde, 2016). Dutch donors were marked by high levels of intention, attitudes and self-efficacy (Veldhuizen & Van Dongen, 2013). Multigallon donors scored higher on self-efficacy, affective attitude and self-identity than occasional donors (Wevers et al., 2014b). Affective attitude was positively related to return behaviour, while pressure to donate showed a negative relationship. Higher levels of self-efficacy, cognitive attitudes, affective attitudes and subjective norms were associated with lower levels of dropout (Veldhuizen, Atsma, Van Dongen, & De Kort, 2012).

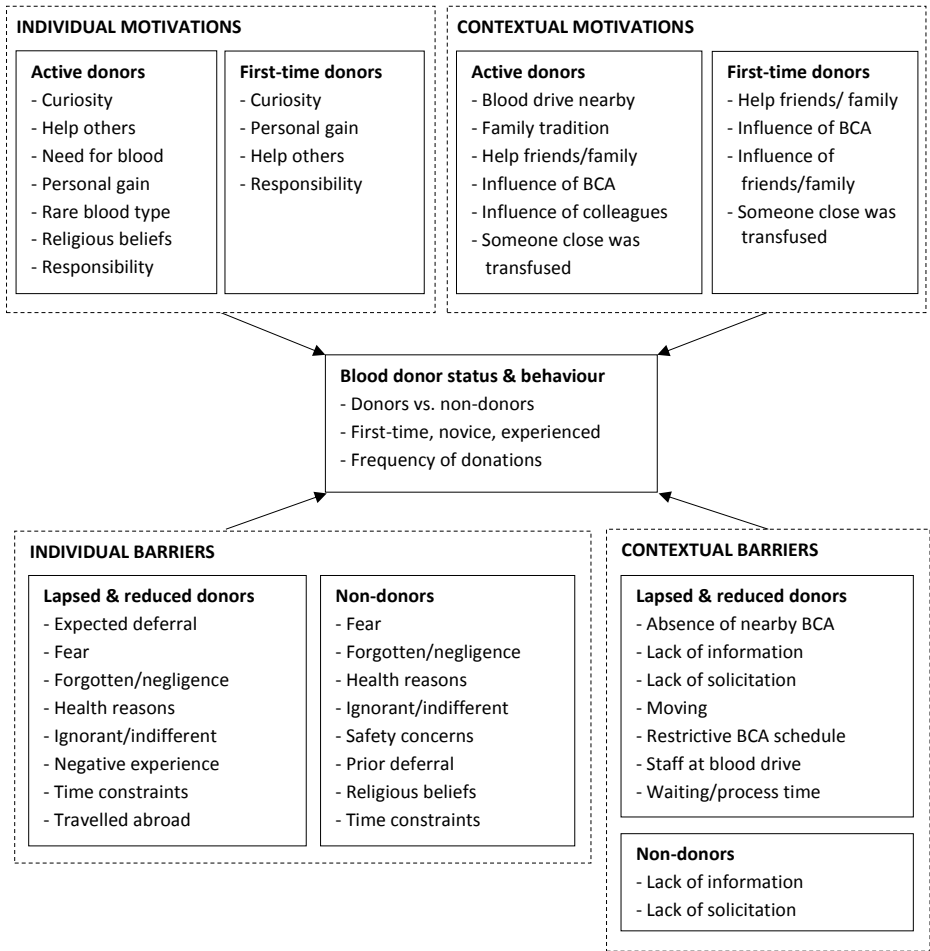


Figure 2.3 Overview of self-reported individual and contextual motivations and barriers to donate blood, differentiated by donor group.

In studying altruism as a motivation to donating blood, Bolle and Otto (2010) found no difference in the level of altruism between donors and non-donors (i.e., total amount of money donated to a charitable cause after filling in an online questionnaire served as a measure for their level of altruism). Evans and Ferguson (2014) proposed a refinement of the general altruism concept, arguing that there are five theoretically distinct dimensions of altruism: impure altruism, kinship, self-regarding motives, reluctant altruism, and egalitarian warm-glow. Donors consistently scored higher than non-donors on feelings of warm-glow and reluctant altruism, but not on other forms of altruism (Ferguson et al., 2012b).

Regarding the donor career, cognitive and behavioural motives (e.g., intentions, self-efficacy and habit formation) showed associations in all donor career stages. For first-time and novice donors, reluctant altruism was a distinguishing factor, while experienced donors were marked by warm-glow and pure altruism. Impure altruism was higher among first-time donors than novice and experienced donors (Ferguson, Atsma, De Kort, & Veldhuizen, 2012a).

No differences in levels of susceptibility to social influence between donors and non-donors appeared in one study (Griffin, Grace, & O’Cass, 2014). Among participants who were aware of the need for blood, those who were asked to give blood were more likely to donate in the upcoming blood drive than those who were not asked to make an active decision (Stutzer, Goette, & Zehnder, 2011).

Adverse reactions and deferral. As the self-reported barriers indicated, negative donation experiences and deferral might be reasons to lapse or stop donating (Charbonneau et al., 2016; Duboz & Cunéo, 2010; Wevers et al., 2014a). Nine studies explored the role of adverse reactions (e.g., fainting, needle reactions) and deferral (e.g., low haemoglobin, travelling abroad) on donor status and behaviour.

Donors who experienced an adverse reaction reported showed lower return rates than donors who did not experience an adverse event (France et al., 2014; Gemelli et al., 2017; Veldhuizen et al., 2012). This stopping risk increased with the severity of the reaction (Custer et al., 2012; Eder, Notari IV, & Dodd, 2012) and had a higher impact on first-time donors than repeat donors (Custer et al., 2012; Eder et al., 2012; Van Dongen, Ruiters, Abraham, & Veldhuizen, 2014; Wiersum-Osselton et al., 2014). One study found that vasovagal reactions and fatigue, but not needle reactions, were negatively related to return rates (Van Dongen et al., 2013). Mixed results were found on the relationship between both age (Custer et al., 2012; Eder et al., 2012) and sex (Custer et al., 2012; Van Dongen et al., 2013; Veldhuizen et al., 2012; Wiersum-Osselton et al., 2014), and return rates after an adverse reaction.

Donors who were temporarily deferred were less likely to return (especially for first-time donors and longer deferral periods) and had lower donation frequencies after deferral (Custer et al., 2011; Gemelli et al., 2017; Hillgrove et al., 2011). Age and education were positively related to return after deferral (Custer et al., 2011).

Contextual characteristics

Besides individual characteristics, context also plays a role in blood donor behaviour. For example, it was found that children raised in a ‘blood donor family’ were more likely to become donors themselves (Pedersen et al., 2015). We will discuss contextual characteristics by differentiating between person related factors (i.e., urbanization, community characteristics, collective life events) and blood centre factors.

Person-related factors. In Spain and the US, no differences were found between people from rural and urban areas in their likelihood to donate (Abásolo & Tsuchiya, 2014; Gillum & Masters, 2010). In contrast, German municipalities with a larger population reported lower donation rates (Weidmann, Schneider, Litaker, Weck, & Klüter, 2012). Although there were no differences in donation frequency between urban and rural areas in the UK, people from London donated less than those in other regions (Lattimore et al., 2015). In contrast, Canadian, Greek and Serbian donors from metropolitan areas either showed higher propensities to donate (Vavic et al., 2012), or higher donation frequencies (James et al., 2014; Kalargirou et al., 2014) than donors from non-metropolitan areas. In Switzerland, living in an urban area was associated with higher chances of becoming an inactive donor (Volken et al., 2015).

In a German study, communities with a higher percentage of people aged 30 and above, a lower percentage of non-German inhabitants and a lower percentage of unemployed people had higher donor rates (Weidmann et al., 2012). There were no differences in propensity to donate between people living in low, mid or high-income regions (Abásolo & Tsuchiya, 2014; Weidmann et al., 2012). In Canada, communities with a higher proportion of singles and a lower proportion of children had higher annual donation rates. In contrast, communities with a higher proportion of educated people and higher immigrant rates had lower annual donation rates (Cimaroli et al., 2012).

As mentioned before, different motivations might be important for people in deciding to donate blood. One way these motivations can be triggered is by the occurrence of a life event. One study examined the effect of a collective, traumatic life event on donor behaviour (Tran et al., 2010). In the weeks after the terror attacks on September 11th 2001, the number of first-time donors was almost three times higher than in September 2000. However, the return rate of these first-time donors did not differ. Women and older people were more likely to become loyal donors compared to men and younger people.

Blood centre factors. BCAs play an important role in donor management, for example by providing information about donating blood, reminding donors about their next donation opportunity, and offering monetary or symbolic rewards. The effectiveness of information and reminders provided by BCAs was tested in seven experimental studies. People who read a short educational brochure on blood donation (e.g., information on the need for blood and the donation process) were more likely to sign up for an upcoming blood drive compared to people who read a standard blood bank brochure or a brochure unrelated to blood donation (France, France, Kowalsky, & Cornett, 2010). This effect was also present when donation-anxiety was heightened (i.e., in the presence of a mobile blood collection unit; Masser, France, Himawan, Hyde, & Smith, 2016b).

Both first-time and active donors who were reminded to donate by phone were more likely to donate than (first-time) donors who were not reminded (Garrett Whitney & Hall, 2010; Godin, Amireault, Vézina-Im, Germain, & Delage, 2011). Overall, men and older people were most likely

to donate after a call (Bruhin et al., 2015). First-time donors were especially likely to donate when they received both an informational brochure and a phone call reminder (Masser et al., 2016a). Among repeat donors, the combination of a phone call and an email reminder had a positive effect on return rates of men, but not women (Germain & Godin, 2016).

Moreover, not only the presence and content of the promotional and educational material of the BCA matters, the framing of these materials might also influence on donor behaviour (Chou & Murnighan, 2013; Moussaoui, Naef, Tissot, & Desrichard, 2016). First, Moussaoui and colleagues (2016) found that the return rate of lapsed donors did not vary when they received a donation invitation framed with a “save lives” messages or a neutral invitation. Chou and Murnighan (2013) even found that donors were more likely to donate at an upcoming blood drive when they received a loss-framed message (i.e., “help prevent someone from dying!”), than a gain-framed message (i.e., “help save someone’s life!”).

Canadian donors mentioned absence of a nearby blood drive as an important reason to reduce donation frequencies (Charbonneau et al., 2016). Within German communities, there was a relationship between available donation sites and donation rates for mobile sites but not for fixed sites (Weidmann et al., 2012). The relationship had an inverted U-shape, with the positive association decreasing as the number of sessions rose.

The effects of monetary rewards have been tested in experimental settings. When Italian donors were rewarded with one day paid leave, employed donors made, on average, one donation extra per year (most likely on Mondays and Fridays to extend their weekends) compared to self-employed or unemployed donors (Lacetera & Macis, 2013). Donation frequencies increased with the monetary value of incentives offered. Also, donors were more likely to donate in places where higher rewards were offered, especially younger donors (Lacetera et al., 2014).

Regarding non-monetary rewards, the number of donors and frequency of donations in the US increased when symbolic incentives were offered (e.g., t-shirts, coupons, mugs) and when their perceived value increased. If another donation site close to the donors standard centre offered an incentive, donors were more likely to move to that centre and adjust their timing to receive the incentive (Lacetera, Macis, & Slonim, 2012). When comparing the influence of private and public symbolic rewards (i.e., receiving a medal and being mentioned in the local newspaper, respectively) on donation frequency in Italy, Lacetera and Macis (2010) found that donors only increased their frequency when the thresholds for the public rewards were within reach. There was no decrease in donation frequency after these quotas were reached.

First-time donors satisfied with the overall donation experience were more likely to return to donate than those who were (moderately) unsatisfied (Garrett Whitney & Hall, 2010). However, only 1% of lapsed donors reported that dissatisfaction with the personnel was a barrier to donating (Charbonneau et al., 2016). Satisfaction with medical personnel was lower for younger donors (Vavic et al., 2012).

For men, but not for women, increased waiting time at the donation site decreased return rates (Craig, Garbarino, Heger, & Slonim, 2017). Among active donors, 28% reduced their donation frequency because of waiting time, while 23% of the donors mentioned it as a lapsing reason (Charbonneau et al., 2016).

There might be several other ways in which BCAs can influence donor behaviour. A post donation phone-interview (e.g., identifying motivations, making a donation plan) increased the likelihood for a subsequent donation, but not the donation frequency (Sinclair et al., 2010). Van Dongen and colleagues (2014) also showed the importance of making a donation planning, as for the third donation decision only planning failure was a significant predictor of non-return behaviour.

DISCUSSION

Essential findings

The goal of this review was to identify individual, network and contextual characteristics that relate to blood donor status and behaviour, and to systematically discuss differences between study results. We found empirical evidence on five main lines of research: donor demographics, motivations and barriers, adverse reactions and deferral, contextual factors, and blood centre factors.

Demographic characteristics are strongly related to donor status and behaviour. However, the results vary considerably between studies, countries, and sample characteristics. There is no general profile in terms of certain socio-demographic characteristics that is characteristic of first-time, loyal, frequent, or non-donors. Individual (non-)donor behaviour cannot be fully understood without taking into account the widely ranging cultural and historical contexts on national and regional levels. Previous research has suggested that donor profiles vary between blood collection regimes because donors are recruited using different strategies (Healy, 2000).

Self-reported barriers were quite consistent between studies. However, barriers to donate blood varied between members of different socio-demographic groups. Regarding motivations, we can conclude that blood donation is not just a purely altruistic act. Motivations to donate blood are dynamic and multidimensional, and include both self-regarding and other-regarding motives. These findings have implications for BCAs, as more tailored recruitment and retention campaigns might be able to more effectively address barriers and motivations for (non-)donors from specific socio-demographic groups.

Adverse reactions and deferral are negatively related to donor behaviour, especially for first-time donors. There might be a relation with donors' age and sex, but these results are inconclusive and understudied.

Regarding contextual factors, we cannot draw any strong conclusions. Results on urbanization and community characteristics are mixed, with no clear differences to be found between or within countries. Furthermore, we recognize culture as an important contextual factor (De Kort et al., 2010; Merz et al., 2016), but none of the studies investigated its role in relation to blood donor status or behaviour.

BCAs play an important role in blood donor behaviour. Providing information and reminders were effective ways of boosting attendance rates. Experimental studies on (non-) monetary rewards also showed promising results. However, since all studies were performed in two US and Italian cities by the same research group, more research is needed to draw conclusions on the generalizability of the results. Some other blood centre factors play a role as well (e.g., decreasing waiting time, planning future donations), but too few studies have investigated these factors to conclude on their effectiveness.

No studies were found on network characteristics of donors and non-donors. Although some studies included parental and partner status (Abásolo & Tsuchiya, 2014; Atsma et al., 2011; Gillum & Masters, 2010; Shehu et al., 2015), these relations could not exclusively be attributed to (social) networks, but also represent demographic transitions.

Limitations

Systematic reviews are limited by the quality of the available studies and more specifically, the representativeness and comparability of findings. Several of the included studies failed to describe basic sample characteristics (e.g., mean age, percentage of men and women), while others relied on non-random samples of university studies, making it difficult to generalize the study results and draw reliable conclusions.

With regard to comparability, a variety of concepts were used to study the same topic (e.g., community characteristics, self-reported barriers), while others used different definitions of donor status, making it difficult to compare findings across studies. In order to enable international comparisons, we would recommend the use of *DOMAINE* definitions (De Kort & Veldhuizen, 2010) to characterize groups of donors and their behaviour.

Future research

Despite the limitations, this review can serve as a basis for future research. First, we want to emphasize the importance of donor careers. Most research on donor behaviour and motivations used cross-sectional methods without taking into account that people and their behaviour might change. However, Ferguson and colleagues (2012a) showed how altruistic motives to donate blood differed between first-time, novice and experienced donors. We encourage the use of dynamic approaches and methods, following individual donors across several years to investigate motivational change.

Moreover, if behaviour and motivations change over time, it will be interesting to explore how, when and why these changes take place. One possibility might be the occurrence of a life event. Collective events seem to have an effect on donating blood for the first time (Tran et al., 2010), but based on self-reported barriers (Charbonneau et al., 2016; Duboz & Cunéo, 2010), we can assume that individual events have effects as well. For example, health-related events might increase the awareness of need for blood or feelings of social responsibility, making it more likely that a person starts donating or increases the frequency of donating. Other life events can influence the network characteristics of donors (e.g., moving to another city), which affect the propensity to donate due to decreased network influences.

Second, it is worthwhile to further explore network characteristics to discover how familial ties and peer pressure influence individual donor behaviour. Bani and Strepparava (2011) found that around 22% of the people were influenced by family and friends in their decision to donate, while Pedersen and colleagues (2015) suggested that familial and heritable influences could be even stronger, extending beyond donors' own awareness.

Finally, we suggest to pay attention to the broader level of contextual and blood centre factors. They are important from a practical point of view because they can be influenced by BCAs (e.g., providing information and reminders proved to have a positive influence on donor behaviour). Current research can be improved by modelling blood centre factors in hierarchical ('multilevel') models to investigate the role of contextual characteristics (e.g., regional differences within countries) in these BCA strategies. Also they can be tested in field experiments, which allow for stronger causal inferences.

In summary, this systematic review has provided an overview of the recent literature on individual and contextual characteristics related to blood donor status and behaviour. If the great diversity of the results have one thing in common, it is that blood donor behaviour cannot be understood from one set of (non-)donor characteristics, as we have already stressed the importance of cultural and historical contexts in individual behaviour. Research on donor behaviour should try to explore the interrelationships between the individual, contextual, and network levels (e.g., multilevel designs and longitudinal studies), which could help us to better understand donor behaviour, and further assist BCAs in designing tailored recruitment and retention strategies. We hope that this will contribute to safeguarding a sufficient and matching blood supply in the future.





BLOOD DONATION ACROSS THE LIFE COURSE: THE INFLUENCE OF LIFE EVENTS ON DONOR LAPSE

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All authors contributed to the study design. TP developed the main conceptual ideas and wrote the manuscript with support from all other authors. TP wrote the code and performed the statistical analyses, with the help from Femmeke Prinsze (department of Donor Medicine Research, Sanquin Research) in constructing the blood donor database. Appendices 3.1 – 3.3 are available online at: osf.io/pzhuv/.

ABSTRACT

In this chapter, we examine how blood donation loyalty changes across the life course as a result of life events. Previous studies have shown that life events affect involvement in prosocial behaviour, possibly as a result of loss of human and social capital. Using register data from the blood collection agency in the Netherlands, linked to longitudinal survey data from the Donor InSight study ($n = 20,560$), we examined whether life events are related to blood donor lapse. Childbirth, losing a job, and starting a job increase the likelihood of donor lapse, while health-related events (i.e., blood transfusion in a family member, death of a family member) decrease the likelihood of donor lapse. Moreover, results showed how social and practical concerns explain donors' decisions to donate blood after the occurrence of life events. We discuss theoretical implications for further studies on prosocial and health-related behaviour.

INTRODUCTION

Prosocial behaviour can take many forms, ranging from volunteer work for the local community to charitable giving to international causes and from living blood donation to post-mortem organ donation. These examples share the characteristic that they are intended to help one or more people other than the self. The likelihood to be involved in prosocial activities not only varies between persons but also within persons across their life course. Taking blood donation as an example, our study addressed the following question: How does prosocial behaviour change across the life course as a result of life events?

Previous life course studies – dating back to the late 1970s (Knoke & Thomson, 1977; Mortimer & Shanahan, 2002) – have examined how civic engagement and involvement in prosocial behaviour are susceptible to change over time. For instance, changes in the likelihood and frequency of volunteering are shown to be related to life events, especially in the family domain. Having young children is often a detrimental factor for volunteering (Einolf, 2018; Nesbit, 2012). Work-related events affect volunteering to a lesser extent, although full-time employment and job loss were both found to decrease volunteer rates in men (Lancee & Radl, 2014; Oesterle et al., 2004).

The current study focused on blood donation in the Netherlands to broaden our theoretical understanding of changes in prosocial behaviour across the life course. Donating blood is a typical prosocial act that is completely voluntary and anonymous – and benefits the recipient at a cost to the donor in terms of discomfort and time. Yet, cultural differences in blood donation do exist between countries. For instance, in the Netherlands – being a fairly small European country with a population of about 17 million – blood collection is organized around a monopolist blood collection agency (BCA), which annually collects whole blood and plasma from approximately 330,000 non-remunerated donors at 39 fixed and 82 mobile collection sites throughout the country. This system largely contrasts to the collection system in the United States – population about 330 million – for example, where the American Red Cross as well as large numbers of non-profit community-based blood banks provide blood to local hospitals, all of which have their own guidelines on (financially) remunerating their donors. In his analysis of the relation between institutional factors and blood donor behaviour, Healy (2000) showed that the way blood collection is organized in a country relates to the diversity and loyalty of blood donors. For instance, blood collection via the Red Cross is likely to attract non-diverse but loyal donors due to their embeddedness in religious communities, while blood banking systems are more likely to attract diverse but incidental donors.

Despite cross-country differences in donor diversity and loyalty, BCAs in Europe and the United States share the characteristic that the number of blood donors is steadily decreasing, making studies on blood donor behaviour socially relevant. While there is an urgent need to build solid groups of committed donors to guarantee a sufficient blood supply (Greinacher

et al., 2017), every year, 5% of the Dutch donor population (approximately 20,000 donors) withdraw from the donor pool due to nonmedical reasons (Klinkenberg et al., 2018b). For BCAs to design more effective retention strategies, it is important to gain in-depth knowledge of decisive moments in blood donors' lives to stop or resume donating.

Furthermore, previous donor studies have shown that nonmedical, self-reported reasons to stop donating blood, such as time constraints and decreased social connections, are notably related to life events such as childbirth and changing jobs (Piersma et al., 2017). However, a major shortcoming of these studies is that they typically relied on cross-sectional data, measuring donor behaviour and motivations at one point in time without taking into account that people and their behaviour are susceptible to change (Bart, Volken, Fischer, & Mansouri Taleghani, 2014). While findings from these cross-sectional analyses illustrated the potential influence of life events, it is not clear whether there exists a causal relationship with blood donor behaviour over time. In line with Healy's (2000) key ideas, emphasizing the importance of endogenous factors as determinants of donor behaviour, we examined whether changes in the work and family domain as well as health-related life events in the family explain changes in blood donation across the life course. More specifically, we examined at what moments blood donors were at risk for lapse, that is, a transition from active to inactive donor.

Moreover, we investigated *why* certain events were related to blood donor lapse. The integrated theory of volunteering (Wilson & Musick, 1997) explained effects of life events on prosocial behaviour to be a result of changes in human and social capital: life events affecting available time, health, and social connectedness subsequently affect the likelihood of being involved in prosocial behaviour. Previous research showed that blood donation is indeed sensitive to the material costs that donors have to incur (Schreiber et al., 2006). Individuals with more human capital (e.g., available time and health) and social capital (e.g., social connections) were more likely to donate blood (Bekkers, 2006). As these predictions have rarely been tested in relation to life events, we linked large-scale longitudinal survey data from the Donor InSight study (Timmer et al., 2019) to register data from the BCA in the Netherlands (Sanquin, 2018a) to study whether life events influenced blood donor lapse and to what extent changes in available time, health, and social connections explained these effects.

Human and social capital affect blood donation

To increase knowledge about determinants of prosociality in the case of blood donation, we integrate human and social capital theories within a life course perspective (Elder, 1994; Elder et al., 2003), leading to a number of testable hypotheses. The life course perspective is a well-established framework for studying various kinds of human behaviour and its development over time. It examines human agency, links life stages over time, and studies behaviour within social networks and sociocultural contexts. Adapting these life course principles are key in understanding transitions in blood donor behaviour over time as a result of life events. We believe that circumstances in people's lives shape donors' human

and social capital, making it more or less likely that they continue to donate blood over time (Figure 3.1). We will elaborate on the potential role of human and social capital in shaping blood donor behaviour over the life course.

Human capital and the resources perspective. Human capital is the set of people's individual assets or resources enabling certain behaviour. Sufficient time and health are needed to meet minimal blood donation criteria (Bekkers, 2006). As a result, giving blood depends on a person's available time and health resources: The resource-rich are more likely to be involved in prosocial behaviour than the resource-poor (Musick & Wilson, 2008) as the relative costs of donating blood are lower for individuals who are healthier and have more time. Life events affecting a person's available time and health are therefore likely to influence their likelihood of being involved in blood donation.

The trade-off between resources and blood donation is not always as straightforward as it seems. A study on blood donor demographics concluded that donors did not differ from non-donors in terms of their employment status (Priller & Schupp, 2011). Kalargirou and colleagues (2014) even showed that people who are employed are more likely to be donors than those who do not have a job. Although the unemployed do have more available time, they are not more likely to donate blood as it is questionable to what extent this relatively small investment of time is a reason for donor lapse. Such counterintuitive findings can be explained by the theory of social capital.

Social capital and the network perspective. Social capital is defined as the set of people's social connections within their social network and the behavioural norms that arise from them (Lin, 1999). People who have many formal and informal social connections and are part of larger social networks have a higher likelihood of being involved in prosocial behaviour (Wilson & Musick, 1998). The influence of friends, family, and co-workers was indeed reported as being a motivator for people to start giving blood (Bani & Strepparava, 2011; Misje et al., 2005).

When donors are exposed to behavioural norms that encourage blood donation, for instance, by talking about blood donation and knowing other blood donors, their loyalty may increase because the costs of not complying with these behavioural norms become higher. Consistent with what social capital theory predicts, the meta-analysis by Bednall and colleagues (2013) showed subjective and descriptive norms to be positively related with the likelihood of donating blood. The size and composition of social networks change over time due to the occurrence of life events, such as entering the labour market or the death of a relative (Wrzus et al., 2013). Life events that affect a person's social network are therefore likely to influence their likelihood of being involved in blood donation.

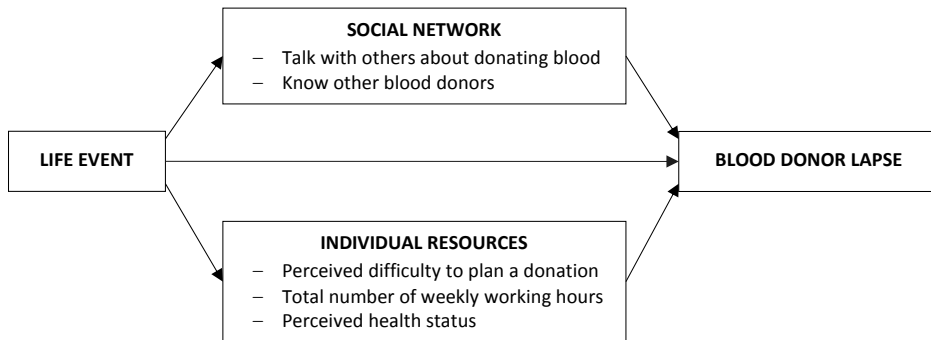


Figure 3.1 Conceptual model for the hypothesized relation between life events and blood donor lapse, with individual resources and social networks as mediators of the main effects.

Life events affecting blood donation

The expected relations between life events and blood donor lapse are displayed in Figure 3.1, including the potential mediating mechanisms derived from human and social capital theories. For each life event (i.e., a blood transfusion in a family member, a serious disease in a family member, the death of a family member, childbirth, starting a job, losing a job), we describe its impact on donor lapse, following the resources perspective and the social network perspective. These life events were selected because they yielded interesting findings in previous empirical studies, although we do not expect all life events to be associated with all mediating mechanisms in the model. We elaborate on specific hypotheses and previous empirical findings in the following sections.

Changes in health of family members. To explore the relation between health-related philanthropy and health-related life events, we examined whether a blood transfusion in a family member, a serious disease in a family member, or the death of a family member were related to blood donor lapse. Although these events are qualitatively different, they share a common element that links them to blood donation: They connect acquaintances and family of patients to medical systems and the need for blood. Following the resources perspective, health-related events may be hypothesized to have a negative influence on donor behaviour. Health adversity among family members could make it more difficult for donors to plan a donation as taking care of loved ones takes time and is likely to be prioritized over donating blood. In general, lack of time is one of the most common self-reported reasons to stop donating blood (Piersma et al., 2017), therefore hypothesizing that:

Hypothesis 1a: Donors who experienced a health-related event in the family are more likely to lapse compared to donors who did not experience a health-related event in the family.

Hypothesis 1b: After experiencing a health-related event in the family, donors find it more difficult to plan a donation, explaining why these donors are more likely to lapse.

A contrasting hypothesis on the effect of health-related events follows from the social network perspective. The likelihood of donating blood could increase after a health-related event because people talk about donating more often or get to know other blood donors. Several cross-sectional studies reported that health-related issues in the family, such as a blood transfusion, were a motivational factor in the decision to donate (e.g., Charbonneau et al., 2015). Moreover, a relation was found between health issues and donor loyalty: Donors with a family member who experienced a blood transfusion had a higher number of lifetime donations than donors who did not have a transfused family member (Bani & Strepparava, 2011). Based on the social network perspective, we hypothesized that:

Hypothesis 2a: Donors who experienced a health-related event in the family are less likely to lapse compared to donors who did not experience a health-related event in the family.

Hypothesis 2b: After experiencing a health-related event in the family, donors talk about donation more often and know more other donors, explaining why these donors are less likely to lapse.

Childbirth. Lack of time because of family responsibilities is a commonly reported barrier to donating blood (Piersma et al., 2017). As these conclusions are based on self-reported, cross-sectional studies, it remains unclear to what extent childbirth affects donor lapse over time. Longitudinal studies on volunteer work reported that the presence of young children in the family hindered volunteer participation (Nesbit, 2012; Oesterle et al., 2004) as childbirth may deeply affect the parents' available time and health resources (Elder & Greene, 2012).

Lack of time due to family responsibilities was reported more often by male than female blood donors (Charbonneau et al., 2016), although longitudinal studies on volunteer work contrasted these gender differences, with childbirth being detrimental for women's involvement in volunteer work but not men's (Lancee & Radl, 2014; Quaranta, 2016). We anticipate childbirth to have a larger effect on donor lapse in women than men because women are simply not allowed to donate blood during pregnancy, within six months after childbirth, and while breastfeeding. Donors who are deferred for longer periods of time are less likely to return for a subsequent donation (Custer et al., 2011). Following the resources perspective, we hypothesized that:

Hypothesis 3a: Donors who experienced childbirth are more likely to lapse compared to donors who did not experience childbirth.

Hypothesis 3b: After childbirth, donors find it more difficult to plan a donation and perceive themselves to be less healthy, explaining why these donors are more likely to lapse.

Hypothesis 3c: Childbirth has a larger effect on the lapsing risk in women than men.

Labour market transitions. Entering and leaving the labour market is likely to have negative consequences for blood donation, increasing the risk for lapse. Starting a job increases working hours, with time constraint due to work schedule conflicts being one of the most common self-reported barriers to donating blood (Charbonneau et al., 2016; Klinkenberg et al., 2018b). Yet, time is probably not the only constraining factor. Previous studies showed that losing a job and unemployment are negatively related to health status (Schmitz, 2011), likely leading to more (self-)deferrals and higher lapsing rates. Moreover, Charbonneau and colleagues (2015) reported that some blood donors were convinced by their colleagues to donate blood. Donors who were recruited in the workplace and talked about donating with colleagues were more likely to stop donating blood after they left this network. Based on these findings, we expect that:

Hypothesis 4a: Donors who started a job or lost their job are more likely to lapse compared to donors who remained unemployed or kept their job, respectively.

Hypothesis 4b: After starting a job, donors have a higher number of working hours and find it more difficult to plan a donation, explaining why these donors are more likely to lapse.

Hypothesis 4c: After losing a job, donors perceive themselves to be less healthy, talk about blood donation less often, and know fewer other donors, explaining why these donors are more likely to lapse.

In contrast, we could also expect labour market transitions to positively influence donor behaviour, decreasing the risk for lapse. For donors who lose their job, their working hours decrease, which might make it easier to plan a donation. Moreover, the study by Priller and Schupp (2011) on blood donation and volunteer work suggested that an increase in working hours is not necessarily related to a decrease in prosocial behaviour. Donors who start a job enter new social networks, which increases the likelihood to get to know other donors and talk about donation (Charbonneau et al., 2015). Based on competing explanations from both perspectives, we hypothesized that:

Hypothesis 5a: Donors who started a job or lost their job are less likely to lapse compared to donors who remained unemployed or kept their job, respectively.

Hypothesis 5b: After losing a job, donors have a lower number of working hours and find it less difficult to plan a donation, explaining why these donors are less likely to lapse.

Hypothesis 5c: After starting a job, donors talk about blood donation more often and know more other donors, explaining why these donors are less likely to lapse.

MATERIALS AND METHODS

Data and procedure

To explore relations between life events and blood donor lapse, we analysed the behaviour of 20,560 whole-blood and plasma donors in the Netherlands using data from two databases: the Dutch blood donor database (eProgesa; Sanquin, 2018a) and two waves of the Donor InSight study (DIS; Timmer et al., 2019).

DIS is a large-scale longitudinal survey among a representative sample of Dutch blood donors, registering socio-demographic characteristics, donor health, life events, and motivations to donate blood. The first wave, DIS-I, was collected in 2007 to 2009 and included 31,338 donors. DIS-I had a response rate of 62.8%, which is relatively high compared to other large-scale surveys in the Netherlands (De Leeuw & De Heer, 2002). Nonresponse analyses showed statistically significant yet very small differences between DIS-I respondents and non-respondents with respect to age, sex, and total number of blood donations (Appendix 3.1). The second wave, DIS-II, was collected in 2012 to 2013 and included 34,826 donors. A total of 22,132 donors participated in both waves of DIS, with an attrition rate of 29.4% and an average between-surveys duration of 52 months ($SD = 3.7$, range = 41-63). The complete DIS-I and DIS-II questionnaires can be found on our Open Science Framework (OSF) project page: osf.io/26b83/.

Information from these 22,132 blood donors was linked to the Dutch blood donor database (i.e., register data on all Dutch whole-blood and plasma donors and their behaviour, such as number of donations, return rates, and deferral reasons), based on anonymous personal identification numbers, after permission from the Sanquin Ethics Advisory Board and with informed consent of the study participants. In this linked longitudinal sample, 1,572 donors were excluded because they were ineligible for future blood donations, did not make at least one whole-blood or plasma donation, or did not provide enough information on the occurrence of life events, resulting in a final study sample of 20,560 blood donors.

By linking these databases, we were able to examine whether donors who experienced a life event between DIS-I and DIS-II were more or less likely to lapse than donors who did not experience this life event and whether individual and social mechanisms (measured at the time of DIS-II) were able to explain the relation between the occurrence of life events and donor lapse (Figure 3.2).

Measures

Blood donor lapse. Following the internationally acknowledged and widely used definition in European blood donor management (DOMAINE; De Kort & Veldhuizen, 2010), a lapsed donor was defined as a registered donor who made at least one donation but did not donate in the last 24 months. Hence, we defined two groups: 1) lapsed donors without a donation during the 24 months after completing DIS-II and 2) active donors with at least one donation during these 24 months (1 = lapsed donor, 0 = active donor).

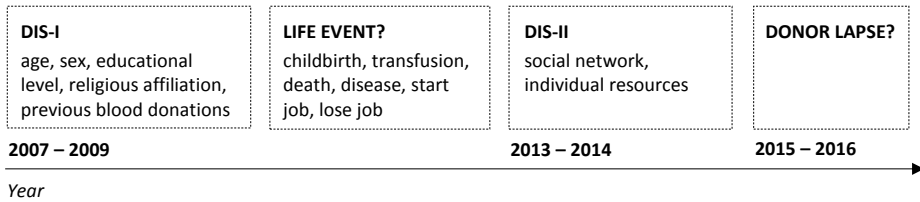


Figure 3.2 Overview of the timing of all measures used in the statistical analyses.

Life events. DIS-I and DIS-II included questions on three categories of life events relevant to our study: health-related events in the family, childbirth, and labour market transitions. With regard to health-related events, donors were asked whether any of their direct family members (i.e., parents, siblings, children) had died, received a blood transfusion, or suffered from a serious disease (i.e., cancer, stroke, heart attack). Dummy variables were created representing the occurrence of these events between DIS-I and DIS-II (e.g., 1 = family member died, 0 = no family member died). For childbirth, a dummy variable was created representing whether a child was born to the donor between DIS-I and DIS-II (1 = child born, 0 = no child born). Starting and losing a job were included as life events related to donors' labour market transitions by comparing the donors' answers on the employment status question in DIS-I and DIS-II. Dummy variables were created representing whether the donor started a job or lost their job between DIS-I and DIS-II (e.g., 1 = donor started a job, 0 = donor remained unemployed).

Mechanisms. Two different mechanisms were defined explaining the possible relations between life events and blood donor lapse: the costs of donating blood and influences from the social network. Costs were measured by three proxy variables: total working hours per week, perceived difficulty to plan a blood donation, and perceived health status at the time of DIS-II. Total working hours per week were measured by an open-ended question, with a higher number of working hours per week representing higher costs to donate blood as time becomes a scarcer resource. Perceived difficulty to plan a blood

donation was measured on a five-point Likert scale ranging from “completely disagree” to “completely agree,” with respondents indicating to what degree they perceived that “it is easy for me to plan giving blood in my life.” Answers were then inversely recoded where a higher score reflected higher costs to donate blood. The perceived health status of the respondent was measured by four statements on a five-point Likert scale (i.e., “I seem to get ill more easily than other people,” “I am just as healthy as other people I know,” “I expect my health to get worse in the coming years,” and “my health is excellent”). Statements were recoded so that a higher score reflected higher costs to donate blood (i.e., the higher the score, the more the respondents perceived themselves to be unhealthy), ranging from “completely disagree” to “completely agree” ($\alpha = .69$). Factor analysis (Principal Axis Factoring with Varimax rotation) showed the four items to load on a single factor, after which regression scores were saved as a variable representing the perceived health of the donor. Total working hours per week, perceived difficulty to donate blood, and perceived health status were included in the analyses as separate indicators of the costs of donating blood.

Influences from the social network were measured by two proxy variables: talking to others about donating blood and knowing other blood donors at the time of DIS-II. Talking about donation was measured on a four-point Likert scale, asking the respondent, “How often do you talk about blood donation with people around you?,” ranging from “never” to “often.” Whether the donor knew any other blood donors was measured by asking: “Are there people among your direct acquaintances who are blood donors?” Respondents could choose multiple options from a list (i.e., no, partner, family members, friends, acquaintances), and their answers were recoded into a dichotomous variable representing whether they knew a blood donor (1 = knows other donors, 0 = does not know other donors). Talking about blood donation and knowing other donors were included in the analyses as separate indicators of the influences from the social network.

Control variables. Donors’ age, sex, educational level, religious denomination, and total number of previous blood donations at the time of DIS-I were included as control variables as these donor characteristics were shown to be related to the likelihood to donate blood (Piersma et al., 2017). Educational level was measured in three categories: low (i.e., none, prevocational secondary education, and lower general secondary education), middle (i.e., senior secondary vocational education, senior general secondary education, and pre-university education), and high (i.e., higher professional education and university education). Religious denomination was measured on a yes-no basis and recoded into four categories: not religious, Protestant (i.e., Dutch Reformed, Reformed, and Protestant), Catholic (i.e., Roman Catholic), and other religion (e.g., Muslim, Hindu, and Buddhist).

Statistical analyses

Logistic regression analyses using Stata 15 (College Station, TX: StataCorp LLC) were performed to estimate the effect of life events on blood donor lapse, adjusted for socio-demographic variables. Respondents were included in the analyses if they were “at risk” for experiencing the life event of interest between DIS-I and DIS-II. For childbirth, we included women aged 45 or younger and men aged 55 or younger ($n = 11,695$), based on studies in biology showing the positive relation between aging and infertility rates (Harris, Fronczak, Roth, & Meacham, 2011). For starting a job, we included all respondents who were unemployed ($n = 1,713$); for losing a job, we included all respondents who were employed ($n = 15,356$). No selection was applied to analyses for health-related events.

Subsequently, we added an interaction between sex of the donor and childbirth to examine whether childbirth differently affected blood donor lapse for men and women. Third, mediation analyses (i.e., $Z_{Mediation}$; Iacobucci, 2012) were performed to test the extent to which costs of donating blood (i.e., working hours, difficulty to plan a donation, and health status) and influences from the social network (i.e., talking to others about donation and knowing other donors) could explain the effects of life events on blood donor lapse, only if the main effect proved to be statistically significant.

RESULTS

Life events and Dutch donors

The mean age of the study sample was 46.7 years ($SD = 12.28$), consisted of 10,854 female donors (52.8%), and had an average number of 27.4 previous donations ($SD = 24.41$; range = 1-335). Of these donors, about a quarter (25.3%, $n = 5,197$) lapsed during the 24 months after DIS-II. Across all life event categories, health-related events were reported most often: 40.5% ($n = 8,319$) experienced a serious disease in the family, 18.9% ($n = 3,884$) experienced the death of a relative, and 9% ($n = 1,855$) had a family member receiving a blood transfusion. Overall, 58.5% ($n = 12,036$) of the blood donors experienced at least one life event of interest. An overview of sample characteristics and descriptive statistics of all study measures is found in Table 3.1.

The descriptive analyses suggested childbirth and losing a job to occur slightly more often among lapsed donors, with both events being positively correlated to donor lapse ($r = .10$, $p < .001$; $r = .03$, $p < .01$, respectively). However, a blood transfusion in a family member and death of a family member occurred slightly more often among active donors, with these events being negatively yet marginally correlated to donor lapse ($r = -.02$, $p < .01$, for both events). For more information, see Appendix 3.2, which includes correlations between all study measures. We now discuss the results for each life event, with complete results of the logistic regression and mediation analyses shown in Table 3.2 (see Appendix 3.3 for the a-path estimates of the mediation analyses).

Table 3.1 Descriptive statistics of study measures, for total sample and stratified by donor status^a.

Characteristics	All donors (<i>n</i> = 20,560)	Active donors (<i>n</i> = 15,363; 74.7%)	Lapsed donors (<i>n</i> = 5,197; 25.3%)
Life events			
Transfusion	1,855 (9.0%)	1,425 (9.3%)	430 (8.3%)
Serious disease	8,319 (40.5%)	6,206 (40.4%)	2,113 (40.7%)
Death	3,884 (18.9%)	2,966 (19.3%)	918 (17.7%)
Childbirth	2,071 (10.1%)	1,268 (8.3%)	803 (15.5%)
Starting a job	469 (2.3%)	343 (2.2%)	126 (2.4%)
Losing a job	622 (3.0%)	447 (2.9%)	175 (3.4%)
Costs			
Working hours	25.6 (±16.7)	26.7 (±16.4)	22.5 (±17.3)
Perceived difficulty to plan donation	1.95 (±1.03)	1.82 (±0.92)	2.32 (±1.22)
Perceived health status	1.91 (±0.65)	1.86 (±0.61)	2.03 (±0.72)
Social network			
Talk about donation	2.07 (±0.50)	2.08 (±0.48)	2.06 (±0.54)
Know other donors	15,056 (73.2%)	11,481 (74.7%)	3,575 (68.8%)
Age	46.7 (±12.28)	46.7 (±11.38)	46.9 (±14.61)
Sex			
Male	9,706 (47.2%)	7,606 (49.5%)	2,100 (40.5%)
Female	10,854 (52.8%)	7,757 (50.5%)	3,097 (59.6%)
Educational level			
Low	517 (2.5%)	363 (2.4%)	154 (3.0%)
Middle	12,479 (60.7%)	9,513 (61.9%)	2,966 (57.1%)
High	7,476 (36.4%)	5,417 (35.3%)	2,059 (39.6%)
Religious denomination			
Roman Catholic	6,277 (30.5%)	4,797 (31.2%)	1,480 (28.5%)
Protestant	4,771 (23.2%)	3,583 (23.3%)	1,188 (22.9%)
Other	754 (3.7%)	557 (3.6%)	197 (3.8%)
None	8,684 (42.2%)	6,384 (41.6%)	2,300 (44.3%)
Previous blood donations	21 (10-37)	23 (11-39)	16 (8-31)

^a Data reported as mean (±SD), number (%), or median (25th-75th)

Health of family members

Blood transfusion in a family member. Donors who experienced a blood transfusion in a family member had 13% lower odds of lapsing than donors who did not experience such an event (*OR* (95% *CI*) = .87 (.78, .98), *p* < .05). Subsequent mediation analyses showed no significant relationship between either talking about donation or knowing more donors and experiencing a blood transfusion in a family member. These results were in support

of Hypothesis 2a as we found a significant relation between a blood transfusion and a decreased likelihood for donor lapse, while rejecting Hypothesis 2b as no evidence was found for the expected mediating variables.

Serious disease in a family member. No significant relation was found between experiencing a serious disease in a family member and blood donor lapse. Also, none of the hypothesized mediating mechanisms was significantly related to a serious disease in a family member, hereby rejecting Hypotheses 1 and 2 with regard to this specific health-related event.

Death of a family member. Blood donors who recently lost a family member had 10% lower odds of lapsing than donors who did not experience the death of a family member during the same period (OR (95% CI) = .90 (.83, .98), $p < .05$). However, none of the hypothesized mediating variables (i.e., talking about donation, knowing more donors) was significantly related to the death of a family member. With regard to this specific health-related event, Hypotheses 2a was supported as we found a negative relation between death of a family member and donor lapse, while rejecting Hypothesis 2b as no evidence was found for the expected mediating variables.

Childbirth

Blood donors who recently had a child had 83% higher odds of lapsing than donors who did not experience childbirth during the same period (OR (95% CI) = 1.83 (1.63, 2.00), $p < .001$), hereby supporting Hypothesis 3a. Mediation analysis showed that childbirth was significantly related to the perceived difficulty to plan a donation (OR (95% CI) = 1.54 (1.40, 1.69), $p < .001$) and that the difficulty to plan a donation was also significantly related to blood donor lapse (OR (95% CI) = 1.81 (1.74, 1.89), $p < .001$). $Z_{Mediation}$ showed that the perceived difficulty to plan a donation was a significant mediator of the relationship between childbirth and donor lapse ($z = 8.53$, $p < .001$). However, we could only partially support Hypothesis 3b as we found no mediating role of the perceived health status of the donor. Moreover, no significant differences were found for men and women in their likelihood to lapse after childbirth, which contrasts expectations stated in Hypothesis 3c.

Labour market transitions

Starting a job. Blood donors who started a job had 34% higher odds of lapsing than blood donors who remained unemployed in the same period (OR (95% CI) = 1.34 (1.02, 1.77), $p < .05$), hereby supporting Hypothesis 4a with regard to this specific labour market transition. Using mediation analyses, we examined whether the positive relation between starting a job and donor lapse could be explained by increased working hours and the increased perceived difficulty to plan a donation. Positive, significant relations were found between

starting a job and increased working hours ($\beta = .70$, $t = 40.06$, $p < .001$) and between increased working hours and donor lapse (OR (95% CI) = 1.02 (1.01, 1.04), $p < .05$). Also, positive, significant relations were found between starting a job and perceived difficulty to plan a donation (OR (95% CI) = 1.34 (1.02, 1.77), $p < .05$) and between perceived difficulty to plan a donation and donor lapse (OR (95% CI) = 1.56 (1.37, 1.76), $p < .001$). $Z_{Mediation}$ showed these mechanisms to be significant mediators of the relationship between starting a job and donor lapse ($z = 2.85$, $p < .01$; $z = 3.22$, $p < .01$, respectively), hereby supporting expectations stated in Hypothesis 4b.

Losing a job. Blood donors who lost their job had 50% higher odds of lapsing than those who kept their job in the same period (OR (95% CI) = 1.50 (1.25, 1.80), $p < .001$), confirming expectations from Hypothesis 4c. To examine the role of mediating mechanisms, we analysed whether a decreased perceived health status, talking less about donation, and knowing fewer other donors explained the relation between losing a job and donor lapse. Results indeed show that losing a job was significantly related to a decreased perceived health status (OR (95% CI) = 1.45 (1.25, 1.67), $p < .001$), talking less about donation (OR (95% CI) = .79 (.65, .97), $p < .05$), and knowing fewer other donors (OR (95% CI) = .74 (.62, .89), $p < .01$). Moreover, all three mechanisms were significantly related to donor lapse. $Z_{Mediation}$ showed the decreased perceived health status and knowing fewer other donors to significantly mediate the main effect ($z = 4.57$, $p < .001$; $z = 2.68$, $p < .01$, respectively), hereby partially supporting Hypothesis 4c.

DISCUSSION

Based on a large-scale longitudinal survey and register data of Dutch blood donors, we investigated the impact of life events on blood donor lapse and examined whether costs and influences from the social network were able to explain this relationship. Life events related to the health of family members, family composition, and labour market transitions all impact blood donor lapse. In line with Elder's (1994) life course perspective, our findings suggest that social and practical concerns indeed play a role in people's decision to donate blood and that this decision is susceptible to change over time.

Human capital and the resources perspective

Following the resources perspective, we found evidence that blood donors make a decision to continue to donate based on their available time. Childbirth increased the likelihood for donor lapse, partially explained by increased perceived difficulty to plan a donation. Remarkably, we did not find differences between men and women, while previous Dutch and Italian studies on volunteer work showed that the presence of young children in the

Table 3.2 Results for the logistic regression analyses of life events on donor lapse^a, mediated by the hypothesized mechanisms^b.

Life events & mechanisms ^c	Model A		
	B ^d	SE	OR ^e (95% CI)
Transfusion	-.13*	.06	.87 (.78-.98)
Talk about donation			
Transfusion	-.13*	.06	.87 (.78-.98)
Know other donors			
Serious disease	.02	.03	1.02 (.95-1.09)
Talk about donation			
Serious disease	.02	.03	1.02 (.95-1.09)
Know other donors			
Death	-.11*	.04	.90 (.83-.98)
Talk about donation			
Death	-.11*	.04	.90 (.83-.98)
Know other donors			
Childbirth	.60***	.06	1.83 (1.63-2.00)
Perceived difficulty to plan donation			
Childbirth	.60***	.06	1.83 (1.63-2.00)
Perceived health status			
Start job	.30*	.15	1.34 (1.02-1.77)
Increased working hours			
Start job	.30*	.15	1.34 (1.02-1.77)
Perceived difficulty to plan donation			
Lose job	.40***	.09	1.50 (1.25-1.80)
Perceived health status			
Lose job	.40***	.09	1.50 (1.25-1.80)
Know other donors			
Lose job	.40***	.09	1.50 (1.25-1.80)
Talk about donation			

^a Blood donor lapse for non-medical reasons. ^b Effects are estimated separately for each life event, only when the donor is at risk for experiencing the life event: childbirth ($n = 11,695$), transfusion, serious disease and death ($n = 20,560$), start job ($n = 1,713$), lose job ($n = 15,356$). ^c Results adjusted for donors' sex, age, educational level, religious denomination and the total number of previous blood donations.

household negatively influenced volunteer work for women but not men (Lancee & Radl, 2014; Quaranta, 2016). This moderating effect of gender is ascribed to cultural differences, with women mainly taking up responsibility for child care in certain countries. It can also be argued that local regulations affect the impact of life events on prosocial behaviour as regulations regarding parental care after childbirth differ significantly between countries. In the Netherlands, fathers have only two days off after childbirth, posing constraints on their available time. In countries with extended paternity leave, fathers have more time after childbirth, making it more likely to stay involved in prosocial activities.

Model B			
B	SE	OR (95% CI)	Z-value^f
-.14*	.06	.87 (.79-.98)	
-.04	.04	.96 (.90-1.02)	.68
-.14*	.06	.87 (.78-.98)	
-.28***	.04	.76 (.70-.81)	1.33
.01	.03	1.01 (.95-1.08)	
-.04	.03	.96 (.90-1.03)	.36
.01	.03	1.01 (.95-1.08)	
-.27***	.04	.76 (.71-.81)	1.92
-.11*	.04	.90 (.82-.98)	
-.03	.04	.97 (.91-1.04)	.04
-.12*	.04	.89 (.82-.97)	
-.27***	.04	.77 (.71-.83)	.15
.49***	.06	1.64 (1.46-1.84)	
.60***	.02	1.81 (1.74-1.89)	8.53***
.62***	.06	1.86 (1.66-2.09)	
.38***	.03	1.46 (1.36-1.56)	1.47
.12	.23	1.08 (.77-1.38)	
.02*	.01	1.02 (1.01-1.04)	2.85**
.18	.15	1.20 (.89-1.62)	
.44***	.06	1.56 (1.37-1.76)	3.22**
.31***	.10	1.37 (1.13-1.65)	
.38***	.03	1.46 (1.38-1.55)	4.57***
.39***	.10	1.48 (1.48-1.23)	
-.27***	.05	.76 (.70-.84)	2.68**
.39***	.10	1.48 (1.23-1.79)	
-.24**	.04	.79 (.73-.86)	1.40

^d Estimated unstandardized regression coefficients. ^e OR indicates the odds of lapsing compared to the reference category. ^f Results for the $Z_{\text{Mediation}}$ analyses (Iacobucci, 2012), with corresponding a-path estimates to be found in Appendix 3.3.

*** $p < .001$ ** $p < .01$ * $p < .05$ (two-tailed tests).

Moreover, we found that starting a job is detrimental for blood donation, partially explained by an increase in working hours. Yet, it is questionable whether time constraints are the real reason for donor lapse. It might well be possible that people perceive that donating blood requires more time and effort than it actually does – a whole blood donation typically takes less than one hour – or that a lack of time is used as excuse for other donation barriers such as fear of adverse reactions, inconvenience, or reduced donation efficacy due to worse health.

Social capital and the network perspective

Following the social network perspective, our results indicate that the trade-off between resources and blood donation is indeed not as straightforward as it seems: Donors who lost their job were more likely to lapse than donors who kept their job, with knowing fewer donors after losing a job partially explaining this effect. Previous studies indeed suggested that the presence of blood donors in the network might influence the decision to start or continue donating (Bani & Strepparava, 2011; Charbonneau et al., 2015). As the effects are small, however, we might argue that social pressure and norms in the workplace are weaker forces in blood donation than peer pressure from friends and family. This “peer proximity” effect, that is, stronger influence from proximal than distal peers (Bearman, Bruckner, Brown, Theobald, & Philliber, 1999), has already been shown to moderate the influence of peer pressure on, among others, smoking (Paek & Gunther, 2007), alcohol consumption (Yanovitzky, Stewart, & Lederman, 2006), and physical activity (Randazzo & Solmon, 2018).

The lack of explanatory power of social influences might also be explained by the difference between short-term and long-term effects of life events. Time constraints due to work or family responsibilities have an immediate effect on day-to-day planning, but it takes more than a day to build social networks. For instance, regarding childbirth, it is assumed that children create more possibilities in terms of social contacts and social integration as parents usually have larger social networks created through their children (Bost, Cox, Burchinal, & Payne, 2002). Social network engagement, however, has been found to be dependent on the children’s age (Einolf, 2018), which may either promote social isolation or social integration (Rotolo & Wilson, 2007): Preschool-aged children need their parents’ attention, making it difficult for parents to be actively engaged, while school-aged children need less attention, creating opportunities to be involved in extended social networks (Nesbit, 2012; Oesterle et al., 2004). To unravel behavioural change and its consequences, we should not only focus on relatively short-term effects of life events but also recognize lifelong processes of change by investigating how life events influence behaviour in later years.

The role of health-related events

In further exploring the mediating role of resources and networks, we found that donors who experienced a blood transfusion or death in the family were slightly more likely to continue donating. It remains unclear, however, why these events have an influence on donor behaviour as none of the hypothesized variables mediated these relations. Perhaps blood donation in these cases is not a result of social interactions but of internal motivational processes as donors are reminded of the need for blood products and the difference they can make by donating. Experimental studies on charitable giving show how giving behaviour is promoted by manipulating people’s awareness of need (Bekkers & Wiepking, 2011b). Yet, maintaining a level of awareness is also important, especially in behaviours that require repeated decisions over time, such as blood donation or other

health-related behaviours. Campaigns targeting health awareness have already shown promising results in promoting behavioural change toward a healthier lifestyle (Peralta, Jones, & Okely, 2009).

Strengths and limitations

One of the main strengths of this study is that it draws on register data from the Dutch donor database, containing objective and reliable information on blood donations and donor lapse. Linking survey and register data enabled a longitudinal design to study the dynamic nature of blood donor behaviour, shifting the focus from static donor behaviour to dynamic donor careers. On a more general note, our study adds to the existing literature as it widens our knowledge of prosocial behaviour and tested the explanatory value of variables derived from human and social capital theories. Going beyond descriptive accounts of donor behaviour, a theoretical understanding of prosocial behaviour forms the basis for more effective, evidence-based practical applications.

The current study also has limitations that need to be addressed. First, survey questions about life events are susceptible to recall bias (Coughlin, 1990). When asked about donating blood, it is more likely that people remember the most salient life events – those that actually motivated them to stop or to keep on donating – leading to possible overestimations of the effect sizes (Bekkers & Wiepking, 2011a). The study design is open to self-selection bias, making it impossible to determine whether nonresponse to the DIS-II questionnaire is the result of the (non)occurrence of specific life events.

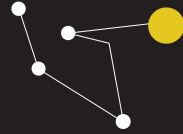
As life events may be influenced by endogenous factors occurring in relation to other person-specific characteristics, the present results may be biased by omitted variables. The data structure also makes it difficult to ascertain the exact order of events; for example, did the lapsed donors perceive themselves to be less healthy after they lost their job, or were they already worse in their perceived health status before they lost their job? We solved these issues to the best of our data's ability by including a number of potentially confounding variables to the models and measuring the mediating variables after the occurrence of the life event (i.e., at the time of DIS-II). Nonetheless, our study is among the first to examine blood donor behaviour across the life course, providing valuable insights in blood donor careers.

Future directions for research and blood collection agencies

Despite these limitations, the current study findings may well serve as a basis for several future directions both in the specific field of blood donor studies and the general field of prosocial behaviour. For instance, the likelihood of being involved in prosocial behaviour is susceptible to change across the life course, yet driving factors underlying these behavioural changes have remained relatively unknown. More indicators of human and social capital need to be examined to investigate their explanatory value.

In the field of blood donor studies, we would encourage research groups from other countries to conduct similar donor career studies to enable cross-country comparisons of relations between life events and blood donor behaviour. Beyond individual and social resources such as time constraints and social connectedness, contextual factors such as different cultures and collection regimes might also be considered “resources” affecting donor behaviour (Healy, 2000). Previous studies have indeed shown cultural differences to be associated with blood donor attitudes across Europe (Merz et al., 2016).

If we want to put our knowledge to use, it is worthwhile to explore people’s motivational change after they experienced a life event, especially in behaviour that requires repeated decisions throughout the life course. Once we have a better understanding of these motivational changes, non-profit organizations such as BCAs can design interventions to test whether promotional materials can make a differences in donors’ decisions to keep donating blood at decisive moments in their lives.





LIFE EVENTS AND DONOR LAPSE AMONG BLOOD DONORS IN DENMARK

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TP, EM, RB, WK and HU contributed to the study design. TP developed the main conceptual ideas and wrote the manuscript with support from all other authors. TP wrote the code and performed the statistical analyses, based on previous work from SA and with additional analyses by Andreas Stribolt Rigas (Copenhagen University Hospital, Rigshospitalet). All authors provided critical feedback on the interpretation of the outcomes and the final version of the manuscript. Appendices 4.1 – 4.3 are available online at: osf.io/pzhuv/.

ABSTRACT

The likelihood of donating blood changes over the life course, with life events shown to influence entry to and exit from the donor population. While these previous findings provide valuable insights for donor management, blood collection agencies need to be cautious about generalizing findings to other countries as blood donor behaviour is context-specific. To examine cross-country variations in donor behaviour, the repeatability of a previous Dutch study on life events and blood donor lapse is examined by using a sample of Danish donors. Register data from Statistics Denmark was linked to the Scandinavian Donations and Transfusions database ($n = 152,887$). Logistic regressions were conducted to examine the association between life events in 2009-2012 and blood donor lapse in 2013-2014. Of the total sample, 69,079 (45.2%) donors lapsed. Childbirth and losing a job increased the lapsing risk by 11% and 16%, respectively, while health-related events in the family (i.e., blood transfusion, disease and death) decreased the lapsing risk by 5%, 7% and 9%, respectively. Life events are associated with donor lapse of Danish donors. These results are comparable to previous findings from the Netherlands (i.e., childbirth and labour market transitions increased lapsing risk; health-related events decreased lapsing risk), with two thirds of the associations being in the same direction. Differences between study results were mainly related to effect sizes and demographic compositions of the donor pools. We argue contextual factors to be of importance in blood donor studies.

INTRODUCTION

Why and when do people give blood? Life events related to family composition, health of family and friends, and labour market transitions affect blood donor behaviour over the life course (Piersma, Bekkers, de Kort, & Merz, 2019). Longitudinal studies from Germany and the Netherlands showed such life events to impact both entry to and exit from the donor pool, hereby illustrating the importance of longitudinal data to examine behavioural change across the blood donor career.

Regarding entry to the donor pool, German data showed that people who recently divorced or finished their education were more likely to start donating blood, while people who got a child or experienced the death of a parent were less likely to start a donor career (Soliman & Boenigk, 2019). Regarding exit from the donor pool, Dutch data showed that childbirth, getting a job and losing a job increased the likelihood of donor lapse, while a blood transfusion for someone close and the death of a loved one decreased this likelihood (Piersma et al., 2019).

Blood donor studies based on self-reports indicated that barriers such as time constraints and decreased social connections are possible reasons to stop donating blood after experiencing a life event (Piersma et al., 2017). Individuals with more available time, and more human and social capital (e.g., available health and social connections) were indeed more likely to donate blood (Bekkers, 2006), and these mechanisms were found to partially explain the association between life events and donor lapse among Dutch donors (Piersma et al., 2019).

While these findings provide valuable insights for donor recruitment and retention, blood collection agencies (BCAs) need to be cautious in generalizing these findings to other countries. Blood donation and its antecedents are shown to be context-specific, with contextual factors such as collection practices and cultural differences influencing blood donor attitudes and behaviour (De Kort et al., 2010; Merz et al., 2016). For instance, organizational variation between European BCAs has been shown to be related to donor diversity and loyalty (Healy, 2000). State-run BCAs recruit more male donors of higher socioeconomic status who are likely to donate only once or twice, while BCAs under a Red Cross regime attract fewer but more loyal donors who are more equally distributed across socioeconomic groups (Healy, 2000).

To contribute to these country studies and identify more universal and possible context-specific mechanisms for blood donor behaviour, we compared the association between life events and blood donor lapse between Denmark and the Netherlands by testing the repeatability (Freese & Peterson, 2017) of previous findings (Piersma et al., 2019) among a large sample of Danish donors. Moreover, by using register data from Statistics Denmark (SD; DST, 2018) linked to the Scandinavian Donations and Transfusions database (SCANDAT; Edgren et al., 2015), we were able to provide more accurate estimates of true effect sizes compared to findings from the Dutch survey study (e.g., by eliminating the possibility of false-positive self-reports as a result of recall bias).

MATERIALS AND METHODS

In order to test the repeatability of previous findings, we selected data, procedures, measures and statistical analyses based on methodological decisions from the previous study (Appendix 4.1 and <https://osf.io/9chtq/>).

Data and procedure

SD (DST, 2018) and SCANDAT (Edgren et al., 2015) were used to examine the association between life events and blood donor lapse among Danish donors. SD contains a wide array of information on the Danish population, ranging from societal information on geography, environment and economy to individual information on labour, income and wealth. SCANDAT contains data on all Danish blood donors and recipients who have been registered since the start of the computerized blood bank system in 1981 and has been used to study a variety of topics concerning blood donor behaviour and transfusion medicine because of the possibility to link SCANDAT to SD using Civil Registration Numbers (CRNs) as personal identifiers (Edgren et al., 2006; Edgren et al., 2015). According to Danish law, register-based research does not require ethical approval (SD, 2014). For this study we used CRNs to link SCANDAT to subsets of SD to examine if active blood donors – who made at least one donation in 2008 – experienced a life event in 2009-2012 (i.e., health-related event in the family, childbirth, losing a job, starting a job), and if these donors lapsed in 2013-2014.

From the sample of still active donors, those who were ineligible for future blood donations as a result of various medical (i.e., death, permanent deferral) and non-medical reasons (i.e., migration, reaching the upper age limit of 67), were excluded from the sample. To retrieve this information we used the ineligibility criteria list from the Danish blood bank (Blodbanken, 2018) and checked whether any of these criteria applied to the donor using migration, death and hospitalization records from SD. Although these records do not contain information on all possible ineligibility reasons (e.g., temporary deferral related to malaria risk travel), it does capture the most prominent reasons for long-term and permanent donor deferral relevant to our study design. The final sample consisted of 152,887 blood donors.

Measures

Blood donor lapse. Blood donor lapse was defined as not making a donation for 24 consecutive months (De Kort & Veldhuizen, 2010), with individual donation information retrieved from SCANDAT (1 = donor lapse, 0 = no donor lapse).

Life events. Inclusion of the six life events of interest was based on the previous analyses among blood donors from the Netherlands. Information on the occurrence of health-related events among family members was retrieved from SCANDAT (i.e., blood transfusion) and SD (i.e., serious disease, death). Based on CRNs we matched the donor to parents, children

and siblings and then matched these family members to transfusion, hospitalization and death records. Using this information, we created a time-dependent dichotomous variable representing whether the donor experienced a health-related event in the family (e.g., 1 = family member died, 0 = no family member died). Information on childbirth was extracted from SD by matching new-born children to their parents using CRNs. We transformed these data such that the individual record of the donor included the CRN of their new-born child and recoded this as a time-dependent dichotomous variable representing whether a child was born to the donor (1 = childbirth, 0 = no childbirth). Information on donors losing or starting a job was retrieved from SD. Time-dependent dichotomous variables were created by tracking changes in employment status: from having a paid job to unemployment (1 = lost their job, 0 = stayed at their job), and from unemployment to having a paid job (1 = started a job, 0 = remained unemployed).

Mechanisms. To further explore the association between life events and donor lapse we included two possible mediating mechanisms in the models. The total number of weekly working hours was included as a proxy for the available time to donate, with a higher number of weekly working hours representing higher costs to donate blood as time becomes a scarcer resource when working hours increase.

Having other blood donors in the family was included as a proxy for the influence of social networks. Based on CRNs we matched the donors to their parents, children, siblings and spouse, and then matched the CRNs of these family members to SCANDAT to create a dichotomous variable representing whether the donor knew donors in the family (1 = knows other donors, 0 = does not know other donors).

Control variables. Sex, age, educational level and total number of previous blood donations were added to the model as control variables. Educational level was coded as lower, medium and higher education according to the International Standard Classification of Education (ISCED) 2011 (UNESCO, 2012), a comprehensive framework to categorize educational levels and facilitate cross-country comparisons of educational systems.

Statistical analyses

Analyses were conducted using Stata 15 (College Station, TX: StataCorp LLC). Conducting logistic regression analyses we estimated the association between life events and donor lapse. Donor inclusion requirements included having been 'at risk' for experiencing a life event of interest (i.e., women aged ≤ 45 and men aged ≤ 55 for childbirth ($n = 117,266$), unemployed donors for starting a job ($n = 7,570$), employed donors for losing a job ($n = 129,836$), and all donors for the health-related events ($n = 152,887$). We then obtained predicted probabilities for donors who were at risk for the event and did or did not experience the event, keeping the other variables in the model at their means.

As to examine whether childbirth differently affected donor lapse for men and women we added an interaction term to the model. Mediation analyses (i.e., $Z_{Mediation}$; Iacobucci, 2012) were performed as to test to what extent the costs of donating blood (i.e., increased working hours) and influences from the social network (i.e., knowing other blood donors) were able to explain the association between life events and donor lapse, only when this association proved to be statistically significant.

RESULTS

Life events and the Danish donor population

Of the total donor sample, 45.2% ($n = 69,079$) lapsed in 2013-2014. Life events occurring most often to the donors were a serious disease in a family member (22.7%, $n = 34,756$), childbirth (15.1%, $n = 23,056$), and a blood transfusion for a family member (9.3%, $n = 14,165$). Table 4.1 shows descriptive statistics of all study measures. Compared to the Dutch donor sample, the Danish donor sample had a lower mean age (39.7 vs. 46.7), comprised of more male donors (53.1% vs. 47.2%), and had a lower average number of previous donations (11 vs. 21). Most notably, the number of lapsed donors was higher in Denmark than in the Netherlands (45.2% vs. 25.3%). With regard to the occurrence of health-related life events we noticed some proportional differences between the samples. A serious disease in a family member and death of a family member were reported by 40.5% and 18.9% of the Dutch donors, and only observed among 22.7% and 8.8% of the Danish donors, respectively.

Health of family members

Blood transfusion in a family member. Donors experiencing a blood transfusion for a family member were 5% less likely to lapse than donors who did not experience such an event (OR (95% CI) = .91 (.88-.94), $p < .001$). We found no evidence of a mediating role of knowing other blood donors in the association between a blood transfusion and donor lapse (Table 4.2). These results are comparable to earlier findings in the Netherlands, with Dutch donors experiencing a blood transfusion being 11% less likely to lapse.

Serious disease in a family member. Donors experiencing a serious disease in the family were 7% less likely to lapse than donors who did not experience a serious disease in the family (OR (95% CI) = .88 (.86-.90), $p < .001$). Subsequent mediation analysis showed no evidence of knowing other donors as an explaining mechanism for the association between a serious disease and donor lapse. These results were different from previous findings, where no significant difference was found among Dutch donors in their lapsing risk after a serious disease in the family.

Table 4.1 Descriptive statistics of study measures, for total sample and stratified by donor status^a.

Characteristic	All donors (<i>n</i> = 152,887)	Active donors (<i>n</i> = 83,808; 54.8%)	Lapsed donors (<i>n</i> = 69,079; 45.2%)
Life events			
Transfusion	14,165 (9.3%)	8,141 (9.7%)	6,024 (8.7%)
Serious disease	34,756 (22.7%)	20,076 (24.0%)	14,680 (21.3%)
Death	13,381 (8.8%)	7,955 (9.5%)	5,426 (7.9%)
Childbirth	23,056 (15.1%)	11,584 (13.8%)	11,472 (16.6%)
Starting a job	5,378 (3.5%)	2,466 (1.2%)	2,912 (4.2%)
Losing a job	6,203 (4.1%)	2,881 (3.4%)	3,322 (4.8%)
Costs			
Working hours	22.6 (±8.23)	23.1 (±7.75)	21.8 (±8.76)
Social network			
Know other donors	40,067 (26.2%)	24,491 (29.2%)	15,576 (22.6%)
Age	39.7 (±12.30)	40.7 (±11.41)	38.1 (±13.28)
Sex			
Male	81,131 (53.1%)	47,126 (56.2%)	34,005 (49.2%)
Female	71,756 (46.9%)	36,682 (43.8%)	35,074 (50.8%)
Educational level			
Low	21,732 (14.2%)	10,969 (13.9%)	10,763 (15.6%)
Middle	87,448 (57.2%)	48,815 (58.3%)	38,633 (55.9%)
High	38,593 (25.4%)	21,613 (25.8%)	16,980 (24.6%)
Previous blood donations	11 (5-22)	13 (6-24)	9 (4-19)

^a Data reported as mean (±SD), number (%), or median (25th-75th).

Death of a family member. Donors having lost one of their family members were 9% less likely to lapse than donors who did not experience a family member's death (*OR* (95% *CI*) = .84 (.81-.87), *p* < .001). As was the case in the other health-related events, further analysis revealed no evidence of knowing other donors being a mediating factor. The association between a family member's death and donor lapse is comparable to the one found among Dutch donors (i.e., an 8% increase in lapsing risk).

Interrelationship between transfusion, disease and death

Since health-related events were correlated to each other (Appendix 4.2), with people receiving a blood transfusion being more likely to suffer from a serious disease and having a higher mortality risk, we explored their interrelationship in the negative association with blood donor lapse. Table 4.3 shows how the unstandardized coefficients changed when the health-related events were introduced in a stepwise manner. While the coefficients for a blood transfusion halved after adding serious disease or a family member's death to the model, the coefficients

Table 4.2 Results for the logistic regression analyses of life events on donor lapse^a, mediated by the hypothesized mechanisms^b.

Life events & mechanisms ^c	Model A		
	B ^d	SE	OR ^e (95% CI)
Transfusion	-.10***	.02	.91 (.88-.94)
Know other donors			
Serious disease	-.13***	.01	.88 (.86-.90)
Know other donors			
Death	-.17***	.02	.84 (.81-.87)
Know other donors			
Childbirth	.19***	.02	1.21 (1.18-1.25)
Start job	-.02	.05	.98 (.88-1.10)
Lose job	.28***	.03	1.32 (1.25-1.39)
Know other donors			

^aBlood donor lapse for non-medical reasons. ^bEffects are estimated separately for each life event and its hypothesized mechanisms, and only when the donor is at risk for experiencing the life event: transfusion, disease and death ($n = 152,887$), childbirth ($n = 117,266$), start job ($n = 7,570$) and lose job ($n = 129,836$). ^cResults adjusted for donors' sex, age, educational level and the total number of previous blood donations.

Table 4.3 Results for the stepwise regression analyses^a of the health-related life events on donor lapse^b.

Life events ^c	Model 1		Model 2		Model 3	
	B ^d	SE	B	SE	B	SE
Transfusion	-.097***	.012				
Serious disease			-.128***	.012		
Death					-.171***	.019

^aEffects are estimated separately for each health-related life event in Models 1-3, in combination with one of the other health-related life events in Models 4-6, simultaneously for all three health-related life events in Model 7, and only when the donor is at risk for experiencing the event ($n = 152,887$).

of the latter two changed only slightly compared to their separate association with donor lapse. The association between a blood transfusion and lapse therefore seems to be subordinate to the association for a serious disease or death. When all three health-related events were added to the model (Model 7), the association between a blood transfusion and lapse disappeared, while the coefficients for serious disease and death only slightly decreased. In this full model, death showed the strongest negative association with donor lapse, while serious disease showed the most robust association across the combined models. Comparing these results

Model B			$Z_{\text{Mediation}}$	
B	SE	OR (95% CI)	% mediated ^f	Z-value
-.08***	.02	.91 (.88-.94)		
-.40***	.01	.69 (.68-.71)		.05
-.13***	.01	.88 (.62-.90)		
-.37***	.01	.69 (.67-.71)		.01
-.17***	.02	.84 (.81-.87)		
-.37***	.01	.69 (.68-.71)		1.32
.27***	.03	1.31 (1.24-1.38)		
-.36**	.01	.70 (.68-.72)	3%	5.36***

^d Estimated unstandardized regression coefficients. ^e OR indicates the likelihood for donor lapse compared with the reference category. ^f Percentage reported only when all paths in the model were significant (Iacobucci, 2012).

*** $p < .001$ ** $p < .01$ * $p < .05$ (two-tailed tests).

Model 4		Model 5		Model 6		Model 7	
B	SE	B	SE	B	SE	B	SE
-.047*	.019	-.044*	.019			-.018	.020
-.115***	.013			-.097***	.013	-.095***	.014
		-.155***	.020	-.120***	.019	-.115***	.021

^b Blood donor lapse for non-medical reasons. ^c Results adjusted for donors' sex, age, educational level and the total number of previous blood donations. ^d Estimated unstandardized regression coefficients.

*** $p < .001$ ** $p < .01$ * $p < .05$ (two-tailed tests).

to the Dutch data, a different pattern emerged. Across all models, the relationships between blood transfusion and death with donor lapse were stable and significant, while no association was found between a serious disease and donor lapse (Appendix 4.3).

Childbirth

Donors who got a child were 11% more likely to lapse than donors who did not get a child within the same period (OR (95% CI) = 1.21 (1.18-1.25), $p < .001$). While childbirth increased the

lapsing risk for both men (OR (95% CI) = 1.18 (1.13-1.23), $p < .001$) and women (OR (95% CI) = 1.24 (1.18-1.29), $p < .001$), this association was significantly stronger for women than men. Compared to the study from the Netherlands, effect sizes differ considerably with Dutch donors who got a child being 56% more likely to lapse than donors who did not get a child. Moreover, in the Netherlands no significant difference was found between men and women in their lapsing risk after childbirth.

Labour market transitions

Starting a job. No difference was found between donors who started a job and donors who stayed unemployed in their subsequent lapsing risk. In the absence of this main effect, we did not perform further mediation analyses and the role of increased working hours in donor lapse. These results differ quite strongly from earlier results in the Netherlands. Starting a job was positively associated with lapse among Dutch donors, with donors who started a job being 22% more likely to lapse compared with donors who stayed unemployed.

Losing a job. Donors who lost their job were 16% more likely to lapse than donors who stayed at their job during the same period (OR (95% CI) = 1.32 (1.25-1.39), $p < .001$). Mediation analysis showed that knowing fewer other blood donors was a significant mediator in the model, yet explaining only 3% of the variance in the relation between losing a job and donor lapse ($z = 5.36$, $p < .001$). These results repeat previous results from the Netherlands, but effect sizes differ slightly as Dutch donors were 35% more likely to lapse after losing their job, while the same effect was found for the small mediating role of knowing other donors in explaining the association between losing a job and donor lapse.

DISCUSSION

Life events and donor lapse in Denmark

Using longitudinal data from SCANDAT and SD, we conclude that life events related to childbirth and work status, as well as health-related events in the family, are associated with blood donor lapse. Childbirth and losing a job increased the risk of donor lapse, with childbirth being more detrimental for future blood donations of women than men. In contrast, health-related events in the family decreased the risk of donor lapse. Once more, the likelihood to donate blood was shown to vary across the donor career, thus illustrating the dynamic nature of blood donor behaviour.

For a large part these results are in line with previous findings from cross-sectional blood donor studies based on self-reports. Time constraints due to childbirth and family responsibilities appear to be among the main reasons for donors to discontinue donating blood (Piersma et al., 2017), while health-related events in the family were mentioned

being a motivational factor to start donating blood (Charbonneau et al., 2015) as well as a reason to continue donating over time (Bani & Strepparava, 2011). There were slight differences in the statistical influence of various health-related events in the family with transfusion having a stronger effect in the Dutch dataset, but serious disease and death in the Danish. The interpretation of these highly correlated events is difficult, but we can robustly conclude that disease, transfusion and death in the family are motivational factors in donor retention. Our finding that people are more likely to lapse after losing their job aligns with previous research suggesting that social connections influence donation decisions (Charbonneau et al., 2015). Although these connections did not play a mediating role in the associations between health-related events and donor lapse, social connections in itself seem to impact on donor behaviour, as knowing fewer other donors was related to an increasing lapsing risk.

We also found some discrepancies compared with previous studies. Time constraints due to work are a common self-reported reason for donors to stop donating blood (Klinkenberg et al., 2018b), but we found no statistically significant association between starting a job and donor lapse. Also, we found no evidence for social connections explaining the association between health-related events and donor lapse. Further understanding of underlying motivational mechanisms is important to provide insight in preventing donors from lapse at certain life stages.

Country comparisons between Denmark and the Netherlands

We found the associations to be comparable between Denmark and the Netherlands. Of the events studied here, two thirds showed the same associative directions with donor lapse, while none of them showed opposite directions. Moreover, half of all confidence intervals showed an overlap between the studies. One might assume that certain (motivational) mechanisms are universal factors associated with blood donor behaviour across the donor career in Western high-income countries. Childbirth constraints a person's available time (Schmitz, 2011), losing a job decreases self-perceived health (Elder & Greene, 2012), and health-related events in the family might raise feelings of moral responsibility, regardless of the local blood collection regime or other contextual differences between countries.

However, we also found some differences between the study results, mainly related to donor sample compositions and the magnitude of effect sizes. Regarding contextual differences between Denmark and the Netherlands, donor samples might differ as a result of organizational variation in blood collection regimes. Following Healy's (2000) categorization, blood collection in the Netherlands originates from a Red Cross regime which is rooted in voluntary, religious organizations, therefore being more likely to attract fewer but more loyal donors. The Danish collection regime might be more effective in recruiting new, young donors but less so in retaining them over time. This could explain why the Danish sample shows a higher proportion of younger, lapsed donors with a lower number of previous

donations. Moreover, differences might be explained by BCA recruitment strategies. In the Netherlands, recruitment was shown to be related to donor diversity and loyalty (Piersma & Klinkenberg, 2018). Differences between Danish and Dutch recruitment and retention strategies might therefore lead to different donor pools in terms of diversity and loyalty, subsequently influencing the extent to which life events impact on donor lapse.

Contextual differences other than those exerted by BCAs might contribute to differences in effect sizes. For instance, regulations regarding parental care after childbirth differ significantly between countries. In the Netherlands, fathers have only two days off after childbirth (Rijksoverheid, 2019), posing serious constraints on their available time, subsequently increasing their lapsing risk (Piersma et al., 2019). The association between childbirth and lapse is smaller for Danish donors, possibly explained by extended parental leave providing parents, especially fathers, with more time after childbirth (Øresunddirekt, 2018). Yet, the list of explanatory contextual factors is inconclusive. For instance, starting a job showed a strong positive association with donor lapse in the Netherlands, but not in Denmark. We speculated that differences might be the result of country variations in commuting distances, importance of the work-life balance or blood collection drives at businesses, but no such differences were found (CBS, 2017b; DI, 2018; OECD, 2018a, 2018c). Are there contextual factors at play here, or are the different result the mere effect of data differences?

Regarding data differences, donor samples and effect sizes could differ as a result of the sole use of register data in the current study as opposed to the combination of register and survey data in the study from the Netherlands. The current study includes all active donors, while the previous study only included donors participating in both waves of the survey. Analyses showed non-responders being more likely younger, male, lapsed donors having made a lower number of average donations, possibly explaining why the Danish sample shows a higher proportion of donors with these characteristics. Moreover, register data eliminates the possibility of introducing recall bias and the telescoping effect (Bekkers & Wiepking, 2011a). In studying self-reporting on the occurrence of life events in surveys, respondents more likely recall life events closely related to their donation decision (i.e., recall bias), or wrongly assign the occurrence of a life event to a specific time-frame when this time-frame is introduced (i.e., telescoping effect), hereby overestimating effect sizes. Register data does not include false negatives, therefore being more accurate in estimating the true effect sizes.

Strengths and limitations

Although this study provides valuable insights on cross-country variations in blood donor behaviour, providing more accurate and reliable estimations, our study also has some limitations. Registers typically provide more accurate and complete sources of data, but do not include relevant variables related to subjective perceptions and other individual factors such as the perceived difficulty to plan a donation and talking to other donors.

Linking population-wide registers to results from motivational questionnaires for a subset of the donor population would allow for an even better understanding of donation decisions across the blood donor career (e.g., understanding interrelationships between various health-related events and their differences between countries). For now, we used variables serving as proxies for these missing variables, corresponding to other mediators from the Dutch theoretical framework: weekly working hours and the extent to which donors know other blood donors. In this way we have used the data without introducing too many incongruences.

While using different contexts and data in replication studies it is difficult to pinpoint exactly which differences explain inconsistencies between study results. We acknowledge this limitation. Our aim was to examine the association between life events and donor behaviour in Denmark. The comparison with the Netherlands shows that contextual and data difference could yield various study outcomes. Researchers as well as BCAs need to be aware of such differences and its implications in interpreting international study results.

Future theoretical and practical directions

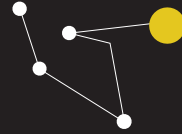
The influence of life events on blood donor behaviour across the life course so far has been studied in the Netherlands, Germany and Denmark. While certainly there are differences between these countries, they also are quite comparable with respect to collection systems as well as socio-economic circumstances and cultural orientation (Insights, 2018; OECD, 2018a, 2018b, 2018c). It is worthwhile to further examine cross-country differences in a broader variety of countries, including the United States and Australia, as well as African and Asian countries as to allow for conclusions on the role of contextual factors in donor behaviour across the donor career.


We suggest future studies to focus on underlying mechanisms explaining the relation between life events and donor behaviour. While the current study and the study from the Netherlands showed social and practical concerns to partially explain why life events impact on donor lapse, the bulk of these associations is still unaccounted for. For instance, neither of the two studies found evidence for social mechanisms playing a role in the relation between health-related events and donor lapse, nor could we conclude on the different results for starting a job and donor lapse.

Further understanding of underlying mechanisms is especially important since the occurrence of specific life events that affect donors' personal resources are increasing (e.g., higher number of labour market transitions due to the rise of temporary contracts; CBS, 2019a). Increasing fluctuations of personal resources might affect donation decisions across the blood donor career. Retaining these donors is important as it is more cost-effective than recruiting new donors as experienced donors are more likely to donate again, have lower no-show rates, and guarantee safer blood compared to novice donors (Schreiber et al., 2003).

In-depth studies of these associations would therefore be of practical interest in making evidence-based decisions on the development of targeted donor retention strategies. For instance, sending postcards to donors who recently got a child might increase engagement between donors and blood banks. Promoting personal donation motivations (e.g., awareness of need, feelings of moral responsibility) might subsequently increase return rates in donors with heightened lapsing risks. Implementing targeted retention strategies requires higher levels of personal contact between donors and blood banks. This will become more feasible in the coming years when services such as online donor portals become more easily available, creating opportunities for more intensive information-sharing, subsequently increasing opportunities for segmented blood donor management.

Moreover, exploring work-home-donation distances might increase understanding in why people change their donation decision after starting or losing a job, and assist BCAs in deciding on where and when to open their donation locations. Strategically positioning of collection sites might be effective in recruiting underrepresented groups of young, male and ethnically diverse donors, which is essential in maintaining a sufficient and matching blood supply (Anani & Denomme, 2018). At the same time, BCAs need to be careful in implementing international practices to their own donor management policies, since we showed that blood donors and their behaviour may differ between countries.





ALTRUISM IN BLOOD DONATION: OUT OF SIGHT OUT OF MIND? CLOSING DONATION CENTRES INCREASES BLOOD DONOR LAPSE

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All authors contributed to the study design, development of the main conceptual ideas, and writing the manuscript. RB and TP wrote the code and performed the statistical analyses. We thank Alfred Wagtendonk (Amsterdam UMC, Vrije Universiteit Medical Centre) for providing the geographical data and Femmeke Prinsze (department of Donor Medicine Research, Sanquin Research) for her help in constructing the blood donor database. Appendix 5.1 is available online at: osf.io/pzhuv/.

ABSTRACT

In this chapter, we examine the strength of altruism in blood donation by testing how blood donor behaviour changes after the price of donating in the form of time and inconvenience increases. More specifically, using register data on all blood donors and variations in geographical locations of blood donation centres in the Netherlands over the past decade, we examined whether closing donation centres influences blood donor lapse, and whether the risk for lapse varies between donors with different blood groups ($n = 259,172$). A lower lapsing risk for donors with universal, O-negative blood is considered as evidence of altruism: their continued efforts in making a societal impact despite the increased time commitment indicates altruism in donor behaviour. Of the total sample, 137,172 (52.9%) donors lapsed at least once. Donors whose nearest donation centre closed were 53% more likely to lapse compared to donors whose donation centre remained open, with the risk for donor lapse increasing with each extra kilometre distance to the new nearest donation centre. While O-negative donors were 10.5% less likely to lapse after closing a donation centre compared to donors with other blood groups, the effect was not stronger as the distance to the new nearest donation centre increased. Based on these results, we conclude that blood donors are clearly sensitive to price changes imposed by blood banks, but that they are not exclusively motivated by purely altruistic concerns. Future studies are recommended to further examine the role of contextual factors in motivational change across the blood donor career. Blood banks are advised to strategically place donation centres throughout the country to promote blood donations, and design interventions to reduce donation barriers after changing their donation centres' locations.

INTRODUCTION

Every day, blood transfusions are used to save lives after traumatic events as well as in treatment of serious diseases. To ensure a sufficient supply of blood products, hospitals heavily rely on donors who voluntarily donate blood to help anonymous recipients in the absence of (financial) compensation. For this reason, blood donation is often regarded as an archetypal example of altruistic behaviour (Titmuss, 1971). Experimental studies on blood donor behaviour, however, have shown that blood donation is not exclusively motivated by altruistic concerns for recipients but also driven by self-regarding motivations such as warm-glow (Ferguson, Farrell, & Lawrence, 2008; Ferguson et al., 2012b).

In this chapter we combine psychological and economic perspectives on altruism. In psychology, personal sacrifice is a key characteristic of the purely altruistic gift (Krebs, 1970; Unger, 1991). We examine the strength of altruistic motivation in blood donation by testing how many donors continue to give blood after the price of donating in the form of time and inconvenience increases (Schreiber et al., 2006). For instance, donors are more likely to stop donating blood after childbirth or starting a new job, when their available time becomes a scarcer resource and blood donation becomes more costly (Piersma et al., 2019). Our prediction from the psychological model is that donors in general are more likely to stop giving blood when the travel distance to the nearest blood donation centre increases. Yet donors who are prepared to make an additional sacrifice and continue to give blood even if it takes more time, may be called altruists.

In economic models of altruism, in contrast, the defining characteristic of a purely altruistic gift is to help supply a public good (Ottoni-Wilhelm, 2017; Vesterlund, 2006). An implication of the economic model is that donors respond to changes in need. When the need for blood increases, altruistic donors should give more. Differences in blood groups among donors create exogenous variation in the need for their blood (Wildman & Hollingsworth, 2009), as the blood group of the donor has to be compatible with that of the patient to prevent transfusion reactions such as blood clotting (Landsteiner, 1961). O-negative donors are an exception to this rule. Their blood can be transfused regardless of the recipient's blood group, making donors with the universal, O-negative blood group more valuable to the blood bank than donors with common blood groups (i.e., A-positive and O-positive, present in 74% of the general population) or less common blood groups (i.e., A-negative, B-positive, B-negative, AB-positive and AB-negative, present in 19% of the general population; Sanquin, 2019c). Our prediction from the economic model of altruism is that donors with the more valuable O-negative blood group are less likely to stop donating when the price increases. To the extent that blood donation is motivated by altruism, O-negative donors should continue donating despite the increased costs, and be willing to sacrifice more, because their blood has a higher public benefit for society (Figure 5.1).

To examine the psychological and economic models of altruism in blood donor behaviour, we use register data on all blood donors and blood donation centres in the Netherlands over the past 10 years (Sanquin, 2018a). First, we track closings of these donation centres to exploit natural variation in the costs of blood donation. When the blood bank closes a donation centre the travel time for donors who live close to that centre increases. Second, we test to what extent the risk of lapse after the closing of a donation centre varies between donors with different blood groups. A lower lapsing risk for donors with O-negative blood is considered as evidence of altruism: their continued efforts in making a societal impact despite the increased time commitment indicates altruism in donor behaviour.

By estimating the effects of closing or changing opening days of blood donation centres on individual donor behaviour, we examine the role of contextual factors in blood donation. In previous studies, former donors reported to have stopped donating blood because the donation centre was too far away or had inconvenient opening times (Klinkenberg et al., 2018b; Schreiber et al., 2006). As these studies use cross-sectional self-reports of donation motivations, we know very little about the causal effects of contextual factors on blood donor behaviour and its influence over time. Yet these insights are of high practical relevance. Blood banks can use them to more efficiently promote blood donations by strategically placing donation centres throughout the country, which is easier than manipulating donors' personal norms and altruistic values (Boenigk et al., 2011).

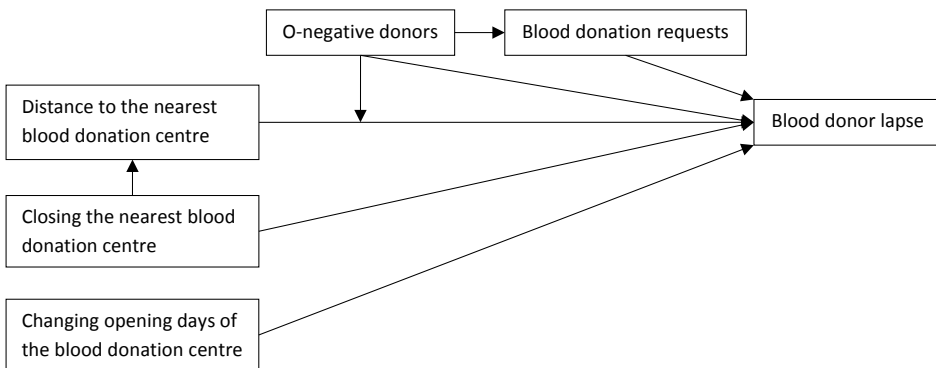


Figure 5.1 Conceptual model for the hypothesized associations between changes in blood donation centre characteristics and blood donor lapse.

Blood collection in the Netherlands

Before we state our hypotheses about altruism in blood donation, and the relation between closings of donation centres and donor behaviour, we provide some background information on the context of our study. In the Netherlands, blood collection is organized by Sanquin, the monopolist non-profit organization responsible for the collection of whole-blood and plasma

throughout the country. Sanquin was founded in 1998 after merging the Central Laboratory for Blood Transfusion Services with the countries' nine independent blood banks, which were part of the Dutch Red Cross. With a population of 17.2 million in 2018, approximately 330,000 voluntary blood donors made slightly over 720,000 non-remunerated, anonymous whole-blood and plasma donations (Sanquin, 2019a). These donors are all invited to donate blood by offline postcards, with O-negative donors receiving a higher average number of yearly donation invitations compared to donors with other blood groups.

To improve the cost-effectiveness of the blood collection, Sanquin constantly evaluates the geographical locations of its blood donation centres. Over the past decade, this led to a large number of reforms in terms of the number of blood donation centres and their opening times. Partly due to a large reorganization in 2013, merging four regional blood banks into one central blood collection agency, the number of donation centres decreased by 46%, from 252 in 2010 to 136 in 2018 (Figure 5.2). Our explorative analyses illustrated that decisions to close donation centres were not random, with rural areas – where donors are likely to be more loyal than in urban areas – in the Northern provinces of the Netherlands showing the largest decrease in the number of donation centres. Due to these non-random closings, this paper does not report on a natural field experiment. It is unknown, however, to what extent the closings have affected blood donor behaviour and whether these effects vary between donors with different blood groups.

Closing blood donation centres

Looking at studies based on self-reports of blood donor motivations, the location of the donation centre is a frequently mentioned reason (not) to donate. Active donors reported that they started donating simply because there was a donation centre close by (Charbonneau et al., 2015; Kuruvatti, Prasad, Williams, Harrison, & Jones, 2011; Schlumpf et al., 2007). Inactive donors reported that they stopped donating because their standard donation centre closed down or moved to a less convenient location (Charbonneau et al., 2016; Godin, Conner, Sheeran, Bélanger-Gravel, & Germain, 2007; Hupfer, Taylor, & Letwin, 2005; Schreiber et al., 2006). In the Netherlands, the presence of a blood collection centre in a municipality was shown to be associated with a higher proportion of blood donors within that municipality (Bekkers & Veldhuizen, 2008). Moreover, two Canadian studies showed that having a blood donation centre within a five kilometre radius was positively associated with the number of donors in that area (Saberton et al., 2009) and the donation frequency of these donors (Cimaroli et al., 2012).

Practical motivations and barriers to donate blood are likely to be associated with distance and time. Donors need to have sufficient time to donate blood (Musick & Wilson, 2008). The time required for a donation increases as the travel time to the nearest donation centre increases. Moreover, the chance that donors stop donating increases when their available time becomes a scarcer resource (Piersma et al., 2019; Schreiber et al., 2006).

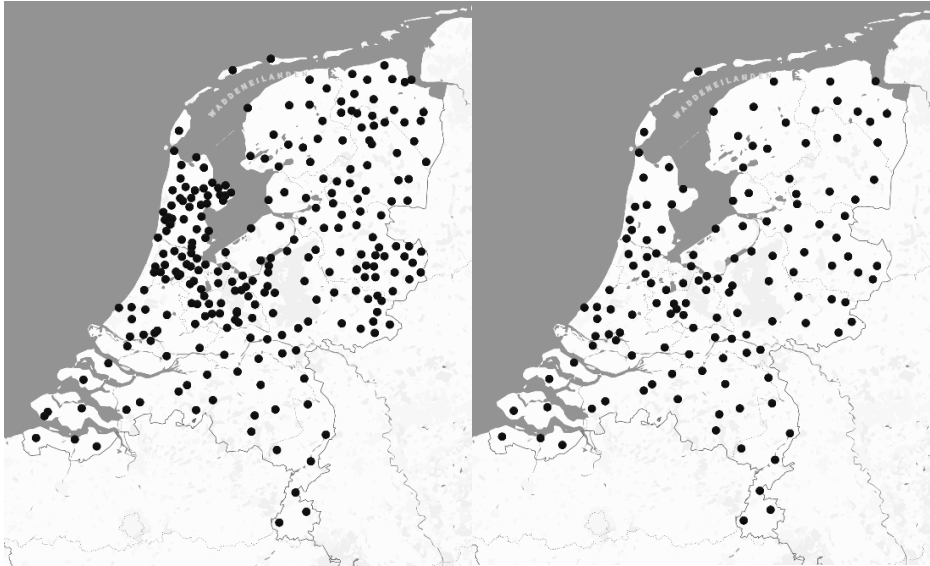


Figure 5.2 Blood donation centres in the Netherlands in 2010 (left) and 2018 (right).

Following this argument, donating blood would become more time consuming, and thus more unlikely, when the distance to the nearest donation centre becomes larger. We hypothesize that:

Hypothesis 1: Closing a donation centre increases the distance to the donor's nearest donation centre, which is positively related to blood donor lapse.

Opening days of blood donation centres

Besides closing a donation centre, its opening days also influence donor's donation decisions. When opening days of donation centres are reduced, it becomes more difficult for blood donors to plan their donations. In an exit-survey among stopped blood donors in the Netherlands, 26% reported that inconvenient opening times of donation centres were among the main reasons to stop donating (Klinkenberg et al., 2018b). Comparable results were found across multiple countries and among donors from different socio-demographic subgroups (Charbonneau et al., 2016; Osborne, Bradley, & Lloyd-Griffiths, 1978; Schreiber et al., 2006).

These findings may be explained from theories on habit formation, with blood donation becoming semi-automatic behaviour over time (Charng, Piliavin, & Callero, 1988). Blood donors accommodate their donations in the rhythm of daily living by rescheduling competing activities to free up a time slot to travel to the donation centre and donate blood. Especially for frequent donors it is convenient to pick a fixed day to donate depending on

the opening hours of the donation centre and the competition for time in their schedules. While it is argued that blood donations are too infrequent and resource-intensive to become automatic behaviour (McMahon & Byrne, 2008), donating blood may become part of a routine, especially when donating more frequently and over longer periods of time (Charng et al., 1988). Descriptive statistics from the Dutch blood donor database (Sanquin, 2018a) show that most donors indeed seem to have a donation routine. In general, the time between two subsequent blood donations is a multiple of seven days, indicating that blood donors have their own preferred donation days (Prinsze, unpublished data). When donors are forced to break their routine, for instance when opening days of the donation centres are changed or reduced, this might negatively affect their donation behaviour. We hypothesize that:

Hypothesis 2: Decreasing the number of opening days of a donation centre is positively related to blood donor lapse.

Altruism as a motivation of blood donation

In the economic model of altruism, blood donations are motivated by public benefits, such as the supply of blood to patients and drug development (Vesterlund, 2006). Because the blood of O-negative donors can be transfused into patients of any blood group, it can be used more efficiently and the public benefits of a donation by an O-negative donor are larger. Previous findings on blood group differences in donation rates are mixed. While some studies found no association between blood groups and donation rates, indicating that blood donation is driven by various motivations (Wevers et al., 2014a; Wildman & Hollingsworth, 2009), others found O-negative donors to have a higher chance of ever donating (Sasaki, Funasaki, Kurokawa, & Ohtake, 2018), returning for a subsequent donation (Gemelli et al., 2017), and being a high-frequency donor (Veldhuizen, Doggen, Atsma, & De Kort, 2009). More specifically, Sasaki and colleagues (2018) found that the positive association between O-negative blood group and blood donations was especially present when donors knew that their blood could be used to treat all patients in need of blood. Hence, we hypothesize that:

Hypothesis 3a: O-negative donors are less likely to lapse than donors with other blood groups.

Hypothesis 3b: An increased distance to the donor's nearest donation centre has a stronger positive relation with blood donor lapse among donors with other blood groups than among donors with the O-negative blood group.

MATERIALS AND METHODS

Data and procedure

To retrieve information on blood donor behaviour and donation centre characteristics, we used historical information from the Dutch blood donor database between 2010 and 2018 – the years for which complete information was available on blood donors and blood donation centres in the Netherlands (eProgesa; Sanquin, 2018a). This large-scale register database contains information on all Dutch whole-blood and plasma donors and individual donation behaviour, such as blood group, donation frequency and return rates, as well as donation dates, times and locations. Donors were included in the study sample if they gave their informed consent to use their anonymised donation data for scientific research.

To arrive at the final study sample, individual blood donors were included if the postal code of their home address was known, if they donated at least once between 2010 and 2018, and if donation information of the donor was known to Sanquin for at least two subsequent years in order to be able to track behavioural changes over time. Moreover, donors were included if they were not permanently deferred for future blood donations, if they donated whole-blood instead of plasma (e.g., different transfusion compatibility, and different strategies for plasma donor recruitment and solicitation), if they did not move (i.e., their postal code did not change in order to only include donors for whom the location change was purely the decision of the blood bank), and if they did not live in the two Southern provinces of the Netherlands (i.e., Limburg and Noord-Brabant where no location changes had taken place; Figure 5.2). The final sample consisted of 259,172 whole-blood donors.

Measures

Blood donor lapse. Blood donor lapse was included in the model as dependent variable. Following the internationally acknowledged definition in European blood donor management (DOMAINE; De Kort & Veldhuizen, 2010), blood donor lapse was defined as a registered donor who made at least one donation but did not donate in the following 24 months. In our analyses, we measured whether or not a donor lapsed in the 24 months after the nearest blood donation centre closed or changed its opening days (1 = donor lapsed, 0 = donor did not lapse).

Donation centre characteristics. Whether or not the nearest donation centre closed in a year (1 = donation centre closed, 0 = donation centre remained open) and the change in its yearly number of opening days were included in the model as independent variables. Changes in the total number of opening days were included as the differences in opening days between two subsequent years (e.g., a donation centre opened for 200 days in 2012 while being open for 150 days in 2013 corresponds to a between-years decrease of 50 opening days).

The distance to the nearest donation centre was included in the model as a mediating factor between the closing of a donation centre and blood donor lapse, measured as the straight-line distance in kilometres among longitudes and latitudes of blood donors' and donation centres' postal codes (geosphere in R; Hijmans, 2017). Boscoe and colleagues (2012) showed straight-line distances to be highly correlated with travel distances in the United States ($r = .94$), hereby serving as an adequate, easy-to-calculate measure for distance. Changes in the distance to the nearest donation centre were included as differences in kilometres between each two subsequent years (e.g., a nearest donation centre located at a distance of three kilometres in 2012 while being located at a distance of eight kilometres in 2013 corresponds to a between-years increase of five kilometres).

Behavioural test of altruism. To test for altruism in blood donation, we included the blood group of the donor. Donors were divided in two groups: donors with the universal, O-negative blood group and donors with any other blood group (i.e., O-positive, A-positive, A-negative, B-positive, B-negative, AB-positive, or AB-negative).

Blood donation requests. To estimate the effort that the blood bank may invest in retaining their blood donors, we added the yearly number of blood donation requests to the model. These donation requests include formal invitations from Sanquin by offline postcards and in some cases by telephone. Previous studies reported how receiving a solicitation for blood donation is among the main motivators for donors to donate blood (e.g., Charbonneau et al., 2016; Duboz & Cunéo, 2010), and O-negative donors receive a higher average number of donation invitations. Blood donation requests were measured as the total number of yearly requests in the year the blood donation centre closed.

Control variables. To control for correlates of closing of blood donation centres and their changes in opening times at the level of the individual donor, we included information on donor's sex, age, total number of previous blood donations, and total number of yearly deferral days (i.e., characteristics previously shown to be associated with blood donor behaviour; Piersma et al., 2017).

To control for correlates at the level of the municipality, we included information on the population density of the donor's municipality in thousands per square kilometre (i.e., previously shown to be associated with the proportion of blood donors within a municipality; Bekkers & Veldhuizen, 2008). For each year, this information was retrieved from open data of the Dutch Central Bureau of Statistics (CBS) and matched to individual donor records based on the municipality code belonging to their postal code (CBS, 2019b).

Statistical analyses

Statistical analyses were conducted using Stata 15 (College Station, TX: StataCorp LLC) to estimate the associations between changes in donation centre characteristics and blood donor lapse. Descriptive analyses were performed on the total study sample to provide an overview of individual blood donor characteristics (e.g., sex, age, donation requests, and blood group prevalence), the occurrence of donor lapse among these donors, and overall blood donation centre characteristics in the Netherlands between 2010 and 2018. As a next step, logistic regression analyses were performed to test our hypotheses.

In testing our first hypothesis, we examined whether closing the nearest donation centre was associated with donor lapse (Table 5.3, Model I), and whether this association was mediated by an increased distance to the nearest donation centre (i.e., $Z_{Mediation}$; Iacobucci, 2012; Table 5.3, Model III). We then obtained predicted probabilities of donor lapse for donors whose nearest location closed or remained open, keeping the other variables in the model at their means. In testing our second hypothesis, we examined whether changing the opening days of a donation centre, rather than closing this centre, was associated with donor lapse.

In testing our third set of hypotheses, we examined differences in the lapsing risk of O-negative donors and donors with other blood groups after their nearest donation centre closed (Table 5.4, Model I), and whether this association was mediated by an increased number of donation requests for O-negative donors (i.e., $Z_{Mediation}$; Iacobucci, 2012; Table 5.4, Model II). We then obtained predicted probabilities of donor lapse for O-negative and the other donors, keeping the other variables in the model at their means. In the final models, we added interaction terms between blood group and the distance to the nearest donation centre, and between blood group and the number of donation requests to examine whether the increased distance and the increased number of donation requests differently affected the lapsing risk of O-negative and the other donors (Table 5.4, Model III and Model IV, respectively).

RESULTS

Overall blood donor sample

Regarding individual blood donor characteristics, the mean age of the total study sample was 48.1 years ($SD = 14.17$). The sample consisted of 150,325 female blood donors (58.0%), donors had an average number of 25.2 previous blood donations ($SD = 29.53$; range = 0-485), and received an average of 2.1 donation requests per year. Of these donors, 10.3% ($n = 26,618$) had the O-negative blood group and 89.7% ($n = 232,554$) had any of the other blood groups (see Table 5.1).

The O-negative donors in the study sample were older and more often female compared to the other donors. Moreover, O-negative donors had a higher average number of previous donations (28.5 vs. 25.1 for other donors) and a higher average number of yearly donation requests from the blood bank (2.8 vs. 2.2, respectively).

Table 5.1 Descriptive statistics of the individual blood donor characteristics from eProgesa, stratified by the donor's blood group^a.

Characteristics	All donors (<i>n</i> = 259,172)	O-negative donors (<i>n</i> = 26,618; 10.3%)	Other donors (<i>n</i> = 232,554; 89.7%)
Age	48.1 (±14.17)	49.5 (±13.63)	47.9 (±14.22)
Sex			
Male	108,847 (42.0%)	10,591 (39.8%)	98,256 (42.3%)
Female	150,325 (58.0%)	16,027 (60.2%)	134,298 (57.7%)
Previous blood donations	25.2 (0-485)	28.5 (0-485)	24.8 (0-485)
Blood donor lapse ^b			
in centres that closed	9,321 (15.3%)	913 (13.7%)	8,408 (15.5%)
in centres that remained open	131,186 (10.2%)	12,561 (8.9%)	118,625 (10.4%)
Blood donation requests			
After centre closed	2.1 (0-16)	2.7 (0-15)	2.1 (0-16)
After centre remained open	2.0 (0-19)	2.6 (0-16)	1.9 (0-19)

^a Data reported as mean (±*SD*), mean (range), or number (%). ^b For descriptive statistics on blood donor lapse, each observation in the data is considered to be a unique case, without taking into account the panel data structure.

Between 2010 and 2018, 52.9% (*n* = 137,172) of all blood donors in the sample lapsed at least once. Of these lapsed donors, 11.2% (*n* = 15,377) returned for a donation in the following years (i.e., so-called 'returning donors'). Donor lapse occurred slightly more often among younger donors ($r = -.03$, $p < .001$), and among donors who received a lower number of donation requests and made a lower number of previous donations ($r = -.06$, $p < .001$; $r = -.04$, $p < .001$, respectively). For more information on the bivariate associations, see Appendix 5.1, which includes Pearson correlations between all study variables.

Blood donation centres in the Netherlands, 2010-2018

Regarding the blood donation centres, Figure 5.2 showed how the number of donation centres decreased by 46% between 2010 and 2018 – mainly in the Northern regions of the Netherlands – with the strongest decrease between 2013 and 2014 (i.e., -22%, from 166 to 136 donation centres). Closing these donation centres was not random but occurred more often in less densely populated municipalities (see Table 5.2). The municipalities' population density was shown to be associated with closings of donation centres ($r = -.06$, $p < .001$).

The average distance between a blood donor and the nearest donation centre in the Netherlands was 4.2 kilometres ($SD = 3.11$; range = 0-24.7) across 2010-2018, with the average distance for all donors having increased over the years (i.e., from 3.8 kilometres in 2010 to 4.3 kilometres in 2018). This distance was smaller in areas where the donation centre was

Table 5.2 Descriptive statistics of the blood donation centre characteristics from eProgesa, stratified by the donation centre status in a year^a.

Characteristics ^b	Donation centre remaining open (<i>n</i> = 1,176; 92.8%)	Donation centre closing (<i>n</i> = 91; 7.2%)
Blood donation centre		
Distance (before closing)	4.2 (0-24.7)	3.2 (0-21.1)
Distance change	N/A	2.3 (-3.9-10.9)
Opening days (before closing)	116.3 (1-257)	36.9 (1-257)
Opening days change	-2.3 (-144-92)	-36.9 (0-0)
Municipality		
Population density	1,601 (21-6,459)	1,176 (64-5,467)

^a Data reported as mean (range).

going to be closed in the upcoming year compared to areas in which the donation centre was going to remain open (3.2 vs. 4.2 kilometres). More than one-fifth of all donors (21.7%; *n* = 56,173) experienced an increase in distance between their home and their nearest donation centre as a result of its closing. After a closing, the average distance to the nearest donation centre increased with 2.3 kilometres (*SD* = 2.73; range = -3.9-10.9), which equals a 72% increased travel distance.

Between 2010 and 2018, blood donation centres in the Netherlands had an average of 113.4 opening days per year (*SD* = 98.45; range = 1-257). For donation centres that remained open in a specific year, the average number of opening days was slightly higher. Moreover, centres that remained open had an average decrease of 2.3 opening days per year (*SD* = 15.41; range = -144-92), showing that donors were confronted with changing donation centre characteristics even when the geographical location of their nearest donation centre did not change. Below, we discuss the results in testing each of the three hypotheses.

Blood donor lapse after the closing of donation centres

Supporting our first hypothesis, we found that the percentage of lapsed blood donors was much higher in the year after the nearest donation centre was closed compared to the percentage of lapsed donors in the year after the donation centre remained open (15.3% vs. 10.2%). Moreover, Figure 5.3 shows how the percentage of lapsed donors after closing the nearest donation centre steadily increased with each extra kilometre distance to the new nearest donation centre. Of the donors whose nearest donation centre closed, 11.6% lapsed when the distance increased by less than one kilometre while 32.8% lapsed when the distance increased by more than nine kilometres.

Logistic regression analyses showed that the association between closing of the nearest centre and lapse was robust to inclusion of covariates (Table 5.3, Model I). Donors were 53% more likely to lapse in the years after their nearest donation centre closed compared to donors whose donation centre remained open (*B* (95% CI) = .26 (.25, .28), *p* < .001). Moreover, we found positive associations between closing a donation centre and an increased distance to

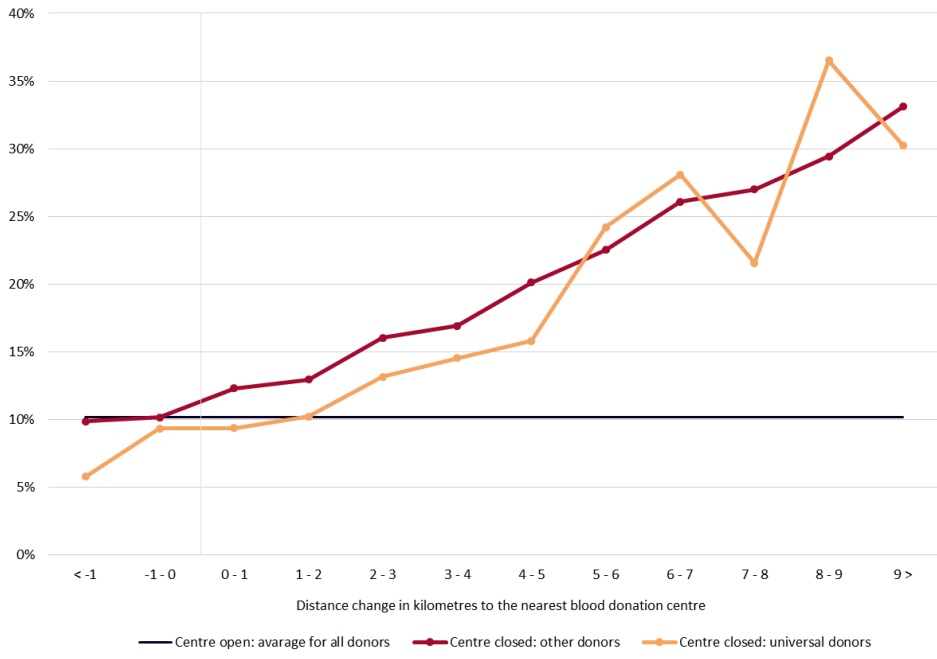


Figure 5.3 Percentage of lapsed blood donors given the distance change in kilometres to the nearest blood donation centre, stratified by donation centre status and blood group.

the nearest donation centre ($\beta = 2.30$, $z = 939.60$, $p < .001$), and between the increased distance and donor lapse (B (95% CI) = .08 (.08, .09), $p < .001$). The increased distance to the nearest donation was shown to be a strong mediator of the relationship between closing a donation centre and blood donor lapse ($z = 38.38$, $p < .001$), hereby supporting expectations stated in Hypothesis 1. While a small positive direct effect of closing remains even after controlling for the increased distance, more than 80% of the initial association is mediated by increased distance (Table 5.3, Model II).

Blood donor lapse after changing opening days of donation centres

In line with expectations from our second hypothesis, the results from the descriptive analysis showed that the percentage of donors who lapsed increased as the number of opening days decreased (up to 15.1% for a decrease of 100 days or more), while the percentage of donors who lapsed decreased as the number of opening days increased (up to 7.9% for an increase of 40 days or more). The regression analysis showed that, when the nearest blood donation centre remained open, donors had a higher lapsing risk as the number of opening days decreased (B (95% CI) = -.002 (-.003, -.002), $p < .001$), hereby supporting expectations stated in Hypothesis 2.

Table 5.3 Results for the logistic regression analyses of donor lapse on closing of the nearest donation centre, mediated by the increased distance to the nearest donation centre^{a,b}.

Variables	Model I			Model II			Z-value ^e
	B (SE) ^d	95% CI	p	B (SE)	95% CI	p	
Closing a donation centre	.26 (.01)	.25, .28	< .001	.05 (.01)	.03, .07	< .001	
Distance to a donation centre				.08 (.002)	.08, .09	< .001	38.38***

^a Blood donor lapse for non-medical reasons. ^b Results adjusted for donors' sex, age, blood group, total number of yearly deferral days and donation requests, total number of previous blood donations, and the municipalities' population density ($n = 259,149$). ^d Estimated unstandardized regression coefficients.

^e Result for the $Z_{Mediation}$ analysis (Iacobucci, 2012).

*** $p < .001$ ** $p < .01$ * $p < .05$ (two-tailed tests).

Altruism as a motivation of blood donation

Descriptive statistics showed that the overall percentage of lapsed blood donors in the year after the nearest donation centre closed was lower for O-negative donors than for other donors (13.7% vs. 15.5%). The percentage of lapsed donors was lower among O-negative donors than among the other donors as the distance to the nearest donation centre increased up to 5 kilometres. For an increased distance of more than five kilometres, a more diffuse pattern emerged (Figure 5.3). Furthermore, our results showed that, although the number of donation requests slightly increased in the year after a donation centre closed, the number of donation requests for O-negative donors did not increase at a higher rate than the donation requests for other donors: from 2.6 to 2.7 requests for O-negative donors (+3.8%) and from 1.9 to 2.1 requests for other donors (+10.5%).

Table 5.4 Results for the logistic regression analyses of donor lapse on the increased distance to a donation centre, including the interaction term for O-negative donors^{a,c}.

Variables	Model I			Model II			Z-value ^f
	B (SE) ^e	95% CI	p	B (SE)	95% CI	p	
Distance to a donation centre	.09 (.002)	.08, .09	< .001	.08 (.002)	.08, .09	< .001	
O-negative donors	-.08 (.02)	-.12, -.03	< .001	-.04 (.02)	-.08, .004	.074	
Donation requests				-.07 (.003)	-.07, -.06	< .001	-13.11***
Requests * O-negative							
Distance * O-negative							

^a Blood donor lapse for non-medical reasons. ^b Donors included in the analysis if their nearest donation centre closed ($n = 54,541$). ^c Results adjusted for donors' sex, age, total number of yearly deferral days, total number of previous blood donations, and the municipalities' population density.

The logistic regression model reported in Table 5.4 (Model I) supported hypothesis 3a: O-negative donors were 10.5% less likely to lapse than donors with other blood groups (B (95% CI) = $-.08$ ($-.12$, $-.03$), $p < .001$). Mediation analyses (Table 5.4, Model II) showed that this relation might be explained by the higher number of donation requests for O-negative donors ($z = -13.11$, $p < .001$), with a positive association between O-negative donors and the number of donation requests ($\beta = .65$, $z = 17.81$, $p < .001$), and a negative association between the number of donation requests and donor lapse (B (95% CI) = $-.07$ ($-.07$, $-.06$), $p < .001$). Moreover, no differences were found between O-negative donors and donors with other blood groups in the association between donation requests and donor lapse (B (95% CI) = $-.01$ ($-.001$, $-.03$), $p = .067$). The lower lapsing risk for O-negative donors is primarily due to the fact that they receive more donation requests in the first place, and less so because these requests are more effectively reducing lapse among O-negative donors (Table 5.4, Model III).

Finally, we also found no differences between O-negative donors and donors with other blood groups in the association between the distance to the nearest donation centre and donor lapse (B (95% CI) = $.01$ ($-.002$, $.03$), $p = .099$), in contrast with expectations stated in Hypothesis 3b. As an additional check, separate fixed effects models were performed for O-negative donors and other donors. Although the effect of increased distance on lapse was slightly smaller for universal donors (B (95% CI) = $.11$ ($.01$, $.31$), $p < .05$) than other donors (B (95% CI) = $.18$ ($.14$, $.22$), $p < .001$), the post-estimation test showed no significant differences between both coefficients (X^2 (1, $n = 3,749$) = 1.57 , $p = .210$). While O-negative donors were generally less likely to lapse after closing a donation centre, this effect was not stronger as the distance to the nearest donation centre increased (Table 5.4, Model IV).

Model III				Model IV			
B (SE)	95% CI	p	Z-value	B (SE)	95% CI	p	Z-value
.08 (.002)	.07, .08	< .001		.08 (.002)	.07, .08	< .001	
-.006 (.03)	-.06, .05	.837		-.04 (.04)	-.11, .03	.230	
-.07 (.003)	-.07, -.06	< .001	14.42***	-.07 (.003)	-.07, -.06	< .001	-1.85
-.01 (.008)	-.001, .03	.067		-.01 (.008)	-.03, .002	.097	
				.01 (.007)	-.002, .03	.099	

^e Estimated unstandardized regression coefficients. ^f Result for the $Z_{\text{Mediation}}$ analysis (Iacobucci, 2012).

*** $p < .001$ ** $p < .01$ * $p < .05$ (two-tailed tests).

DISCUSSION

Using register data on all blood donors and donation centres in the Netherlands over the past decade, we tracked closings, travel distances and opening times of these donation centres to exploit natural variation in the costs of blood donation. This contextual information was then used to study how donors in the Netherlands respond to increases in the price of donating, hereby examining psychological and economic models of altruism in blood donation. Our results show that blood donors are clearly sensitive to price changes. When a blood donation centre is closed or when the donation centre's yearly number of opening days are decreased, donors are more likely to lapse. Moreover, we find evidence of altruism among blood donors in the Netherlands. Donors with an O-negative blood group are less likely to lapse than donors with other blood groups, presumably because O-negative blood can be used for transfusions to patients with any blood group.

Out of sight out of mind?

Following the psychological model of altruism, we found that donors in general are more likely to stop donating blood after the price of donating in the form of time and inconvenience increases. After the nearest donation centre closed, blood donors were more likely to stop donating blood compared to donors whose nearest donation centre remained open. For a large part, this effect was explained by the increased travel distance to the nearest donation centre. For each additional kilometre of travel distance, the risk for blood donors to lapse steadily increased. These results are in line with a vast number of studies reporting that donors stopped donating because their donation centre closed down or moved to a less convenient location (e.g., Charbonneau et al., 2016; Klinkenberg et al., 2018b), as well as studies concluding that the risk for donors to lapse increases when donating blood becomes more time consuming (Piersma et al., 2019; Schreiber et al., 2006).

Changing the opening days of donation centres also influenced the donor's donation decision: the percentage of donors who lapsed increased as the number of opening days decreased. These results are in line with previous donor studies concluding that inconvenient opening times of a donation centre were among the main reasons to stop donating (e.g., Klinkenberg et al., 2018b; Osborne et al., 1978). The effect of changing opening days, however, is relatively small compared to the effect of closing a donation centre. While blood donors are likely to have a certain donation routine, their blood donations may indeed be too infrequent to become automatic behaviour over time (McMahon & Byrne, 2008).

Altruism as a motivation of blood donation

The evidence supports the economic model of altruism, because donors with the universal, O-negative blood group are less likely to lapse compared to donors with other blood groups. We assume that these donors are driven by altruism as their blood can be used more

efficiently and thus has a larger public benefit. Yet no interaction effects were found between O-negative donors and the distance to the nearest donation centre. While O-negative donors in general are more likely to continue donating blood compared to blood donors with other blood groups, they are not much more willing to make an additional sacrifice as the price of donating blood increases.

While the lower lapse among O-negative donors provides some evidence of altruistic behaviour, this does not necessarily imply that O-negative donors have stronger altruistic concerns for others. Gemelli and colleagues (2017), who found a similar association between O-negative donors and their continued donations, suggested that this could be explained by the higher number of donation requests for these donors instead of their altruistic motivations to supply the public good. Our study indeed showed that the number of donation requests explained why O-negative donors were less likely to lapse, indicating that blood donation is motivated by factors other than pure altruism.

Experimental studies on blood donor behaviour showed how blood donations are at least partly driven by self-regarding motivations such as warm-glow (Ferguson et al., 2008; Ferguson et al., 2012b), hereby concluding blood donors and their underlying motivations range from other-regarding altruists to self-regarding warm-glow givers. We thus might assume O-negative donors to be motivated by other forms of altruism, like reluctant altruism (e.g., continuing their blood donations because they feel a moral responsibility to relieve blood shortages) or impure altruism (e.g., continuing their blood donations because they feel more valued as a results of the higher number of donation requests).

Our conclusions on O-negative donors contrast with results from Australia (Wildman & Hollingsworth, 2009), where no association was found between O-negative donors and donation behaviour. Perhaps O-negative donors in the Netherlands are more likely to know that their blood can be used more efficiently or receive more informal donation requests at the donation centre which makes them feel pressured to continue donating. Based on the study by Sasaki and colleagues (2018), knowledge about the use of blood seems to be of importance in the donation decision: the association between O-negative donors and their continued donations was only present when they knew about the special features of their universal blood. This indicated that donors are not so much motivated by pure altruistic concerns, rather by aforementioned reluctant or impure altruism. Unfortunately we were unable to check these assumptions as our data did not include information about donors' knowledge about the transfusion process or about the informal donation requests for donors with various blood groups.

Strengths and limitations

One of the main strengths of this study is the availability of extensive, longitudinal register data on blood donors and donor behaviour, which makes it possible to examine behavioural change across the donor career as a results of blood bank policy decisions. The study

findings are highly relevant in evidence-based decision making on blood donor retention by more strategically relocating collection centres throughout the country. Moreover, using the natural variation of donation centres in the Netherlands allows for a theoretical, multidisciplinary discussion on the presence of altruistic motivations in blood donation as well as the broader field of prosocial behaviour.

The current study also has some limitations that need to be addressed. First, our research data is limited as the Dutch blood donor database does not contain geographical information about the workplace of the donor. Yet we might assume this location to play a role in the donation decision as having a blood donation centre close to the office makes it more convenient for donors to plan their donations right before or after their working hours. Information about closing the nearest donation centre to their house address might thus not be relevant for all donors. It is questionable, however, to what extent including this information would have changed the study outcomes. Almost half of all people in the Netherlands work and live in the same municipality, and the average commuting distance is only 20 kilometres (CBS, 2017b). Besides, it is reasonable to assume that closing a donation centre near the donor's workplace has the same overall effect as shown in the current study.

Second, information on closing the blood donation centres was included on a yearly basis as the register data did not include the centres' exact closing dates. As a result, some donors might have already decided to stop donating blood before the donation centre actually closed later that year. For these donors it is unclear whether they stopped donating blood for reasons related to the closing of the donation centre (e.g., because they knew the donation centre would close later that year and they did not want to plan a subsequent donation at a new location), or because of reasons unrelated to the donation centre. Although we believe that, given the large sample size, the inaccurate measure only biased the study outcomes to a small degree, including more precise closing dates of donation centres would allow for more accurate estimations of the true effect sizes.

Future directions for research and blood collection agencies

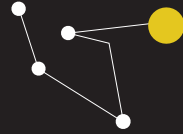
Despite these limitations, our results have shown how blood bank policy decisions significantly affect blood donor behaviour. Future donor studies are recommended to advance theoretical knowledge on underlying mechanisms explaining this association, in order to not only understand when but also why donation decisions change across the blood donor career as a result of contextual changes.

For instance, studies might examine the role of aforementioned variations of altruistic motivations other than pure altruism. Previous studies have shown how such motivations are susceptible to change across the blood donor career, with novice donors more often motivated by reluctant altruism and experienced donors more often motivated by a mix of warm-glow and pure altruism (e.g., impure altruism; Ferguson et al., 2012a). These motivations thus change with donation experience, but might also change when the price

of blood donation changes (e.g., increased time commitment required for a donation). It would be worthwhile for experimental studies to design and test interventions targeting donation barriers with the goal to motivate donors who need to make an additional time investment for a subsequent blood donation. For instance, increasing the awareness of the need for blood – an important motivation for people to make a blood donation (Bednall & Bove, 2011) – by increasing the number of donation requests after closing a donation centre might convince O-negative donors to continue donating over time.

Given the high practical relevance of our study, its conclusions are useful in further optimizing blood donor recruitment and retention. First, blood banks need to be careful with making changes to the donation centre locations as well as their opening days. While small changes might not harm most donors – increasing the distance with one or two kilometres or decreasing the opening days by 40 days per year has a relatively small impact on donor lapse – their lapsing risk increases substantially when the distance increases further. In any case, timely communication about upcoming changes is important in retaining blood donors. The perceived difficulty for donors to plan a blood donation is likely to increase after any change, even when the new donation centre is only a couple of kilometres further away than they were used to. Presenting donors with suitable alternatives for their next donation might be one of the options of in designing interventions to reduce perceived donation barriers associated with new locations and different opening days.

Moreover, it would be worthwhile to test how increasing the number of mobile donation centres while decreasing its opening days affects donor recruitment and retention. Our study has shown that changing opening days has a relatively small effect on donor lapse compared to closing donation centres. Increasing the number of mobile donation centres throughout the country increases the change of having a donation centre in the municipality, makes blood donation more visible and more easily accessible, and potentially increases awareness and knowledge about blood donation among (potential) donors. These factors were all previously shown to be associated with a higher likelihood for blood donation. As argued by Boenigk, Leipnitz and Scherhag (2011), promoting blood donations by strategically placing donation centres throughout the country is easier than manipulating donors' altruistic motivations, and experimenting with mobile centres might be effective in increasing the number of blood donations from a more diverse and loyal donor population in the coming years.





THE RELATION BETWEEN BLOOD DONOR RECRUITMENT, AND DONOR DIVERSITY AND LOYALTY IN THE NETHERLANDS

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ABSTRACT

Blood donor populations have been susceptible to change over the last decades, often showing a trend towards feminization while remaining ethnically homogeneous, leading to an underrepresentation of young men and ethnic minorities. The aim of our study was to examine whether recruitment strategies are related to donor diversity and loyalty of specific demographic groups in the Netherlands. Analyses were conducted using the Dutch blood donor database on whole-blood donors registered between 2013 and 2017 ($n = 155,054$). Chi-squared tests were used to study relationships between donor characteristics (i.e., sex, age, and Duffy-negative antigen as a proxy for donors from African descent) and recruitment strategies; linear and Cox regressions were used to study relationships between recruitment strategies, and number of donations and length of the donor career, respectively. Most donors were recruited via other donors (44.6%) or became donors on their own initiative (28.4%). Young men were often recruited by other donors and Duffy-negative donors were often recruited via missing minorities campaigns. Donors who were recruited by other donors donated most frequently, while telephone recruitment was associated with the lowest number of donations. Although telephone recruitment was associated with the longest donor careers, it also showed the largest proportional stopping prevalence. Student recruitment and missing minorities campaigns were associated with the shortest donor careers. Our results showed proportional differences in how donors of different sexes, age and ethnicity are recruited, and how recruitment relates to donor loyalty. We advocate more personalized, evidence-based recruitment and retention strategies.

INTRODUCTION

Over the last decades, blood donor populations across Europe and the United States have been susceptible to change. Studies from Germany, the United Kingdom and the Netherlands, among others, show a trend towards feminization of the donor pool, while remaining ethnically homogeneous across sex and age groups (Greinacher et al., 2007; Laeijendecker, 2014; Lattimore et al., 2015). These developments have led to an underrepresentation of various demographic groups within the blood donor population compared to the general population, especially among young men and people from ethnic minorities (Atsma et al., 2011). Yet, a balanced donor population is important for securing a safe and sufficient blood supply in future (Greinacher et al., 2007).

Compared with older donors, young donors generally have a longer donor career ahead of them; compared to female donors, male donors are less likely to be medically deferred, are less likely to experience adverse reactions, and are allowed to donate more often in most countries (France et al., 2005; Newman, Pichette, Pichette, & Dzaka, 2003). By the end of 2017, the Dutch donor population consisted of approximately 38% male and 62% female active blood donors, while in the general Dutch population the sex balance was almost evenly distributed (CBS, 2017a). Based on information from the Dutch blood donor database, the imbalance is likely to increase further in the coming years according to the rates of newly registered donors (Figure 6.1).

With regard to ethnic minorities, their underrepresentation poses a problem due to different blood type compositions. This is particularly the case for Sub-Saharan African descendants who substantially differ in extended blood types compared with people of European descent, but are also more prone to blood disorders demanding multiple blood transfusions (Miller et al., 2013; Reid et al., 2002). Due to growing multiculturalism, a diverse blood supply is needed to match with future transfusion needs (Lattimore et al., 2015). Based on Duffy-negative phenotyped donors – a proxy for people of Sub-Saharan African descent, as ethnicity is not registered in the Dutch donor database and this phenotype is strongly ethno-specific (Levinson, 2004) – about .05% of the donor population is found to be Duffy-negative (Figure 6.2). In comparison, it can be estimated that about 165 thousand persons living in the Netherlands are Duffy-negative, which is approximately 1% of the total population (CBS, 2017a; Reid et al., 2002).

Previous intervention-based blood donor studies have investigated methods to assist blood collection agencies (BCAs) in recruiting new blood donors, for instance by providing educational campaigns, message framing within BCA brochures, and offering nonmonetary incentives (Chou & Murnighan, 2013; Frye et al., 2014; Lacetera et al., 2014). Despite these efforts, motivating young men and ethnic diverse non-donors has proven to be challenging (Van Dongen et al., 2016; Wevers et al., 2014a). Hence, the question remains whether and how these potential blood donors can be effectively recruited in the near future.

Effectively recruiting and retaining blood donors?

It has been argued that the declining rate of prosocial behaviour (e.g., charitable giving, volunteering, blood donation) is associated with declining altruistic values and lower societal trust over the last 20 years (Bekkers et al., 2017). Also, the growing migrant population lags behind in prosocial participation, as social and economic segregation makes them less willing and capable to commit to the host country’s society (Schelling, 1969). In this chapter, we take a different perspective, reflecting on the role BCAs play in mobilizing young and ethnically diverse donors. We believe that these groups might be willing to be involved in blood donation, but that they are differently motivated than donors with other demographic characteristics. Our recent systematic reviews showed that motivations and barriers to donate blood differ between men and women, and (non)donors from African backgrounds (Klinkenberg et al., 2018a; Piersma et al., 2017).

Due to these motivational differences, we argue that one size does not fit all in recruiting new donors. Without thoroughly understanding motivational differences between diverse groups of (non)donors, and without incorporating these insights into recruitment

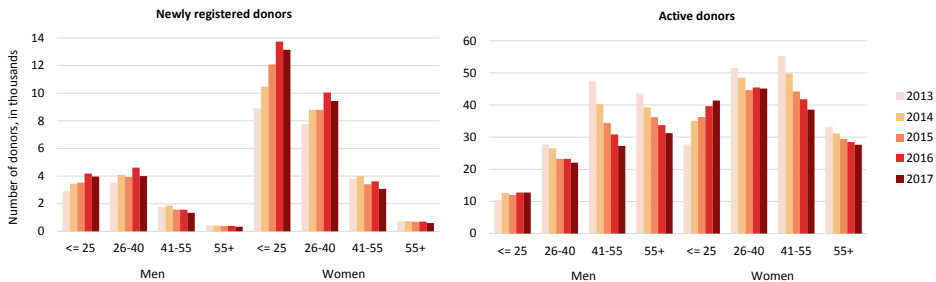


Figure 6.1 The number of whole-blood donors in the Dutch donor pool between 2013 and 2017, divided by donor status, sex and age.

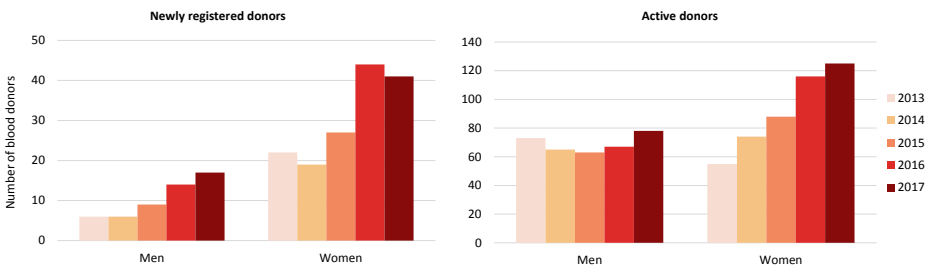


Figure 6.2 The number of Duffy-negative whole-blood donors in the Dutch donor pool between 2013 and 2017, divided by donor status and sex.

campaigns, the use of these campaigns might not lead to desired recruitment outcomes. We examined whether recruitment strategies are related to donor diversity and loyalty of specific demographic groups in the Netherlands. Moreover, we discuss and examine the increasingly popular donor-recruits-donor strategy as a specific case of evidence-based donor recruitment to highlight potential unexpected side-effects in implementing intuitively embraced recruitment strategies.

Mechanisms of altruism underlying recruitment strategies

As opposed to the traditional belief that blood donation is an act of pure altruism (Titmuss, 1971), it is reasonable to assume that donating blood is not solely driven by altruistic motives (Ferguson et al., 2008). Self-reported motivations from donors include a wide range of other reasons to be involved in blood donation (e.g., responding to feelings of moral responsibility, serving self-interest by getting a health check, or relieving blood donor shortages; Piersma et al., 2017).

The 'mechanisms of altruism' approach (MOA; Ferguson, 2015) provides a framework to order the various self-reported blood donor motivations by defining eight broad motivational categories: altruism, indirect reciprocity, warm glow, self-interest, advantageous inequality aversion, reluctant altruism, direct or social interventions, and personal or organizational context (Table 6.1). In terms of the MOA approach, we argue that people with different demographic characteristics can generally be defined as different donors. Men, compared to women, more often reported that they donated blood to get a regular health check, because it makes them feel good about themselves, and because they were influenced by friends and family (Bani & Strepparava, 2011; Glynn et al., 2002).

African minorities more often reported to be motivated by health checks and community-involved recruitment campaigns compared to the Western majority populations (Klinkenberg et al., 2018a; Polonsky, Ferdous, Renzaho, Waters, & McQuilten, 2018). It is reasonable to suggest that these groups need a different recruitment approach than women and people from Western majority populations. Yet, BCAs often design one-size-fits-all campaigns, potentially leading to a lack of sufficient matching between targeted and recruited donors (Carver, Chell, Davison, & Masser, 2017). We therefore assume some demographic groups to be either underrepresented or overrepresented as a result of the use of current BCA recruitment strategies:

Hypothesis 1: People from different age categories, sexes and people from Sub-Saharan African minorities are different in the way they are recruited as blood donors.

Donor-recruits-donor as specific donor recruitment case

Donor-recruits-donor is a form of social intervention, with active donors recruiting potential donors from their network, and has been praised as the most cost-effective and sustainable recruitment strategy (Lemmens, Ruiters, Abraham, Veldhuizen, & Schaalma, 2010). It has been

estimated that the costs for social interventions such as donor-recruits-donor are more than two times lower than for cold recruitment (e.g., direct intervention bij BCA; Misje et al., 2005). Moreover, it is suggested that donor-recruits-donor is effective in recruiting new donors. Current donors are generally willing to help with recruiting new donors (Lemmens et al., 2008), and when a potential donor is personally asked by another donor, he or she is more likely to register as a donor as well (Gillespie & Hillyer, 2002). This might be promising for increasing diversity of the donor pool, as men and African minority populations report social interventions as one of the motivations to start donating blood (Bani & Giussani, 2010; Klinkenberg et al., 2018a).

Table 6.1 Overview of the eight mechanisms of altruism (MOA).

Mechanisms of altruism	Description
Altruism	Donating to help others, save lives, or because it feels as a duty to do so
Indirect reciprocity	Donating because family, friends or acquaintances received blood
Warm-glow	Donating because it is enjoyable and gives a good feeling about the self
Self-interest	Donating to get something in return, such as a regular free health
Advantageous inequality aversion	Donating to relieve feelings of guilt or to ease the conscience
Reluctant altruism Interventions	Donating to relieve a shortage of blood or blood donors
Direct	Donating because of a recruitment approach by the blood bank
Social	Donating because of a personal recruitment approach by another donor
Context	
Personal	Donating for practical reasons (e.g., having a donation center close by)
Organizational	Donating to support the blood bank or to support research

Note. Adapted from: Ferguson, E. (2015). Mechanism of altruism approach to blood donor recruitment and retention: a review and future directions. *Transfusion Medicine* (25)4, 211-226.

This social intervention motivation, however, might also play a counterproductive role in the donor-recruits-donor strategy. Research on prosocial behaviour has shown that people from certain socio-demographic groups are more likely to be solicited for volunteer work and charitable giving than others, especially females, members of religious groups, and the higher-educated (Bekkers & Schuyt, 2008; Wiepking & Maas, 2009). Moreover, those involved in volunteer work in the past are more likely to be asked to engage in voluntary work again: 'Once on the list of usual suspects, I'm likely to stay there' (Putnam, 2000). This may lead to a self-reinforcing process of selective mobilization, increasing the homogeneity of those involved in prosocial behaviour. In the case of blood donation, with an overrepresentation of women and donors from Dutch descent (Atsma et al., 2011),

recruitment based on social interventions might reinforce the trend towards feminization and ethnic homogeneity, rather than promoting a balanced donor pool. Based on these competing perspectives, we hypothesized that:

Hypothesis 2a: Donor-recruits-donor strategies enhance heterogeneity in the donor pool in terms of age, sex and ethnicity.

Hypothesis 2b: Donor-recruits-donor strategies enhance homogeneity in the donor pool in terms of age, sex and ethnicity.

Relation between recruitment strategies and donor loyalty

Specific recruitment strategies may not only appeal differently to certain demographic groups, but may also influence how newly recruited donors interpret and appreciate their donor career. For instance, direct or social interventions may make a potential donor feel pressured to sign up, negatively influencing donor loyalty over the long term. From the social desirability theory (Steenkamp et al., 2010), it is assumed that people are more likely to conform to perceived societal norms when confronted with a solicitation to become a donor. Sargeant and Hudson (2008) showed that, after a direct intervention for charitable giving, lapsed donors were more likely than active donors to report feeling pressured to donate money. Although these people are more likely to sign up, they are not more likely to become loyal donors. We would expect recruitment strategies based on direct and social interventions, such as donor-recruits-donor or on-site recruitment by the BCA, to be less effective in donor retention than donors who started donating on their own initiative because of altruistic motivations.

On the other hand, a personal recruitment approach may result in higher feelings of commitment and responsibility, which may positively affect donor loyalty. This might especially be the case for social interventions, when being recruited by family, friends or colleagues. Misje and colleagues (2005) reported that short-term donors were more often recruited by mass media, while long-term donors were more often recruited by social interventions. To further explore the possible relation between recruitment strategies and donor loyalty, we formulated the following hypotheses:

Hypothesis 3a: Donors recruited via different recruitment strategies differ in their number of subsequent blood donations.

Hypothesis 3b: Donors recruited via different recruitment strategies differ in their subsequent stopping prevalence.

MATERIALS AND METHODS

Data and procedure

To test our hypotheses, we used information from the Dutch blood donor database (eProgesa; Sanquin, 2018a), containing information on all Dutch blood donors and their donations, such as deferral reasons, return rates, and blood groups. For our analyses, we selected all whole-blood donors who entered the donor pool within a 5-year time frame (January 2013 to December 2017) and for whom the recruitment strategy was registered. Our final sample consisted of 155,054 blood donors.

Measures

Recruitment strategies. During the online registration, each donor is asked to indicate why they decided to sign up as a donor by presenting a list of all possible recruitment strategies. eProgesa keeps a record of the specific recruitment strategy for each donor, with 30 different strategies being registered between 2013 and 2017. Based on previous categorizations by the department of Donor Relations of the Dutch BCA, the authors independently categorized the strategies according to type of recruitment. Individual categorizations were compared in a meeting, whereas disagreements on categorizations were resolved by discussion with the department of Donor Relations to define the final set of 10 clustered recruitment strategies (Table 6.2 and Appendix 6.1).

Donor loyalty. To explore the relation between recruitment strategies and donor loyalty, we included two indicators of donor loyalty in the model: the total number of whole-blood donations, based on register data from eProgesa, and the length of the donor career until stopping (i.e., whether the donor deregistered from the donor database for any medical or nonmedical reason).

Demographic characteristics. Regarding donor demographics, we looked at the donors' sex, age – divided into four categories (i.e., 18-25, 26-40, 41-55, 55+) – and the prevalence of Duffy-antigens as a proxy for people from Sub-Saharan African descent (Reid et al., 2002).

Control variables. The number of invitations to donate, the year the donor was recruited (with 2013 as reference category) and the ABO/D blood groups were included as control variables, as these can be strongly related to the dependent variables and can alter the outcomes if not controlled for.

Table 6.2 Descriptive statistics of all study measures^a.

Characteristic	All donors (n = 155,054)	Men (n = 48,167; 31.1%)	Women (n = 106,887; 68.9%)	Duffy-negative (n = 240; 0.2%)
Age	29.2 (±11.1)	30.7 (±11.2)	28.5 (±11.0)	29.9 (±10.5)
18-25 years	76,862 (49.6%)	19,503 (40.5%)	57,359 (53.7%)	97 (40.4%)
26-40 years	49,773 (32.1%)	18,659 (38.7%)	31,114 (29.1%)	95 (39.6%)
41-55 years	23,031 (14.9%)	7,943 (16.5%)	15,088 (14.1%)	41 (17.1%)
55+ years	5,388 (3.5%)	2,062 (4.3%)	3,326 (3.1%)	7 (2.9%)
Number of donations	3.5 (±4.6)	4.4 (±5.8)	3.1 (±3.8)	2.5 (±3.1)
Stopped donors	47,683 (30.8%)	15,645 (32.5%)	32,038 (30.0%)	82 (34.2%)
Recruitment strategy				
Donor-recruits-donor	69,168 (44.6%)	23,968 (49.8%)	45,200 (42.3%)	80 (33.3%)
Own initiative	44,024 (28.4%)	12,743 (26.5%)	31,281 (29.3%)	79 (32.9%)
Patient-recruits-donor	11,312 (7.3%)	3,168 (6.6%)	8,144 (7.6%)	21 (8.8%)
Telephone recruitment	6,877 (4.4%)	2,092 (4.3%)	4,785 (4.5%)	7 (2.9%)
Promotion team	6,725 (4.3%)	1,333 (2.8%)	5,392 (5.0%)	13 (5.4%)
Offline media	5,315 (3.4%)	1,474 (3.1%)	3,841 (3.6%)	5 (2.1%)
Online media	4,840 (3.1%)	1,179 (2.4%)	3,661 (3.4%)	10 (4.2%)
Businesses & organizations	3,160 (2.0%)	1,114 (2.3%)	2,046 (1.9%)	6 (2.5%)
Students & education	3,148 (2.0%)	866 (1.8%)	2,282 (2.1%)	11 (4.6%)
Missing minorities	485 (0.3%)	230 (0.5%)	255 (0.2%)	8 (3.3%)
Years donor	2.1 (±1.3)	2.1 (±1.3)	2.1 (±1.3)	1.7 (±1.1)
Blood group				
O-negative	13,692 (8.8%)	4,179 (8.7%)	9,513 (8.9%)	22 (9.2%)
O-positive	55,229 (35.6%)	17,432 (36.2%)	37,797 (35.4%)	112 (46.7%)
A-negative	11,087 (7.2%)	3,342 (6.9%)	7,745 (7.2%)	7 (2.9%)
A-positive	49,740 (32.1%)	15,546 (32.3%)	34,194 (32.0%)	53 (22.1%)
B-negative	2,489 (1.6%)	752 (1.6%)	1,737 (1.6%)	9 (3.8%)
B-positive	12,088 (7.8%)	3,991 (8.3%)	8,097 (7.6%)	26 (10.8%)
AB-negative	1,032 (0.7%)	324 (0.7%)	708 (0.7%)	3 (1.3%)
AB-positive	4,623 (3.0%)	1,502 (3.1%)	3,121 (2.9%)	7 (2.9%)
Unknown	5,074 (3.3%)	1,099 (2.3%)	3,975 (3.7%)	1 (0.4%)

^a Data reported as mean (±SD) or number (%).

Statistical analyses

Statistical analyses were conducted using IBM SPSS 23 (Chicago, IL, USA). Chi-Squared tests were performed to examine whether donors from different demographic groups were recruited via specific recruitment strategies and Phi-coefficients were calculated to further examine differences. We then examined whether recruitment strategies were related to donor loyalty, looking at the total number of donations and stopping prevalence within the 5-year time frame using linear and Cox regression analyses, respectively.

RESULTS

Descriptive statistics

The majority of the 155,054 included whole-blood donors were women (68.9%) and people aged 25 years or younger (49.6%). These donors had a total average of 3.5 whole-blood donations, with women and Duffy-negative donors having a lower average donation frequency (Table 6.2). More than 30% of the registered donors stopped within this same 5-year time frame, with a higher proportion of stopped donors among men and Duffy-negative donors. Most donors were recruited by the donor-recruits-donor strategy (44.6%), followed by becoming a donor on their own initiative (28.4%) and being recruited by a patient (7.3%).

Demographic differences in recruitment strategies

In line with expectations from hypothesis 1, our results showed that recruitment strategies differ for men and women (X^2 (9, $n = 155,054$) = 1,190), for donors from different age categories within men and women (X^2 (63, $n = 155,054$) = 17,563), and for donors who do or do not have the Duffy-negative phenotype (X^2 (9, $n = 155,054$) = 91). Women were less likely than men to be recruited by the donor-recruits-donor strategy ($\phi = -.07$), but were more likely than men to be recruited by the BCA promotion team ($\phi = .05$). With regard to the various age groups, subdivided by sex, men aged 25 and younger were most likely to be recruited by the donor-recruits-donor strategy ($\phi = .06$) – hereby supporting hypothesis 2a in favour of hypothesis 2b – while women aged between 26 and 40 were least likely to be recruited by other donors ($\phi = -.06$). Duffy-negative donors were more likely to be recruited by missing minority campaigns ($\phi = .02$). All Phi-coefficients between the study measures can be found in Appendix 6.2.

Recruitment strategies and donor loyalty

The first model demonstrates the association between sex, age and ethnicity, and the number of blood donations, controlled for the length of the donor career, number of invitations and the ABO/D blood groups (Table 6.3). Women (B (95% CI) = $-.69$ ($-.73$, $-.66$))

and Duffy-negative donors (B (95% CI) = $-.61$ ($-1.05, -.17$)) make less donations compared with the reference group, while older donors make more donations (B (95% CI) = $.02$ ($.02, .03$)). In the second model, the donor-recruits-donor strategy and becoming a donor on own initiative were added. Both were positively associated with the number of donations compared with the other strategies, although the association was larger for the donor-recruits-donor strategy (B (95% CI) = $.41$ ($.37, .45$)) compared with own initiative (B (95% CI) = $.22$ ($.17, .27$)). In the last model, the different recruitment strategies were added with becoming a donor on own initiative as reference category. Those who were recruited via the donor-recruits-donor strategy had the highest number of subsequent donations (B (95% CI) = $.17$ ($.13, .21$)). Telephone recruitment showed the strongest negative relation with the number of subsequent donations (B (95% CI) = -1.04 ($-1.14, -.95$)). These results show how that, in line with hypothesis 3a, donors recruited via different recruitment strategies differ in their number of subsequent blood donations.

As shown in Table 6.4, the Cox regression analysis showed that women were less likely to end their donor career (HR (95% CI) = $.78$ ($.77, .80$)) while Duffy-negative donors were more likely to stop (HR (95% CI) = 1.54 ($1.24, 1.91$)). No differences were found for age. Controlled for the other determinants, telephone recruitment (HR (95% CI) = $.89$ ($.85, .93$)) and promotion team recruitment (HR (95% CI) = $.90$ ($.86, .94$)) were associated with the longest donor careers, while student recruitment (HR (95% CI) = 1.32 ($1.23, 1.42$)) and missing minorities recruitment (HR (95% CI) = 1.30 ($1.14, 1.49$)) were associated with the shortest donor careers. However, the actual stopping rate over the whole sample is the highest for telephone recruitment (52.0%) and missing minorities recruitment (46.4%), while lowest for recruitment at businesses and organizations (22.7%) and recruitment via online media (23.2%). These results are in support of hypothesis 3a as donors recruited via different recruitment strategies differ in their subsequent stopping prevalence. The actual cumulative survival rate per recruitment strategy for the length of the blood donor career between registration and stopping is presented in Figure 6.3.

DISCUSSION

Recruitment campaigns are associated with donor diversity and loyalty

The results from our study showed that there are proportional differences in how people from different age categories, sexes and ethnic groups are recruited. For instance, the donor-recruits-donor strategy might add to creating a balanced donor pool, as relatively more young men were recruited by other donors. These results are in line with studies reporting men to be motivated to donate blood because they were convinced by friends, family and colleagues (Piersma et al., 2017). Social interventions might therefore be effective in reaching out to young, male non-donors, while direct interventions from the BCA might be

Table 6.3 Results of multivariate linear regression analyses on the number of total donations ($n = 155,054$)^a.

Variables	Model I		
	B (SE)	95% CI	<i>p</i>
Women	-.69 (.02)	-.73, -.66	< .001
Age	.02 (.001)	.02, .03	< .001
Duffy-negative	-.61 (.22)	-1.05, -.17	.006
Recruitment strategy			
Donor-recruits-donor			
Own initiative			
Patient-recruits-donor			
Promotion team			
Offline media			
Online media			
Businesses & organizations			
Students & education			
Missing minorities			
Telephone recruitment			
Intercept	-3.20 (.07)	-3.33, -3.07	
<i>F</i>	6634.55		
Adjusted <i>R</i> ² (%)	42.1%		

^aAll models are controlled for the length of the donor career, number of donation invitations, year of recruitment and ABO/D blood groups.

more effective in recruiting female blood donors. However, social interventions, and more specifically the donor-recruits-donor strategy, might not be as effective in increasing the number of blood donors of African descent, as fewer Duffy-negative donor were recruited by other donors. It might be the case that donating blood or talking about blood donation is generally not embraced in the community due to taboos and symbolic beliefs, restricting possibilities to recruit new donors (Grassineau et al., 2007). Rather, recruitment strategies focused around reluctant altruism and raising the awareness of need for specific blood products, as is the case with missing minority recruitment, might be more effective in recruiting these non-donors.

Donor loyalty, in terms of the number of blood donations and the length of the donor career, differs between donors and between the various recruitment strategies. Next to recruitment, our results showed that retention of young men and African donors is difficult as well. Although male donors donate more frequently than women, male donors and Duffy-negative donors have shorter donor careers. With regard to recruitment strategies, the

Model II			Model III		
B (SE)	95% CI	p	B (SE)	95% CI	p
-.67 (.02)	-.70, -.63	< .001	-.67 (.02)	-.71, -.63	< .001
.03 (.001)	.02, .03	< .001	.03 (.001)	.027, .030	< .001
-.58 (.22)	-1.01, -.14	.010	-.57 (.22)	-1.01, -.13	.011
.41 (.02)	.37, .45	< .001	.17 (.02)	.13, .21	< .001
.22 (.02)	.17, .27	< .001	<i>Ref.</i>	<i>Ref.</i>	
			-.14 (.04)	-.06, .80	< .001
			-.12 (.05)	-.21, -.03	.011
			-.07 (.05)	-.17, .03	.145
			-.06 (.05)	-.16, .04	.268
			-.04 (.07)	-.16, .09	.556
			-.10 (.07)	-.23, .02	.103
			-.79 (.16)	-1.10, -.48	< .001
			-1.04 (.05)	-1.14, -.95	< .001
-3.49 (.07)	-3.62, -3.35		-3.25 (.07)	-3.38, -3.11	
5968.21			4387.59		
42.2%			42.4%		

donor-recruits-donor strategy has the strongest positive relation with subsequent donations, supporting findings from Misje and colleagues (2005) and Lemmens (2010) who advocated the importance of friends, families and colleagues. Although there are differences between recruitment strategies and length of donor careers, we do not find clear differences when looking at the potential role of social desirability in blood donor behaviour over the long term. Recruitment based on direct interventions, social interventions, or donating on own initiative do not differ from each other in a clear direction. For instance, recruitment by offline media, donor-recruits-donor, or the promotion team shows marginal differences in their donor career survival rate (Figure 6.3).

Strengths and limitations

One of the strengths of this study is that the Dutch donor database provides a lot of information over a long period of time. Instead of surveying a sample of donors, we were able to use the information of all Dutch donors recruited between 2013 and 2017, including

Table 6.4 Results of Cox regression analyses on ending the donor career ($n = 155,054$)^a.

Variables	Model I		
	HR (SE)	95% CI	<i>p</i>
Women	.78 (.01)	.77, .80	< .001
Age	1.00 (.00)	.999, 1.000	.333
Duffy-negative	1.56 (.11)	1.26, 1.94	< .001
Recruitment strategy			
Donor-recruits-donor			
Own initiative			
Patient-recruits-donor			
Promotion team			
Offline media			
Online media			
Businesses & organizations			
Students & education			
Missing minorities			
Telephone recruitment			
Chi-square (df)	132,426 (17)		

^aAll models are controlled for the number of blood donations, number of donation invitations, year of recruitment and ABO/D blood groups.

the specific recruitment strategy in play. Moreover, this is one of the first studies in blood donor research that examines the role of BCAs in the relation with donor demographics, recruitment strategies and donor loyalty.

However, this study has some limitations. First, the recruitment strategies were mainly self-reported by blood donors during registration. It may be that the donor is not fully aware of the reason for registration or multiple cues led to the decision to register. Moreover, given the measurement bias it is not possible to draw conclusions on the causal effects of recruitment strategies on donor diversity and loyalty. Before moving from associations to effects, a more objective and unbiased registration of blood donation motivations is needed, as well as the development of these donation motivations across the blood donor career. Yet the results of our study provide some early indications about how strategically choosing recruitment strategies may affect the composition of the blood donor population.

Second, as the recruitment and retention of ethnic minority donors becomes more urgent, we used the Duffy-negative phenotype as a proxy for African background. Although this phenotype is exceedingly rare in people of European descent, this proxy does not fully correspond with ethnicity. Also, not all donors have been fully

Model II			Model III		
HR (SE)	95% CI	<i>p</i>	HR (SE)	95% CI	<i>p</i>
.78 (.01)	.77, 0.80	< .001	.78 (.01)	.77, .80	< .001
1.00 (.00)	.999, 1.001	.627	1.00 (.00)	1.000, 1.002	.034
1.56 (.11)	1.26, 1.94	< .001	1.54 (.11)	1.24, 1.91	< .001
1.02 (.01)	1.00, 1.05	.029	1.00 (.01)	.98, 1.03	.784
1.02 (.01)	.99, 1.04	.168	<i>Ref.</i>	<i>Ref.</i>	
			1.02 (.02)	.99, 1.06	.268
			.90 (.02)	.86, .94	< .001
			.93 (.03)	.88, .98	.005
			1.07 (.03)	1.01, 1.14	.031
			.96 (.04)	.89, 1.04	.292
			1.32 (.04)	1.23, 1.42	< .001
			1.30 (.07)	1.14, 1.49	< .001
			.89 (.02)	.85, .93	< .001
132,427 (19)			132,606 (26)		

phenotyped, making it possible that a small number of donors from African descent are still unknown to the BCA. Finally, the actual effect sizes of recruitment strategies were small, suggesting that demographic characteristics are more important predictors of donor loyalty. Nonetheless, we found relations between donor recruitment, diversity and loyalty, stressing the added value of thoughtful decision making in deploying specific recruitment strategies.

Future directions in blood donor studies and recruitment

More fundamental research on donor recruitment and their effects on the blood donor career is needed to better understand how targeted (non-)donors can best be recruited and retained. Systematically adjusting recruitment interventions and performing (field) experiments to test new strategies is one of the ways to increase our understanding of donation motivations in specific target groups. Possible underlying individual, network and contextual motivations to donate blood, such as warm-glow giving, experienced social pressure, or feelings of moral responsibility, should be taken into account. Information about these donation motivations should be integrated into BCAs registration data to make evidence-based decisions about when and how to communicate with their blood donors.

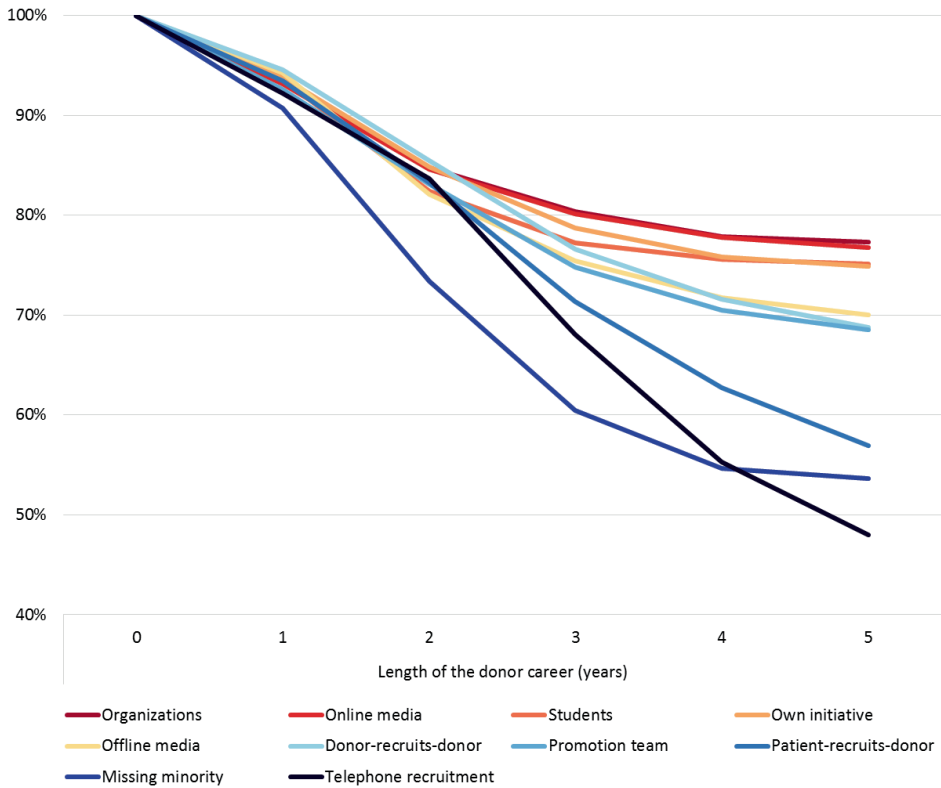


Figure 6.3 Cumulative percentage of registered blood donors per recruitment strategy within the five year time-frame (2013-2017).

Based on the preliminary findings presented in this chapter, it seems to be worthwhile for BCAs to further facilitate social interventions such as donor-recruits-donor recruitment. However, solely focusing on the donor-recruits-donor strategy will probably not be enough to recruit the much needed Duffy-negative donors. Personalized, evidence-based recruitment strategies should be designed, tested and evaluated to effectively motivate African minorities.

While we advocate the development of more personalized recruitment strategies, we also stress the importance of personalized donor retention. As we have shown, donors recruited by direct interventions, such as recruitment among students and ethnic diverse donors, may need more support in continuing their donor careers and becoming loyal donors over time. Donor careers are highly person-specific and attention needs to be paid to the role of BCAs in evidence-based recruitment and retention of our blood donors.





DISCUSSION

Parts of the practical and theoretical recommendations for future blood donor studies are published as: Piersma, T.W., & Merz, E.-M. (2019). (Non-)donor demographics, donation willingness, and the donor career. *Transfusion*, 59(6), 1894-1896.

The paper was based on a keynote presentation from EM at the 2018 Annual Meeting of the American Association of Blood Banks (AABB) in Boston, MA. EM decided on the conceptual framework of the presentation, with the help and critical feedback of TP in writing the manuscript and developing its respective theoretical arguments.

DISCUSSION

Without blood donors, there are no blood products to transfuse and no plasma donations for pharmaceutical drug production. Four million patients in Europe are treated annually with blood-derived products given by voluntary blood donors. However, only about 3% to 4% of the population in Europe are registered as blood donors, and donor numbers have been decreasing during the recent decades. At the same time, the demand for blood products is shifting in times of demographic change, migration, and longevity (Merz & Van der Meer, 2018). Hence, it is crucial that a country's donor pool is sufficient and specific enough to ensure access to every needed blood type and plasma product. Securing a sufficient, diverse, and loyal donor pool is challenging, as donating blood is a costly endeavour. Donating requires individual resources (e.g., adequate health and available time) and can involve medical risks such as fainting or bruises, that can vary over the life course. Onset, continuation and cessation of blood donation – the blood donor career – can occur at specific moments during an individual's life course.

From our systematic literature review (Chapter 2) we concluded that a thorough and inclusive investigation of blood donor behaviour as a specific form of prosocial behaviour is lacking. Yet, blood donation serves as a perfect case for studying determinants of prosocial behaviour, as blood donors voluntarily donate their blood to help anonymous recipients in the absence of (financial) compensation. Scholars from various disciplines such as sociology, psychology and economics have studied a wide range of individual donor characteristics and donation motivations, showing that the likelihood to be involved in prosocial activities varies within persons and among different socio-demographic categories. Less is known about motivational mechanisms explaining these differences, as well as reasons for their development across the life course. Social scientific theories previously used for examining charitable giving and involvement in volunteer work can be applied to blood donation in order to investigate diverging donation motivations, as well as to adopt a dynamic approach to (blood) donor careers.

This information does not only widen our theoretical knowledge on prosocial behaviour, but is fundamental to develop effective evidence-based donor management. In our view, a multidisciplinary approach that encompasses the interplay among groups of determinants (i.e., demographic, psychological and health), while paying attention to motivational mechanisms, and social and contextual influences, can explain the onset and continuation of blood donation throughout the blood donor career and offer clues for developing targeted donor recruitment and retention strategies. The goal of this dissertation, therefore, was to set the scene for a dynamic, multidisciplinary approach in blood donor studies by starting to answer the following research question:

Which individual, social and contextual factors are associated with blood donor behaviour, and what influence do these factors have across the blood donor career?

Main findings: factors associated with the blood donor career

We have presented four empirical papers throughout this dissertation, based on insights from our systematic literature review (Chapter 2). We will now summarize the main findings of these studies (Figure 7.1). Structured around the five paradigmatic principles of the life course perspective (Elder et al., 2003), we examined to what extent individual, social and contextual factors (human agency, linked lives, and time and place, respectively) are associated with donor behaviour across the blood donor career (life-span development), given the historical and societal developments (timing) urging for a better understanding of blood donors and their behavioural decisions.

Human agency: individual factors across the blood donor career. Using the large-scale survey data of the Dutch Donor InSight study (DIS; Timmer et al., 2019), we found that individual life events related to the health of family members, the family composition, and labour market transitions all impact on blood donor lapse to some extent (Chapter 3). More specifically, blood donors who got a child, found a new job or lost their job had a higher risk of blood donor lapse in the years following the event compared to people who did not experienced these events. On the other hand, donors who experienced a blood transfusion for a family member or a serious disease in a family member were more likely to continue donating, compared to donors who did not experience either of these health-related life events. In our follow-up study (Chapter 4), these events were shown to have a similar influence on the lapsing risk of blood donors in Denmark.

In line with Elder's (1994) human agency principle of the life course perspective, our findings suggest that practical concerns play a role in people's decision to stop donating blood after the occurrence of a life event. For instance, after childbirth, donors perceive that they do not have enough time to plan a blood donation while donors who lost their job perceived that they are less healthy than other people around them, making them feel ineligible to donate blood. Both individual factors were shown to increase the risk for lapse in these donors. Moreover, these results align with human capital theories on behaviour, and blood donation specifically. As sufficient time and health are needed to meet the minimal donation criteria, the resource-rich are more likely to continue their blood donor career than the resource-poor (Bekkers, 2006; Musick & Wilson, 2008).

Linked lives: social factors across the blood donor career. The blood donation decision is not just a trade-off of personal resources. Results from Chapters 3 and 4 showed that the donation decision is influenced by donor's linked lives and social network changes across the blood donor career. Donors who lost their job were more likely to lapse than donors who kept their job, with knowing fewer other blood donors after losing a job partially explaining this effect. Although increased social connections did not play a mediating role in the associations between health-related events and donor lapse, social connections in

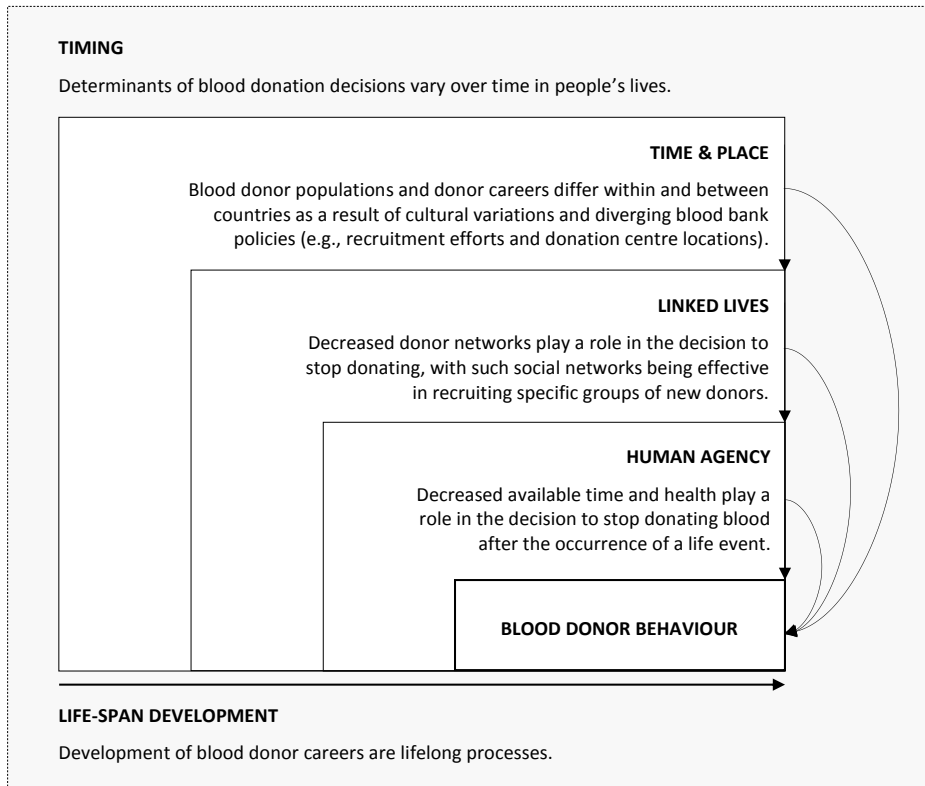


Figure 7.1 The main findings of our studies presented throughout this dissertation, structured around the five paradigmatic principles of the life course perspective.

itself seem to impact on blood donor behaviour as knowing fewer other blood donors was related to an increased lapsing risk. In line with expectations from social capital theories and previous blood donor studies, people who are part of large social networks and who have more blood donors among their social connections are more likely to be involved in blood donation themselves (Bani & Strepparava, 2011; Charbonneau et al., 2015; Wilson & Musick, 1998).

Since blood donations are not made in social isolation, we assume that recruitment strategies based on social influence are effective methods in approaching prospective blood donors. In Chapter 6, we examined the use of social interventions (i.e., donating because of a personal recruitment approach by another blood donor; Ferguson, 2015), in which we observed that the donor-recruits-donor strategy was among the most often self-reported recruitment methods for blood donors to register with Sanquin. This was especially true

for male donors aged 35 and younger, compared to female and older blood donors. Given these results, social interventions are effective methods in increasing the number of young and male donors within the blood donor population.

Yet social interventions might not be as effective in motivating non-donors with other demographic characteristics as well as retaining these donors across the blood donor career. In line with expectations on social desirability – the tendency of people to behave in socially acceptable ways to avoid receiving negative evaluations of significant others – Misje and colleagues (2005) reported that short-term donors were more often recruited by mass media and the blood bank (i.e., direct interventions), while long-term donors were more often recruited by other blood donors from their social network such as friends and family (e.g., social interventions). In contrast, we found no clear differences between direct and social interventions, and their associations with the length of the blood donor career (Chapter 6). These diverging results suggest that the long-term role of linked lives in blood donor behaviour warrants further investigation.

Time and place: contextual factors across the blood donor career. Based on the findings from Chapter 4, comparing results from the Dutch and the Danish life events studies, we assume certain motivational mechanisms to be universal factors associated with blood donor behaviour across the donor career. Childbirth constrains a person's available time (Schmitz, 2011), losing a job decreases the self-perceived health (Elder & Greene, 2012), and health-related events in the family raise feelings of moral responsibility, regardless of the local blood collection regime or other contextual differences between countries. Aside these similarities, some notable differences were found between the study results, mainly related to blood donor sample composition (i.e., higher proportion of younger, lapsed donors with a lower number of previous donations in Denmark compared to the Dutch donor base) and the magnitude of effect sizes (i.e., generally smaller in the Danish study), indicating the importance of taking into account contextual differences between countries and blood collection regimes.

Regarding these contextual differences between Denmark and the Netherlands, diverging descriptive characteristics of both blood donor samples might differ as a result of organizational variation in blood collection regimes. Following Healy's categorization (Healy, 2000), blood collection in the Netherlands originates from a Red Cross regime which is rooted in voluntary, religious organizations, therefore being more likely to attract fewer but more loyal donors. The Danish collection regime, consisting of several regional blood banks, might be more effective in recruiting new, young donors but less so in retaining them over time (e.g., due to larger recruitment efforts among students and weaker ties between volunteering, religious involvement and blood donation compared to Red Cross systems).

These contextual differences might also contribute to differences in the effect sizes of life events on donor behaviour. For instance, results from the Netherlands showed how donors who started a new job were more likely to lapse as a result of increased difficulty

to plan a donation and increased working hours. In Denmark, however, no association was found between starting a job and donor lapse. This could be explained by increasing efforts of the Danish blood bank to place mobile donation centres at a large number of companies, especially in the Copenhagen region (Blodbanken, 2019). When blood donors in Denmark start a new job, it is likely that increased working hours are less of a barrier to continue donating as it is relatively easy to give blood during working hours, at the workplace.

Based on these results we can state that, indeed, time and place are influential in the donation decision (Elder et al., 2003). Blood donor careers are embedded in, and shaped by, the places they experience and their respective cultural values and behavioural norms. On the other hand we assume blood collection agencies to play a role in the donation decision on a national level as well, as blood donations depend on the interaction between blood banks and their donors. Using register data on all donors and geographical locations of donation centres in the Netherlands over the past decade, Chapter 5 showed how blood donors are highly sensitive to changing characteristics of these donation centres. When a donation centre closed, donors were more likely to stop donating blood compared to donors whose nearest donation centre remained open, with this risk steadily increasing for each additional kilometre of travel distance to the new donation centre. Moreover, changing the opening days of donation centres also influenced the donor's donation decision: the percentage of donors who lapsed increased as the number of opening days decreased.

Yet donating blood is not only motivated by practical concerns about the physical presence of donation centres. In addition to the wide variety of donation motivations listed in Chapter 2 (e.g., altruistic feelings, warm-glow, or solicitation by the blood bank or other donors), results from Chapter 6 showed how blood bank's recruitment strategies based on these donation motivations play a role in creating diverse and loyal donor populations. While most donors were recruited via other blood donors (i.e., the donor-recruits-donor strategy) or registered with the blood bank on their own initiative, we could assess proportional differences in how people from different sex, age and ethnicity were recruited as donors. For instance, the donor-recruits-donor strategy was especially reported by donors aged 35 or younger. Among older donors, the blood bank promotion team was the most commonly reported recruitment method. Moreover, our results show that recruitment methods are associated with the length of the blood donor career. While 70% of the donors recruited by other donors were still actively donating blood after five years, this ranged from a high 80% for recruitment via organizations and online media to a low 50% for missing minority campaigns and telephone recruitment. Chapters 6 thus shows that blood donor careers are highly person-specific, and some donors need more support in becoming loyal donors over time.

Interrelationships between individual, social and contextual factors across the donor career. From our study findings, we conclude that individual, social and contextual factors all have their own influence on donation decisions across the blood donor career.

However, these factors are interrelated in their association with blood donor behaviour. In Chapter 6, we showed how recruitment attempts by the blood bank are related with demographic characteristics of newly registered blood donors. These characteristics are well likely to be associated with donor loyalty across the blood donor career, influencing the extent to which blood banks need to communicate with their donors to optimally organize donor retention. These blood bank campaigns then possibly affect the way in which people talk about blood donation and get to know other blood donors, hereby influencing social donor networks. In other countries, with other personal beliefs about donating blood or other social network influences, these motivational factors might well have other consequences on the blood donation decision. For instance, when donors have the possibility to donate blood at the workplace (e.g., Denmark, United States), donor networks and social influence from colleagues might be more significant in the length of the blood donor career compared to other countries with other local blood bank regulations. These are just two of many examples in which the various individual, social and contextual factors are embedded and able to mutually influence each other across individual blood donor careers.

The conclusions drawn from the studies presented throughout this dissertation have their theoretical implications for future studies on blood donor behaviour, as well as practical implications for blood collection agencies in more effectively recruiting and retaining a diverse, representative blood donor population. We will elaborate on these theoretical and practical issues in the remainder of this chapter, but not before we have discussed the methodological strengths and limitations essential to the interpretation of our conclusions.

Methodological considerations

Across the studies presented in this dissertation, we have used a unique combination of data from representative blood donor surveys and two national blood donor registers. By using these large-scale, longitudinal datasets we were able to analyse a great number of individual blood donor careers, moving away from static donor behaviour and examining actual blood donations instead of self-reported donation intentions. As the data included individual and social blood donor information (e.g., available time, health and social connections), as well as contextual information about blood bank policies (e.g., locations and opening times of donation centres) across several years, we were able to provide a life course perspective on blood donor behaviour. Moreover, the longitudinal nature of the data allowed us to draw preliminary conclusions about causal influences on blood donor behaviour over time. Even extensive surveys and registers, however, do not fully safeguard from any methodological limitations.

Method biases in (longitudinal) survey studies. First, by using data from the longitudinal DIS-survey in Chapter 3, our study design was susceptible to recall bias and self-selection bias. Relying on this self-reported donor data means that, in coding whether people experienced

a life event, we had to rely on their personal memories which might have caused recall bias (Coughlin, 1990). Recall bias might especially play a role in life events closely related to blood donation. When asked about donating blood, it is more likely that people remember the most salient life events – those that actually motivated them to stop or keep on donating after an event – leading to possible overestimations of the effect sizes (Bekkers & Wiepking, 2011a). Besides, this specific study design was open to self-selection bias. As we only included respondents who completed both the DIS-I and DIS-II questionnaires, it was impossible to determine whether non-response to the DIS-II questionnaire is the result of the occurrence of specific life events. Perhaps the non-responders were more likely to experience life events which are negatively related to blood donor behaviour, causing the reported effect sizes to be underestimations, not overestimations, of the real effect sizes.

Another limitation of this survey data was the inability to examine long-term effects (e.g., 10 to 20 years) of individual, social and contextual factors on blood donor behaviour. While a new, third wave of data collection for the DIS-survey was completed in 2018, DIS-III does not contain information about the socio-economic status of blood donors or the occurrence of life events over the previous years. Collecting this information is worthwhile in mapping and understanding blood donor careers as it would present researchers with the opportunity to explore the long-term influence of fluctuations of individual and social resources on blood donor behaviour (i.e., congruent with the paradigmatic principle of life-span development; Elder et al., 2003). For instance, donors who recently got a child were more likely to lapse in the following years as they felt less able to plan subsequent blood donations. On the long-term these donors might decide to continue their blood donations – after getting used to their new lives and planning blood donations is less of an issue. Such long-term fluctuations were shown to be influential in transitions in and out of volunteering after childbirth (Einolf, 2018; Nesbit, 2012; Oesterle et al., 2004). By not taking into account potential reactivations of blood donor careers, the conclusions from Chapters 3 and 4 overlook potential long-term effects of life events. To unravel behavioural change and its consequences, we should recognize lifelong processes of change by investigating blood donor resilience, that is donors' ability to overcome personal and social setbacks and continue their blood donations over time.

As a final limitation of our survey data, we should mention that DIS-I and DIS-II do not contain any information on the non-donor population. A better understanding of the onset of the blood donor career is essential besides our present knowledge about its continuation, especially when taking in mind the urgent need of restoring the socio-demographic balance of the blood donor population in the coming years. The onset of specific behaviour, such as blood donation, requires more careful and deliberate consideration than the continuation of this same behaviour over time (Wiertz & Lim, 2018). Individual, social and contextual factors might therefore have a different influence on blood donation decisions of non-donors than current donors. For instance, the extent to which self-regarding and other-regarding motivations play

a role in the donation decision was shown to differ between first-time, novice and experienced donors (Ferguson et al., 2012a). Including non-donors in future study samples would provide the opportunity to explore their donation motivations and barriers beyond the scope of this dissertation, with the ultimate goal of more effectively organizing future recruitment efforts.

Measurement error in register data. The abovementioned limitations of survey data can be solved to some extent by using registers as a more complete and objective source of data. At the same time, one should realize that register data in itself are not the holy grail in research designs, but have their limitations as well. Limitations of register data used throughout this dissertation are mainly related to the completeness and objectivity of the data, or the lack thereof. For instance, in the case of our Danish life events study (Chapter 4), there was no link between the Scandinavian Donation and Transfusion Database (SCANDAT; Edgren et al., 2015) and survey data on blood donor characteristics, making it hard to determine the role of human agency and linked lives in the relationship between life events and blood donor behaviour. As is characteristic for register data in general, there was no motivational component to SCANDAT. We were therefore unable to perform an exact replication of the Dutch life events study (Chapter 3), as this requires the same study design as well as the same data structure. As a result, it proved to be difficult to pinpoint exactly whether inconsistencies between the study findings were the effects of contextual differences between Denmark and the Netherlands, or whether the differences were the mere effect of data incongruences.

As another example, the Dutch blood donor database (Sanquin, 2018a) used in examining associations between changing donation centre characteristics and donor lapse (Chapter 5) did not include information about the exact closing dates of the donation centres – some donors might have already decided to stop donating blood before the donation centre actually closed later that year – and geographical information about the workplace of the donor – some donors plan their donations right before or after their working hours making information on the nearest donation centre to their home address irrelevant. Although we believe that, given the large sample size, the inaccurate measure only biased the study outcomes to a small degree, including more precise measures would allow for more accurate estimations of the true effect sizes.

With regard to objectivity of register data, information from the Dutch blood donor database (Sanquin, 2018a) as used in Chapter 6, showed that register data is not always as objective as it seems. During the online donor registration, each new donor is asked to indicate why they decided to sign up as a blood donor by presenting a list of all possible recruitment strategies. This information is then entered to the donor database and regarded as register data, while this is more similar to self-reported survey data. It may be that the donor is not fully aware of the reason for registration or multiple cues led to the decision to register. For instance, it is quite unlikely that all of the approximately 70,000 blood donors who reported to have registered on their own initiative were indeed purely motivated by

their own initiative without any other influence from family, friends, (online) media or the blood bank. Receiving a solicitation for blood donation, or the lack thereof, is among the main motivators and barriers for (non-)donors to donate blood (e.g., Charbonneau et al., 2016; Duboz & Cunéo, 2010). Using the somewhat biased information from blood bank registers make it difficult to draw strong conclusions on the associations between recruitment strategies and donor diversity and loyalty.

Implications for theory and future research

Despite and because of the methodological considerations, this dissertation offers multiple directions for researchers aiming for a broader theoretical understanding of blood donor behaviour, hereby moving beyond basic descriptions of donor characteristics and motivations (Masser, Ferguson, Merz, & Williams, in press). We will discuss some theoretical implications of our study findings by elaborating on economic and psychological models of altruism in blood donation as well as the role of personal resources and social influence in the donation decision. Moreover, based on these implications, we provide specific recommendations for future research focused around the question of when and why people donate blood, examined by using experimental studies, advanced registers and international collaborations. These recommendations might well serve as a way to solve the previously reported methodological limitations in future blood donor studies.

Economic and psychological models of altruism. Following the psychological model of altruism, we conclude that donors are more likely to stop donating blood after the price of donating increases. When donors go through life stages detrimental to their available time and health (i.e., childbirth, labour market transitions) or when the donor's nearest blood donation centre is closed – hereby increasing the travel distance to the donation centre – blood donors are more likely to lapse (Chapter 3 and Chapter 5, respectively). While blood donation is often regarded as archetypal example of altruistic behaviour (Titmuss, 1971), our results indicated that motivations other than pure altruistic concerns are involved in blood donation. Blood donors are generally not very willing to sacrifice additional personal resources for the benefit of anonymous recipients.

Following the economic model of altruism, we found some evidence of altruistic motivations among blood donors in the Netherlands as donors with the universal, O-negative blood group were less likely to lapse compared to donors with other blood groups (Chapter 5). We might assume that these donors are driven by altruistic motivations as their blood can be used more efficiently and thus has a larger public benefit to society, but our results do not imply that O-negative donors have stronger altruistic concerns than other donors. We might assume O-negative donors to be motivated by other forms of altruism, like reluctant altruism (e.g., continuing their blood donations because they feel a moral responsibility to relieve blood shortages) or impure altruism (e.g., continuing

their blood donations because they feel more valued as a results of their higher public benefit). We recommend future studies to examine how diverging altruistic motivations play a role for different subgroups of the donor population and whether these are susceptible to change throughout the blood donor career, for instance by using the Mechanisms of Altruism (MOA) approach (Evans & Ferguson, 2014). Moreover, attention should be paid to the role of personal resources (human agency) and social influence (linked lives), as discussed in the following sections.

Life events and personal resources. With the likelihood of blood donation increasing after a health-related event in the family, our findings suggest that ‘altruism born of suffering’ and donor resilience apply to blood donors as well as previously shown in volunteers (Staub & Vollhardt, 2008; Vollhardt, 2009). Negative life events do not necessarily lead to decreased prosocial behaviour for all donors. While a lack of personal resources seems to be detrimental to blood donation, it is questionable whether time constraints are the real reason for donors to lapse. It might well be possible that people perceive that donating blood requires more time and effort than it actually does – a whole blood donation typically takes less than one hour – or that lack of time is used as excuse for other donation barriers such as fear of adverse reactions, inconvenience, or reduced donation efficacy due to worse health.

Although a lack of personal resources does play an important role in the blood donation decision – many people are ineligible for blood donation due to strict health requirements – it is likely that a large part of the non-donors and lapsed donors do not exactly know what it takes to make a donation. There is rather a perceived than an actual lack of resources. Intervention studies raising awareness about the minimal set of personal resources – or ‘self-efficacy’ – needed to make a blood donation might prove to be effective (re)activating donor careers. While levels of self-efficacy were shown to be steady predictors of donation intentions across the blood donor career (Veldhuizen, Ferguson, De Kort, Donders, & Atsma, 2011), underlying reasons for change of the donation efficacy might vary between novice and more experienced donors. Future studies should widen the range of personal resources relevant to blood donation, and examine whether certain donation barriers (e.g., fear, waiting times, negative donation experience; Klinkenberg et al., 2018b) are related to specific stages in life and the donor career. Intervening on barriers related to the most frequent but detrimental life events (e.g., childbirth and labour market transitions) is especially promising for improving blood donor retention rates.

Social influence in blood donations. Although we found some evidence for the role of donor networks in the decision to start and keep on donating blood (Chapter 3 and Chapter 6, respectively), the exact way in which blood donor networks explain the donation decision remains unknown. Whereas previous studies suggested that the presence of blood donors in the network influenced the decision to start or continue donating (Bani & Strepparava,

2011; Charbonneau et al., 2015), the effects found in our studies were small, with decreased donor networks only playing a mediating role in the relation between losing a job and donor lapse. We might argue that social pressure and norms in the workplace are weaker forces in blood donation than peer pressure from friends and family. Specifically related to the family influence, social learning theory (i.e., explaining how people learn and adapt specific behaviour by observation, imitation and modelling; Bandura, 1977) could provide insight in how a family tradition of blood donation is passed on from one generation to the next. Large registers like SCANDAT or qualitative studies on blood donors and their direct family members would be ideal resources to examine social learning and the influence of parental modelling in blood donor behaviour.

Moreover, theories on peer proximity, stating that social influence from proximal peers is stronger than that of distal peers (Bearman et al., 1999), might help in understanding how networks of family, friends and acquaintances differently affect donation decisions. Exploring these social networks would also provide insight in the varying effectiveness of blood donors and blood banks in recruiting more and diverse donors, as well as retaining these donors over time. While it is assumed that people are more likely to conform to perceived societal norms when confronted with a personal solicitation to become a donor – as is the case with the donor-recruits-donor strategy – it remains unclear whether social proximity of the recruit is indeed related to donor loyalty. In the light of its low costs and the high willingness of donors to recruit new donors (Lemmens et al., 2008; Lemmens et al., 2010), it is worthwhile to study the long-term effectiveness of personal recruitment strategies (e.g., by conducting network analyses using online social network sites).

From intention to behaviour: onset and continuation of the blood donor career. In understanding motivational mechanisms underlying donation decisions over time, we highly recommend to switch from self-reported blood donations and donation intentions to actual donation behaviour as an outcome measure. Donation willingness is generally high but registering with donor centres lags behind. Analysis of the Eurobarometer data (Huis in 't Veld et al., 2019), a biennial survey among more than 27,000 participants in 29 European countries, shows that willingness to donate blood varies greatly across age groups and countries. Additional analyses using the 2014 Eurobarometer data, distinguishing between the millennials (aged 15-24 years), the generation X (aged 25-39 years), the middle-aged (40-54 years), and the baby boomers (aged 55+), showed that in many countries the willingness to donate blood is highest among the two youngest age groups (i.e., the millennials and generation X, ranging from a 'low' 60% in Slovakia until over 90% in Sweden and Croatia, and an average of 77% and 73%, respectively).

Although this data showed that people report high willingness to donate blood, the relation between willingness and behaviour is relatively low (Sheeran, 2002). In Europe, only three to four percent of all people eligible for blood donation are actually registered as

blood donor (Toumi & Urbinati, 2015). As introduced in Chapter 1, societal and demographic developments, as well as advanced knowledge on iron depletion in frequent blood donors, larger and more diverse donor populations are required to meet future blood demands despite decreased blood usage. Examining what factors increase willingness, and what hinders these willing people to subsequently start a blood donor career, offers important insights into targeted recruitment strategies. Moreover, as this dissertation points out, tracking donor behaviour subsequent to registration is key in understanding blood donors and their behavioural decisions over time. The question that remains then, is how to track donations and motivations across the blood donor career.

Experiments. Having access to large databases containing information on actual blood donor behaviour and donation motivations, as is the case in the Netherlands, provides numerous insights on when and why people decide to donate blood. At the same time, it makes it difficult to get a grip on the non-donor population – the onset of the blood donor career. Linkage to general population registers would provide such opportunities, something already possible in Denmark and Sweden. While the advanced studies on blood donor health in these countries show the population-wide registers' great potential, studies on (non-) donor behaviour using this same information lag behind. Using such databases to examine potential blood donors would increase our knowledge of individual, social and contextual factors leading up to the blood donor career.

As we have argued before, the extent to which donation motivations can be extracted from blood bank registers is limited. Setting up field experiments would provide a good complementation to this objective data in collecting information on (non-)donor motivations and barriers to donate blood. In addition to several previous field experiments on blood donor motivations, we would encourage the use of actual donation behaviour over intentions and incorporate ideas on the blood donor career in designing such experiments (i.e., examining potential behavioural change by tracking donors over a longer period of time). As we have shown throughout this dissertation, people who decide to start donating blood will not necessarily keep on donating for the rest of their lives. Combining (field) experiments to identify (non-)donor motivations (e.g., designing recruitment campaigns targeting various donation motivations), combined with register data to track subsequent long-term donor behaviour, would be promising in providing a further understanding of the blood donor career and its associated determinants. It would be especially promising to use social network sites such as Facebook, Twitter and Instagram for setting up online field experiments – an easy and accessible way to target large and diverse (non-)donor populations. Despite its many advantages and some first promising findings – especially young female donors reported to be motivated to donate blood by social media (Sümnig, Feig, Greinacher, & Thiele, 2018) – the number of studies examining the role of social network sites in the blood donation context remains limited to date (Abbasi et al., 2018).

International collaborations. Besides the aforementioned recommendations, getting a better grip on blood donor careers would benefit from understanding international contextual differences in donor behaviour. In line with key ideas from Healy, we have shown that different cultures and blood collection agencies are potentially related to the donation decision. It has to be noted that, in comparing study findings, we have only used blood donor career studies from Western, high-income countries such as the Netherlands, Denmark, Germany and the United Kingdom. While certainly there are differences between these countries, they also are quite comparable with respect to blood collection systems as well as socio-economic circumstances and cultural orientation (Insights, 2018; OECD, 2018a, 2018b, 2018c). For instance, the influence of closing blood donation centres might be country-specific. As the Netherlands is a small country, closing a donation centre typically requires a relatively small additional effort to make a subsequent blood donation. Chapter 5 showed the travel distance to increase with a maximum of eleven kilometres, but this is likely to increase in larger countries. It is worthwhile to further examine cross-country differences in a broader variety of countries, including the United States and Australia, as well as African and Asian countries as to allow for conclusions on the role of time and place in motivational mechanisms and their respective donor behaviour across the blood donor career.

Implications for blood collection agencies

The research findings presented in this dissertation have strong societal relevance: by successfully increasing the number of blood donations from a more diverse and loyal donor population, more lives can be saved in the future. This makes it important for scientific publications in the field of blood donor studies to provide practical implications based on their solid theoretical framework, which can then be used by blood banks to implement evidence-based donor management strategies. We will provide some practical implications relevant to our findings on individual, social and contextual factors across the blood donor career.

Diverging donation motivations (within and between countries). Throughout the dissertation, we have shown how blood donors within and between countries, as well as their motivations and barriers to donating blood, are highly heterogeneous. For instance, results from our systematic review (Chapter 2) indicated how (non-)donors from different sex and age groups are differently motivated to donate blood. As a result, recruitment strategies which prove to be successful in motivating a specific group of non-donors might not work for others. Blood banks are therefore advised to work towards the development of segmented recruitment strategies targeted to specific groups of non-donors, instead of the common one-size-fits-all strategies. While it might be tempting to make more general use of the donor-recruits-donor strategy in light of its low costs and relatively easy implementation, our results indicated that promotion teams or missing minority campaigns might be more effective in motivating a diverse group of new blood donors (Chapter 6).

Some previous blood donors studies already used a segmented approach in analysing donation motivations and donor recruitment (e.g., for a review on sex differences in donation motivations see Carver et al., 2017). While its findings can be used in developing new recruitment strategies, results from our cross-country analysis (Chapter 4) showed that blood banks need to take in mind the life course principle of time and place in interpreting previous study outcomes. Some motivational mechanisms in blood donation, as well as their influence on donation decisions across the donor career, might differ between countries as a result of cultural differences or institutional differences of blood collection agencies (Ferguson et al., 2018). It is essential to be aware of contextual differences when applying study results from other countries to local blood donor management policies.

Personalised recruitment and retention. While we have advocated for the development of more segmented, personalized recruitment strategies, we also stress the importance of personalized donor retention in order to build towards a reliable blood supply over the coming years. Observational data used in this dissertation showed how, without adequate interventions from the blood bank, a vast percentage of donors is at risk to stop donating blood (e.g., after going through certain life stages or after closing the nearest donation centre). For those loyal donors who keep on donating despite any adverse events, donation motivations change across the donor career. For instance, experienced donors are more likely to be motivated by feelings of warm-glow rather than empathic concerns (Ferguson et al., 2012a; Ferguson et al., 2012b). In order to retain these experienced donors, targeted messages from the blood bank should therefore focus on warm-glow instead of altruism. Field experiments have already shown how informing donors about their past blood donation use increases retention for both active and lapsed donors (Shehu, Winterich, Clement, & Veseli, 2018). It would be worthwhile, however, to perform additional experiments in order to determine on the cost-effectiveness of such segmented, personalized retention messages before an overall implementation.

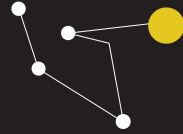
Moreover, retaining blood donors is not only about manipulating donation motivations, but also about creating the right conditions for blood donation in the first place (Boenigk et al., 2011). For a large number of donors, changing locations and opening days of donation centres is detrimental to donation behaviour (Chapter 5). Timely communication about upcoming changes – presenting suitable alternatives for subsequent blood donations – might reduce perceived donation barriers associated with new locations and different opening days and increase the likelihood for continued blood donor careers. These examples illustrate that blood donor careers are highly person-specific and blood banks should adopt a long-term view on personalized donor management. However, with a lack of data-driven campaign evaluations in many blood banks, it is difficult to

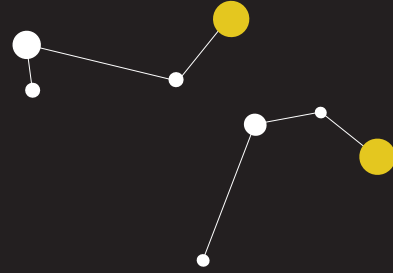
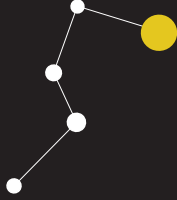
determine exactly on the impact of recruitment campaigns and retention strategies on donor loyalty. To evaluate their effectiveness, it is essential to track donor behaviour and donation motivations over time and conducting impact evaluations based on these objective data (Piersma, 2019).

Towards building equal relationships. An advantage of increased knowledge about your donors and their behaviour is the possibility to engage in more personal interactions. A trend in the broader field of fundraising is to switch from one-way interactions between fundraisers and donors to equal relationships between both parties: 'relationship fundraising' (Broodman & Peerdeman, 2017), that is "dealing with donors individually, recognizing each donor as unique in terms of giving history, motivation for giving, and the overall standard of care expected from the charities being supported" (Sargeant, 2001, p. 180). Again, it has to be noted that the right data has to be in place to get to know your donors and engage in personal interactions. One option would be to conduct regular longitudinal studies like Donor InSight (Timmer et al., 2019), but these surveys are labour-intensive, time-consuming and prone to respondent drop-out over time. As an alternative, implementation of a Customer Relationship Management (CRM) system in the form of an online blood donor portal is a cheaper and easier option to collect real-time data on blood donors and makes it easier to communicate with specific, targeted subgroups of the donor population.

From the perspective of the donor, an online donor portal might promote blood donations as it appeals to individual, social and contextual factors which have been proven to be important in the donation decision. Related to individual factors, donors can get insight in their own donation pattern, check if they are eligible for the next donation, and get information about donation locations near them and their opening times. From a human agency perspective, this allows donors to easily retrieve information about individual resources needed for the next donation. Are they healthy enough? And do they have enough time to travel to the nearest donation centre? Moreover, if donors provide information about their life events relevant to blood donation (e.g., childbirth, moving), targeted motivational messages from the blood bank can prevent these donors from lapsing. Related to social factors, donors can link up with other donors to ask questions and share their experiences. From a linked lives perspective, blood banks can more easily facilitate donor networks, allowing donors to talk about donation and get to know other blood donors around them.

These recommendations might all contribute to the development of segmented, personalized recruitment and retention strategies that trigger the right motivations and reduce donations barriers at the right times across the blood donor career. Successfully increasing the number of blood donations from a more diverse and loyal donor population guarantees a stable, adequate and sufficient blood supply which saves lives.





SUMMARY

SUMMARY

Annually, four million patients in Europe are treated with blood-derived products, used in saving lives after traumatic events as well as in treatments of cancer, hemophilia and autoimmune diseases. To ensure a sufficient blood supply, hospitals heavily rely on donors who voluntarily donate blood to help anonymous recipients. Currently, only three to four percent of all people eligible for blood donation is actually registered as a donor – a European-wide average of approximately 29 blood donors per 1000 inhabitants – causing a vulnerable balance between blood supply and demand. Moreover, the percentage of registered blood donors has been declining slowly over the past decade. The general demand for blood has also been declining, but as the need for blood product diversity is increasing, blood donor recruitment is still a challenge. The dissertations' first and introductory chapter discusses how blood banks keep being challenged to work towards sufficient and healthy donor populations to match future demands of all needed blood types. Understanding blood donors is key. What motivates and hinders people to donate blood? And how can these donors be more effectively recruited and retained?

By means of a systematic literature review presented in Chapter 2, we outline how economists, psychologists and sociologists studied a wide range of individual donor characteristics and donation motivations. While we show that the likelihood to be involved in blood donation varies within persons and among different socio-demographic categories, these studies lack theoretical and empirical knowledge on whether and how blood donor behaviour is susceptible to change over the life course. Social scientific theories previously used to examine other forms of prosocial behaviour (i.e., charitable giving and volunteering) can be applied to blood donation in order to investigate diverging donation motivations and to provide a better understanding of blood donor careers, that is blood donor behaviour over the life course. By adopting a life course perspective on blood donation, this dissertation aims to answer the following research question:

Which individual, social and contextual factors are associated with blood donor behaviour, and what influence do these factors have across the blood donor career?

Research design and data: combining longitudinal registers and surveys

To answer the dissertation's research question, we conducted a number of observational studies and reported on natural variations of blood donation centres. These studies used a unique combination of data from representative blood donor surveys and two national blood donor registers from the Netherlands (i.e., Donor InSight and the Dutch blood donor database) and Denmark (i.e., Statistics Denmark and the Scandinavian Donations and Transfusions database).

By using these large-scale, longitudinal datasets we were able to analyse dynamic blood donor careers of approximately 500 thousand donors while examining actual blood donations instead of self-reported donation intentions. As the data included individual and social blood donor information (e.g., available time, perceived health and social connections), as well as contextual information about blood bank policies (e.g., locations and opening times of donation centres) across several years, we could provide a life course perspective on blood donor behaviour.

Main findings: factors associated with the blood donor career

Chapter 3 shows how the donation decision is susceptible to change across the blood donor career as a result of life events. Childbirth, losing a job and starting a job increased the likelihood of donor lapse, while health-related events (i.e., blood transfusion in a family member, death of a family member) decreased the likelihood of donor lapse. At the individual level, practical concerns play a role in the donation decision. Decreased available time after childbirth and starting a job, as well as lower self-perceived health in combination with losing a job are reasons for donors to lapse. Moreover, at the social level, having fewer other blood donors in the social network partly explains why donors are more likely to lapse after they lost their job. Given donor's behavioural change after experiencing a life event, we advise blood collection agencies to design promotional materials addressing relevant barriers to donate blood and motivate donors to keep donating blood at decisive moments during their donor career.

As these results concluded on blood donor careers in the Netherlands only, without taking into account potential contextual differences between countries, the study presented in Chapter 4 examined the repeatability of these findings among blood donors in Denmark. From the analyses we conclude that life events are indeed associated with donor lapse of Danish donors. These results are comparable to our findings from the Netherlands, with two thirds of the associations being in the same direction (i.e., childbirth and labour market transitions increased lapsing risk; health-related events decreased lapsing risk). However, some differences emerged between the study findings, mainly related to donor sample compositions and the magnitude of effect sizes. These differences might either be the results of contextual differences between blood collection agencies, with blood collection in the Netherlands being rooted in voluntary, religious organizations, therefore attracting fewer but more loyal donors compared to Danish blood banks, or the result of data differences, with the sole use of register data in Denmark providing more accurate estimations of true effect sizes. As a result of cross-country variations in blood donors and their behaviour, blood collection agencies need to be careful in implementing international practices to their own donor management policies by taking into account empirical studies' context.

The study reported in Chapter 5 shifted the focus from individual and social factors to the role of blood banks to further explore their role in the donation decision. We concluded that blood donors are clearly sensitive to price changes imposed by the blood bank. Donors whose nearest blood donation centre closed were 53% more likely to lapse than donors whose nearest donation centre remained open. Moreover, changing the opening days of donation centres also influenced the donor's donation decision: the percentage of donor lapse increased as the number of opening days decreased. We found some evidence of altruistic motivations among blood donors in the Netherlands: donors with the universal, O-negative blood group were less likely to lapse compared to donors with other blood groups. We might assume that these donors are driven by altruistic motivations as their blood can be used more efficiently and thus has a larger public benefit. Yet no interaction effects were found between O-negative donors and the distance to the nearest donation centre. While O-negative donors in general are more likely to continue donating blood compared to blood donors with other blood groups, they are not willing to make an additional sacrifice as the price of donating blood increases. In conclusion, blood collection agencies need to be careful in changing donation centre locations and openings day, and timely communication about upcoming changes is important in donor retention. Presenting donors with alternatives for their next donation might reduce perceived barriers associated with new locations and different opening days, which increases the likelihood for donor return.

To further explore the role of blood banks in the donation decision, the study presented in Chapter 6 moved away from the physical presence of blood banks to the role recruitment strategies play in creating diverse and loyal donor populations. While most donors were recruited via other blood donors (i.e., the donor-recruits-donor strategy) or registered with the blood bank on their own initiative, we could assess proportional differences in how people from different sex, age and ethnicity were recruited as donors. For instance, the donor-recruits-donor strategy was especially reported by donors aged 35 or younger. Among older donors, the blood bank promotion team was the most commonly reported recruitment method. Moreover, our results show that recruitment methods are associated with the length of the blood donor career. While 70% of the donors recruited by other donors were still actively donating blood after five years, this ranged from a high 80% for recruitment via organizations and online media to a low 50% for missing minority campaigns and telephone recruitment. Given the wide variety of motivations for registration as a blood donor (e.g., altruistic feelings, warm-glow, moral responsibilities, or conforming to the family tradition), subsequent blood donor careers are highly person-specific, and some donors could use more support in becoming loyal donors over time.

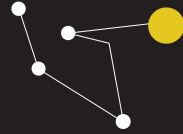
Conclusion: considerations and future outlook

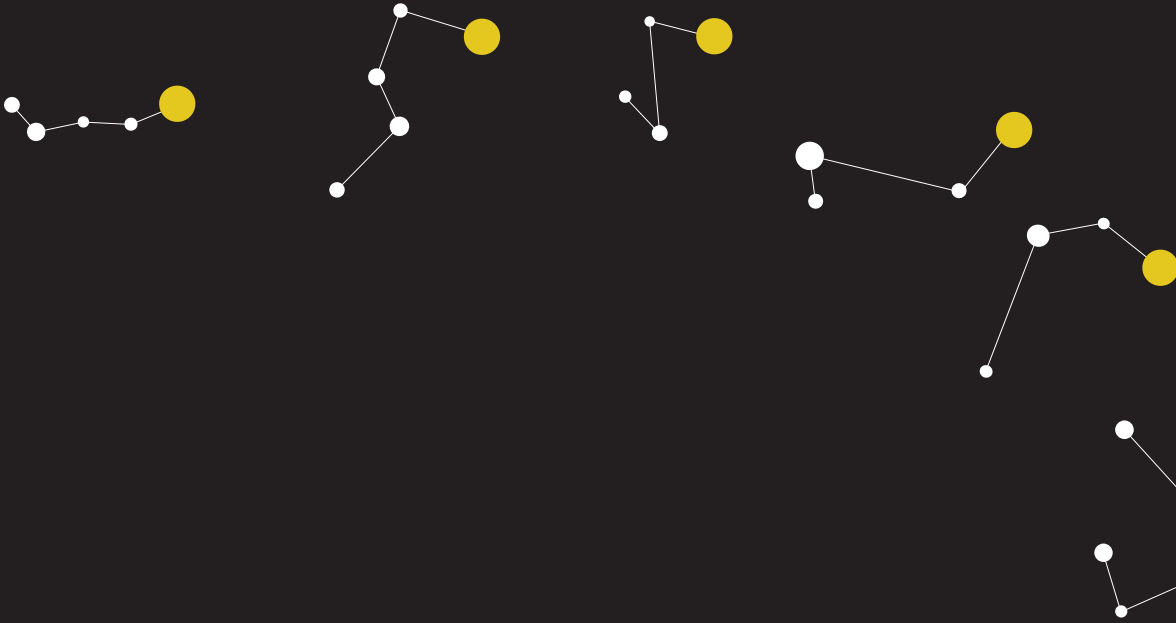
In the seventh and concluding chapter, aside from summarizing the dissertations' key findings, we describe methodological considerations, discuss theoretical implications, and conclude by elaborating on practical applications of our findings in recruitment and retention of blood donors. Regarding data and methods, we describe how extensive surveys and registers do not fully safeguard from any methodological limitations. While our longitudinal survey data was prone to recall bias and self-selection bias – potentially underestimating reported effect sizes – the registers used to provide a broader, long-term picture of the blood donor career were limited by their lack of completeness and in-depth, qualitative information.

Despite and because of these considerations, the concluding chapter is offering multiple directions for researchers aiming for a broader theoretical understanding of blood donor behaviour, hereby moving beyond basic descriptions of donor characteristics and motivations. For instance, we discuss the role of altruistic values in blood donation, both from a psychological and an economical perspective, and propose how perceived individual resources and social influence from other blood donors shape the donor career beyond altruistic motivations. Moreover, we recommend future donor studies to examine actual donation behaviour instead of self-reported blood donations and donation intention, as the relation between intention and behaviour is relatively weak. We discuss the great potential of combining the results of online field experiments with register data to identify (non-)donor motivations and track donor behaviour over time (e.g., designing and evaluating online recruitment campaigns to increase diversity of the donor population).

Given the studies' societal relevance, this chapter concludes with a number of practical recommendations for more effective blood donor management. First, we advocate the development of personalized recruitment strategies targeted to specific groups of non-donors, instead of the common one-size-fits-all strategies. While it might be tempting to make more general use of the donor-recruits-donor strategy in light of its low costs and easy implementation, our results indicate that this is not effective in motivating diverse groups of new blood donors. Second, we stress the importance of personalized donor retention by responding to changing donation motivations and strategically placing donation centres throughout the country. However, lacking data-driven campaign evaluations makes it difficult to determine on the impact of retention strategies on donor loyalty. Implementation of a Customer Relationship Management (CRM) system in the form of an online blood donor portal is an accessible option to collect real-time data on blood donors while making it easier to communicate with targeted subgroups of the donor population. From a donor perspective this allows for an easy way to share information relevant for the blood bank (e.g., childbirth, change of address), retrieve information about individual resources needed for the next donation, link up with other blood donors and share donation experiences. From a blood bank perspective this allows for targeted motivational messages, triggering the right donation motivations at the right times across the blood donor career.

In conclusion, our results show how, without adequate interventions from the blood bank, a vast percentage of donors is at risk to stop donating blood. Yet in the light of societal and demographic developments, as well as a result of advanced knowledge on iron depletion in frequent blood donors, larger and more diverse donor populations are required to meet future blood demands despite decreased blood usage. Designing personalized interventions, taking in mind individual, social and contextual factors associated with the blood donation decision, is key in working towards evidence-based recruitment and retention. Successfully increasing the number of blood donations from a more diverse and loyal donor population guarantees a stable, adequate and sufficient blood supply which saves lives.





SAMENVATTING

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Jaarlijks worden er in Europa vier miljoen patiënten behandeld met bloedproducten, bijvoorbeeld bij levensreddende operaties na trauma, maar ook bij de behandeling van kanker, hemofilie en auto-immuunziektes. Om een voldoende bloedvoorraad te waarborgen zijn ziekenhuizen sterk afhankelijk van donors die op vrijwillige basis bloed doneren om daarmee anonieme ontvangers te helpen. Momenteel is echter slechts drie à vier procent van de personen die medisch geschikt zijn om bloed te doneren ook daadwerkelijk geregistreerd als bloeddonor – met een Europees gemiddelde van ongeveer 29 bloeddonors per 1000 inwoners – waardoor er een kwetsbare balans is ontstaan tussen de vraag naar en het aanbod van bloed. Daarnaast is het percentage geregistreerde bloeddonors in de afgelopen tien jaar geleidelijk afgenomen. Hoewel de algemene vraag naar bloed in deze periode ook is afgenomen, is het nog steeds van groot belang dat er nieuwe donors worden geworven. De vraag naar meer diverse, specifieke bloedproducten is immers juist toegenomen. Het eerste en inleidende hoofdstuk van deze dissertatie bespreekt hoe bloedbanken constant worden uitgedaagd in hun streven naar een voldoende en gezonde donorpopulatie, om hiermee volledig te kunnen voldoen aan de toekomstige vraag naar alle specifieke bloedtypen. Het beter begrijpen van (potentiële) bloeddonors staat hierbij centraal. Wat motiveert mensen om bloed te doneren, of wat weerhoudt hen hier juist van? En hoe kunnen zij zo effectief mogelijk geworven én behouden worden voor de bloedbank?

Door middel van een systematische literatuurstudie, gepresenteerd in Hoofdstuk 2, hebben we geschetst hoe economen, psychologen en sociologen in de afgelopen jaren een grote verscheidenheid aan individuele donorkenmerken en donatiemotivaties hebben bestudeerd. Hoewel we aan de hand van deze studies laten zien dat de kans om bloed te doneren sterk kan verschillen binnen personen, alsmede tussen personen met verschillende sociaal-demografische kenmerken, ontbreekt het in deze studies aan theoretische en empirische kennis over de mate waarin bloeddonorgedrag onderhevig is aan verandering over tijd, gedurende de levensloop. Sociaalwetenschappelijke theorieën die gebruikt zijn om andere vormen van prosociaal gedrag te onderzoeken (e.g., gelddonatie en vrijwilligerswerk) kunnen ook worden toegepast op bloeddonatie om uiteenlopende donatiemotivaties te onderzoeken, en om een beter begrip te krijgen van de bloeddonorcarrière – bloeddonorgedrag gedurende de levensloop. Door gebruik te maken van een levensloopperspectief op bloeddonorgedrag beogen we in deze dissertatie de volgende onderzoeksvraag te beantwoorden:

Welke individuele, sociale en contextuele factoren zijn gerelateerd aan bloeddonorgedrag, en op welke manier spelen deze factoren een rol gedurende de bloeddonorcarrière?

Onderzoeksdesign en data: combineren van longitudinale registers en vragenlijsten

Om de centrale onderzoeksvraag van deze dissertatie te beantwoorden hebben we zowel een aantal observationele studies uitgevoerd alsmede gerapporteerd over de natuurlijke variatie in bloeddonatiecentra. Deze studies hebben gebruik gemaakt van unieke combinaties van verschillende databronnen: longitudinale vragenlijsten onder een representatieve steekproef van de Nederlandse bloeddonorpopulatie, en twee nationale bloeddonorregisters uit Nederland (i.e., Donor InZicht en de Nederlandse bloeddonordatabase) en Denemarken (i.e., Statistics Denmark en de Scandinavian Donations and Transfusions database).

Door gebruik te maken van deze grootschalige, longitudinale data waren we in staat om de individuele bloeddonorcarrières van ongeveer 500 duizend donors te analyseren. Daarnaast bood dit de mogelijkheid om daadwerkelijke bloeddonaties te onderzoeken, in plaats van zelf-gerapporteerde intenties om te doneren. Mede door de ruime aanwezigheid van individuele en sociale bloeddonorinformatie (e.g., beschikbare tijd en gezondheid, en sociale netwerken), en contextuele bloedbankinformatie (e.g., wervingstrategieën, en locaties en openingstijden van donatiecentra) over het afgelopen decennium was het mogelijk om een levensloop perspectief op bloeddonor gedrag te bieden.

Kernbevindingen: factoren gerelateerd aan de bloeddonorcarrière

Hoofdstuk 3 laat zien hoe bepaalde levensgebeurtenissen de donatiebeslissing beïnvloedt gedurende de bloeddonorcarrière. Na de geboorte van een kind, het verliezen van een baan, of het starten van een nieuwe baan wordt de kans groter dat een donor uitvalt, terwijl de kans op uitval kleiner wordt nadat een donor een gebeurtenis meemaakt gerelateerd aan de gezondheid van een familielid (i.e., een bloedtransfusie of overlijden). Op individueel niveau spelen praktische overwegingen een rol in de donatiebeslissing. Het gebrek aan tijd na de geboorte van een kind en na het starten van een nieuwe baan, alsmede een slechter beeld van de eigen gezondheid na het verliezen van een baan blijken redenen voor donors om uit te vallen nadat zij een van deze levensgebeurtenissen meemaken. Daarnaast spelen ook sociale factoren een rol in de donatiebeslissing. Een afname van het aantal bloeddonors in het sociale netwerk verklaart gedeeltelijk waarom donors een grotere kans hebben om uit te vallen nadat zij hun baan zijn verloren. Gezien de verhoogde uitvalkans van donors na het meemaken van specifieke levensgebeurtenissen adviseren we bloedbanken om campagnemateriaal te ontwerpen dat ingaat op de door ons geïdentificeerde donatiebarrières, met als doel deze donors te motiveren om bloed te blijven doneren op beslissende momenten gedurende hun donorcarrière.

Aangezien we op basis van de resultaten uit Hoofdstuk 3 enkel conclusies kunnen trekken over bloeddonorcarrières in Nederland, zonder hierbij rekening te houden met potentiële contextuele landverschillen, test de studie uit Hoofdstuk 4 de reproduceerbaarheid van deze resultaten onder bloeddonors in Denemarken. Op basis van de analyses concluderen we dat levensgebeurtenissen ook gerelateerd zijn aan de

uitvalkans van bloeddonors in Denemarken en dat de resultaten vergelijkbaar zijn die uit de Nederlandse studie. Tweederde van de resultaten laten dezelfde associatie zien tussen levensgebeurtenissen en donoruital: de geboorte van een kind en transities op de arbeidsmarkt verhogen de kans dat een donor uitvalt, terwijl de kans kleiner wordt wanneer de donor een gezondheids-gerelateerde gebeurtenis meemaakt in de familie. Er waren echter ook enkele verschillen tussen de bevindingen van beide studies, met name in de samenstelling van de donorpopulaties en de sterkte van de effecten. Deze verschillen zouden enerzijds verklaart kunnen worden door contextuele verschillen tussen bloedbanken, waarbij bloedinzameling in Nederland van origine geworteld is in religieuze organisaties en zij om die reden minder grote aantallen, maar wel meer loyale donors werven vergeleken met Deense bloedbanken. Anderzijds zouden de verschillen verklaart kunnen worden door de data die gebruikt is in de statistische analyses. In de Deense studie is enkel gebruik gemaakt van registerdata, wat zorgt voor meer accurate schattingen van de daadwerkelijke effecten vergeleken met de vragenlijstdata uit de Nederlandse studie. Als een gevolg van de landverschillen tussen bloeddonors en hun donorgedrag zullen bloedbanken zorgvuldig om moeten gaan met het implementeren van nieuwe donormanagement strategieën op basis van internationaal onderzoek.

De studie gerapporteerd in Hoofdstuk 5 verlegt de focus van individuele en sociale factoren naar de rol die bloedbanken spelen in de donatiebeslissing. We concluderen dat bloeddonors, na ingrijpen van de bloedbank, vatbaar zijn voor veranderingen in de prijs om te doneren. Donors van wie de dichtstbijzijnde donatielocatie sloot hadden namelijk 53% meer kans om uit te vallen dan donors van wie de dichtstbijzijnde locatie open bleef. Daarnaast had ook het veranderen van het jaarlijkse aantal openingsdagen een invloed op de donatiebeslissing: het percentage uitval van donors nam toe naarmate het aantal openingsdagen afnam. Ook vonden we enig bewijs voor een altruïstische motivatie in bloeddonatie: donors met de universele, O-negatieve bloedgroep hadden een minder grote kans om uit te vallen dan doneren met andere bloedgroepen. We kunnen aannemen dat O-negatieve donors worden gemotiveerd door altruïstische motivaties omdat hun bloed efficiënter kan worden gebruikt in de behandeling van patiënten en hierdoor een grotere bijdrage wordt geleverd aan het algemeen nut. Er werden echter geen effecten gevonden in de interactie tussen O-negatieve donors en de afstand tot het dichtstbijzijnde donatiecentrum. Hoewel O-negatieve donors over het algemeen meer geneigd zijn hun donaties voort te zetten, is het niet zo dat ze een extra opoffering willen maken als de prijs om te doneren toeneemt. Concluderend stellen we dat bloedbanken voorzichtig moeten zijn met het veranderen van locaties en openingstijden van donatiecentra, en dat tijdige communicatie bij dergelijke veranderingen belangrijk is in donorbehoud. Het aanbieden van alternatieven aan donors die te maken krijgen met deze veranderingen zal mogelijk hun donatiebarrières – gerelateerd aan nieuwe locaties en andere openingsdagen – verminderen, en hiermee de kans op terugkeer verhogen.

Om de rol van bloedbanken in de donatiebeslissing beter inzichtelijk te maken, ligt de focus van de in Hoofdstuk 6 gepresenteerde studie niet op de fysieke aanwezigheid van de bloedbank, maar op de rol die wervingsstrategieën spelen in het creëren van een meer diverse en loyale donorpopulatie. Hoewel de analyses uitwezen dat de meeste donors werden geworven door andere bloeddonors (i.e., de donor-werft-donor strategie), konden we proportionele verschillen onderscheiden in de manier waarop mannen en vrouwen, en personen uit verschillende leeftijdsgroepen en van verschillende etnische achtergronden werden geworven als bloeddonor. Zo werd de donor-werft-donor strategie vooral gerapporteerd door donors van 35 jaar en jonger, en rapporteerden oudere donors vooral dat zij waren geworven door het promotieteam van de bloedbank. Daarnaast laten de resultaten zien dat de wervingsstrategieën gerelateerd zijn aan de lengte van de bloeddonorcarrière. Terwijl 70% van de donors die geworven werden door andere donors na vijf jaar nog steeds actief bloed doneerden, varieerde dit percentage sterk: van bijna 80% voor donorwerving via bedrijven en online media, tot slechts 50% voor telefonische werving en donorwerving onder etnische minderheden in Nederland. Gezien de grote verscheidenheid aan motivaties van personen om zich aan te melden als bloeddonor (e.g., altruïstische waarden, een morele verantwoordelijkheid, of conformeren aan familie tradities), zijn de hierop volgende bloeddonorcarrières zeer persoonsafhankelijk. Sommige donors hebben dan ook meer steun nodig om gedurende de jaren loyale donors te worden dan anderen, en bloedbanken zouden door middel van meer persoonlijke communicatie met hun donors een belangrijke rol in kunnen spelen.

Conclusie: methodologische overwegingen en een vooruitblik

In het zevende en concluderende hoofdstuk bieden we, naast een samenvatting van de kernbevindingen van deze dissertatie, een overzicht van de belangrijkste methodologische overwegingen, mogelijke theoretische implicaties voor toekomstig onderzoek, en een aantal mogelijke praktische aanbevelingen voor de werving en het behoud van bloeddonors. Met betrekking tot de data en onderzoeksmethoden beschrijven we hoe het gebruik van uitgebreide vragenlijsten en registers onze studies niet volledig vrijwaren van methodologische limitaties. Enerzijds bleek de data van de longitudinale vragenlijsten vatbaar voor herinneringsbias en zelf-selectiebias, wat mogelijk heeft geleid tot onderschatting van de gerapporteerde effecten. Anderzijds werd de registerdata, gebruikt om een lange-termijn beeld te schetsen van de donorcarrière, in zekere mate beperkt door het gebrek aan verdiepende, kwalitatieve informatie.

Ondanks en vanwege deze limitaties biedt het concluderende hoofdstuk een aantal interessante richtingen voor toekomstige studies, met name voor onderzoekers die voor het theoretische begrip van bloeddonorgedrag verder willen kijken dan algemene beschrijvingen van sociaal-demografische donorkenmerken. Zo bespreken we onder andere de rol van altruïsme in bloeddonatie vanuit een psychologisch en economisch perspectief,

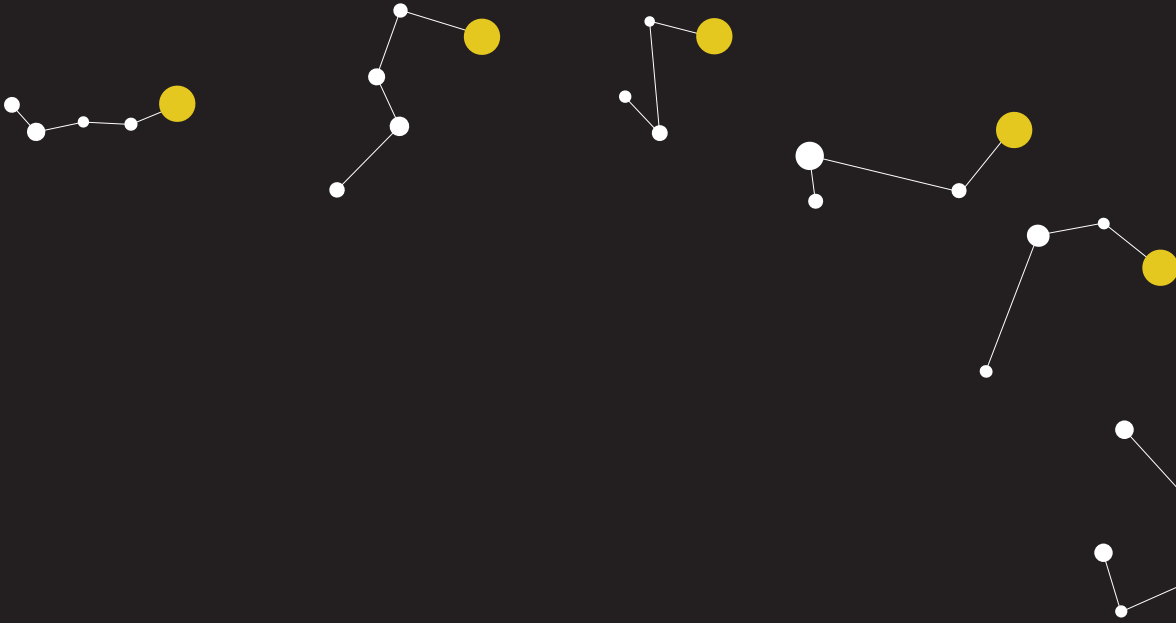
en beschrijven we hoe – anders dan de veelgenoemde altruïstische motivatie – individuele bronnen en sociale invloeden de donorcarrière vorm geven. Daarnaast adviseren we om onderzoek naar bloeddonsors te baseren op daadwerkelijk donatiegedrag in plaats van zelfgerapporteerde intenties om te doneren, gezien de relatief zwakke relatie tussen intenties en gedrag. Tot slot behandelen we het grote potentieel van het combineren van online veldexperimenten met registerdata – een effectieve manier om motivaties en barrières van (potentiële) donors te identificeren, en hun donatiegedrag over tijd te bestuderen (e.g., het ontwikkelen en evalueren van online wervingscampagnes die trachten de diversiteit van de donorpopulatie te vergroten).

Gezien de maatschappelijke relevantie van de studies sluiten we het concluderende hoofdstuk af met een aantal praktische aanbevelingen voor effectiever bloeddonormanagement. Allereerst pleiten we voor de ontwikkeling van persoonlijkere wervingsmethoden die zich richten op specifieke groepen van potentiële donors, in plaats van de one-size-fits-all methoden die nu vaak worden ingezet. Hoewel het, gezien de lage kosten en de eenvoudige implementatie, verleidelijk is om nog meer gebruik te maken van de donor-werft-donor strategie, tonen onze resultaten aan dat dit niet effectief is in het motiveren van een meer diverse groep nieuwe donors. Ten tweede benadrukken we het belang van persoonlijkere behoudstrategieën door in te spelen op veranderende donatiemotivaties gedurende de donorcarrière en door het strategisch openen van donatiecentra door het land. Het gebrek aan data-gedreven evaluaties van de huidige campagnes maakt het echter lastig om conclusies te trekken over de impact van behoudstrategieën op de loyaliteit van donors. Het implementeren van een Customer Relationship Management (CRM) systeem in de vorm van een online bloeddonorportaal zou enerzijds een toegankelijke optie zijn om op een directere manier gegevens te verzamelen over donors, terwijl dit het anderzijds gemakkelijker maakt om te communiceren met subgroepen van de donorpopulatie. Vanuit het perspectief van de donor maakt dit het gemakkelijker om relevante persoonsinformatie met de bloedbank te delen (e.g., de geboorte van een kind, een verhuizing), informatie te verkrijgen over aanstaande donaties, contact te leggen met andere bloeddonsors, en ervaringen te delen over het donatieproces. Vanuit het perspectief van de bloedbank maakt dit het gemakkelijker om, op basis van deze informatie, donors gerichtere berichten te versturen en hen op de juiste momenten gedurende de bloeddonorcarrière te motiveren om hun donaties voort te zetten.

Concluderend kunnen we stellen dat, zonder adequate interventies van de bloedbank, een groot percentage van de huidige donors het risico loopt om te stoppen met hun bloeddonaties. In het licht van recente maatschappelijke en demografische ontwikkelingen, alsmede het voortschrijdend inzicht in de negatieve gevolgen van frequente bloeddonaties op ijzervoorraden van donors, is het essentieel om te werken aan een grotere en meer diverse bloeddonorpopulatie. Het ontwikkelen van gepersonaliseerde interventies kan hier

in grote mate aan bijdragen, mits er voldoende rekening wordt gehouden met individuele, sociale en contextuele factoren die een rol spelen in de donatiebeslissing. Als het aantal bloeddonthaties van een grotere, loyalere en meer diverse donorpopulatie wordt verhoogd, kan de komende jaren een voldoende en stabiele bloedvoorraad gegarandeerd worden waarmee levens worden gered.





DANKWOORD

DANKWOORD

Het voelt enigszins onwerkelijk om te zeggen, maar nu is het dan écht af. Voor u ligt het tastbare resultaat van vier jaar werk. Vier jaren die werden besteed aan het ontwerpen van studies, het verzamelen, koppelen, opschonen en analyseren van databestanden, en het schrijven en publiceren van papers. Dit alles was niet mogelijk geweest zonder een groot aantal bijzonder fijne en inspirerende personen die mij gedurende deze jaren zowel direct als indirect hebben geholpen om tot dit resultaat te komen, en waarvan ik velen juist dankzij dit avontuur heb mogen leren kennen.

Dat ik dit avontuur überhaupt aan heb mogen gaan, heb ik in de eerste plaats te danken aan mijn promotoren Eva-Maria Merz en René Bekkers, en mijn copromotor Wim de Kort. Het waren vier bijzondere jaren waarin ik ontzettend veel geleerd heb en waar ik met veel plezier op terug kijk. Niet in de laatste plaats vanwege jullie begeleiding.

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Dear members of the reading committee, prof. dr. Eamonn Ferguson, prof. dr. Michel Clement, dr. Lesley Hustinx, dr. Daphne Thijssen-Timmer, prof. dr. Pamala Wiepking, and prof. dr. Aart Liefbroer, thank you very much for taking the time and effort to read my dissertation. I am honoured that you are willing to come (all the way) to Amsterdam to share this beautiful day with me. I look forward to discussing the dissertation with you during the defence.

Daarnaast wil ik graag alle collega's en oud-collega's van Donorstudies en Donor Medicine Research van Sanquin bedanken. Bedankt voor de ongedwongen sfeer en de inspirerende werkomgeving. Het was mooi om samen te werken met zo'n diverse groep collega's. Of het nou ging over wiskundige voorraadmodellen, het voorspellen van Hb-trajecten, of dat alsmaar veranderende donorgedrag, iedereen probeerde elkaar vooruit te helpen. Dat is de kracht van DMR. Ik zal onze congresbezoeken en maandelijkse borrels bij Radion gaan missen.

OIO'ers en oud-OIO'ers (Joost, Lisa, Marie, Maurits, Rosa, Sem en Tiffany), het was geweldig om juist met jullie dit avontuur te mogen beleven. Bedankt voor alle relaxte overleggen, de actieve uitjes en de *special*-pannenkoekenavonden. Ik kijk al uit naar de volgende aluminium-editie! Hopelijk kunnen Bloedzakje en Reageerbuisje ook een keer op bezoek komen.

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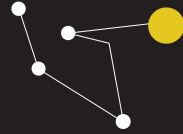
Slutteligt en stor tak til: Henrik Hjalgrim, Klaus Rostgaard, Steffen Andersen og Kasper Nielsen for Jeres hjælp med vores fælles manuskript. Det var en sand fornøjelse at samarbejde med Jer. Som en perfekt afslutning på mit Københavnske ophold, lykkedes det os at publicere manuskriptet i Vox Sanguinis.

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Tjeerd
Delft, mei 2020





ABOUT THE AUTHOR

CURRICULUM VITAE

Tjeerd Willem Piersma was born on May 23, 1991 in Delft, the Netherlands. After receiving his Bachelor's degree in Communication Science in 2012, he continued to study at the VU University Amsterdam. In 2013 and 2014, he obtained his Master's degrees in Policy, Communication and Organization, and Organizational Psychology (cum laude), respectively. After his graduation, Tjeerd worked as an operational manager at one of the largest Dutch coaching agencies, specialised in personal development and team coaching.

After one year of working as an operational manager, Tjeerd started missing the focused, in-depth scientific work and decided to pursue a PhD position. Following a recommendation from dr. Arjen de Wit – his former supervisor during his Master's thesis on charitable giving by non-western immigrants in the Netherlands – Tjeerd applied for a PhD position at the department of Donor Medicine Research at Sanquin Research, and the Centre of Philanthropic Studies at the VU University Amsterdam at the end of 2015. Supervised by prof. dr. René Bekkers, dr. Eva-Maria Merz and prof. dr. Wim de Kort, Tjeerd studied blood donor careers, unravelling individual, social and contextual factors associated with blood donor behaviour over the life course. His research resulted in five publications in international peer-reviewed journals, two scientific awards (i.e., Best Poster Award at the VU University PhD Day 2017 and Best Abstract Award at the European Conference on Donor Health and Management 2018), and his thesis defence in September 2020.

Currently, Tjeerd works as a researcher at the Research and Documentation Centre (WODC), an international knowledge centre on security, criminal, civil and administrative justice, and migration issues. His research focuses on criminal careers, studying how criminal behaviour develops over the life course and whether personal intervention programmes are successful in reducing recidivism rates.

PUBLICATIONS

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- Piersma, T.W., & Klinkenberg, E.F. (2018). The relation between blood donor recruitment and donor diversity and loyalty in the Netherlands. *ISBT Science Series*, 13(4), 384-393.
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- Meijer, R. & Piersma, T.W. (2019, June). Het leven gaat door [Life goes on]. *Bloedverwant* 6+, 34.
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PHD PORTFOLIO

Activity	Institution	Location	Year	ECTS
Courses				
Oral Presentation in English	Academic Medical Centre	Amsterdam	2016	0.5
Conducting Meta-analysis	VU University	Amsterdam	2016	3
Sanquin Science Course	Sanquin Research	Zandvoort	2016	1
Longitudinal and Life Course Research	Bocconi University	Milan	2016	6
Statistics Refresher Course	Radboud University	Nijmegen	2016	1.5
Writing Academic English	VU University	Amsterdam	2017	3
Writing an Empirical Journal Article	VU University	Amsterdam	2017	3
Research Integrity	VU University	Amsterdam	2017	3
Longitudinal Analysis Using Stata	VU University	Amsterdam	2018	2
Data Analysis with R	Erasmus University	Rotterdam	2019	1
Data Visualization with R	Erasmus University	Rotterdam	2019	2.5
Career Development	VU University	Amsterdam	2019	1
Masterclasses and workshops				1
Landsteiner Lecture – Eamonn Ferguson	Sanquin Research	Amsterdam	2016	-
Landsteiner Lecture – Henrik Ullum	Sanquin Research	Amsterdam	2017	-
Landsteiner Lecture – Michel Clement	Sanquin Research	Amsterdam	2018	-
Research Ethics and Integrity	Sanquin Research	Amsterdam	2018	-
ERNOP PhD Workshop	University of Basel	Basel	2019	-
Research visit				
Copenhagen University Hospital	Rigshospitalet	Copenhagen	2018	-
Conference organization				
Sanquin Science Day	NEMO Science Museum	Amsterdam	2017	-
Sanquin Science Day	NEMO Science Museum	Amsterdam	2018	-
Sanquin Science Day	NEMO Science Museum	Amsterdam	2019	-

Conference visits and presentations				2
Nederlandse Vereniging voor Bloedtransfusie – <i>poster</i>	Ede	2016	-	
European Conference on Donor Health and Management – <i>poster</i>	Cambridge	2016	-	
Sanquin Science Day – <i>poster</i>	Amsterdam	2016	-	
Nederlandse Vereniging voor Bloedtransfusie – <i>poster</i>	Ede	2017	-	
VU University PhD Day – <i>poster</i>	Amsterdam	2017	-	
International Society for Blood Transfusion – <i>oral</i>	Copenhagen	2017	-	
Sanquin Science Day – <i>poster</i>	Amsterdam	2017	-	
International Society for Third Sector Research	Amsterdam	2018	-	
European Conference on Donor Health and Management – <i>oral</i>	Copenhagen	2018	-	
Dag van de Sociologie – <i>oral</i>	Rotterdam	2018	-	
Sanquin Science Day – <i>poster</i>	Amsterdam	2018	-	
Sanquin Research Monday Afternoon Lecture – <i>oral</i>	Amsterdam	2019	-	
Nederlandse Vereniging voor Bloedtransfusie – <i>poster</i>	Ede	2019	-	
European Research Network on Philanthropy – <i>oral</i>	Basel	2019	-	
Guest lecture on Non-Profit Marketing – <i>oral</i>	Amsterdam	2019	-	
Awards				
Best Poster Award – <i>VU University PhD Day</i>	Amsterdam	2016	-	
Best Abstract Award – <i>European Conference on Donor Health and Management</i>	Copenhagen	2018	-	

Total ECTS: 30.5





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