

# Beyond fear: A longitudinal investigation of emotions and risk of a vasovagal reaction in first-time whole-blood donors

Amanda Thijsen<sup>1</sup>  | Barbara Masser<sup>2,3</sup>  | Tanya E. Davison<sup>4,5</sup> |  
Anne van Dongen<sup>6</sup> | Lisa A. Williams<sup>7</sup> 

<sup>1</sup>Clinical Services and Research, Australian Red Cross Lifeblood, Sydney, New South Wales, Australia

<sup>2</sup>School of Psychology, The University of Queensland, Brisbane, Queensland, Australia

<sup>3</sup>Clinical Services and Research, Australian Red Cross Lifeblood, Brisbane, Queensland, Australia

<sup>4</sup>Clinical Services and Research, Australian Red Cross Lifeblood, Melbourne, Victoria, Australia

<sup>5</sup>Monash Art, Design and Architecture, Monash University, Melbourne, Victoria, Australia

<sup>6</sup>Psychology, Health, and Technology, Twente University, Enschede, the Netherlands

<sup>7</sup>School of Psychology, University of New South Wales, Sydney, New South Wales, Australia

## Correspondence

Amanda Thijsen, Clinical Services and Research, Australian Red Cross Lifeblood, Level 3, 17 O'Riordan Street, Sydney, NSW 2015, Australia.

Email: [athijsen@redcrossblood.org.au](mailto:athijsen@redcrossblood.org.au)

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## Abstract

**Background:** Fear is a recognized predictor of vasovagal reactions (VVRs) in blood donors. However, less is known about the role of other emotions, including positive emotions, that donors might experience. The aim of this study was to identify the emotions experienced in center that predict onsite VVRs, and to determine at what point during the donation appointment, the experience of these emotions is most influential.

**Study design and methods:** A sample of 442 first-time whole-blood donors (57.7% female; mean  $\pm$  SD age 30.7  $\pm$  11.7 years) completed a survey in the waiting area and before venepuncture in the donation chair to assess their current emotional experience. The survey data were matched with routinely-collected demographic, donation, and donor adverse event information. A generalized estimating equations model was used to identify emotions associated with the occurrence of a VVR.

**Results:** A total of 56 (12.7%) participants experienced a VVR. The occurrence of a VVR was significantly associated with lower *love/closeness/trust* (OR: 0.53, 95%CI: 0.34–0.82) and higher *scared/fearful/afraid* (OR: 1.96, 95%CI: 1.18–3.25) states. Significant interaction effects suggested that the effect of *scared/fearful/afraid* decreased while *stressed/nervous/overwhelmed* increased from the waiting area to before venepuncture on the likelihood of a VVR.

**Discussion:** To effectively reduce donor VVR risk, blood collection agencies need to address a broader range of emotions at different points during the donation process.

## KEYWORDS

anxiety, blood donation, closeness, emotion, fear, generalized estimating equations, new donor, stress, trust, vasovagal reaction, whole blood

## 1 | INTRODUCTION

Donating blood for the first time can be a highly affective experience, and donors report a range of changing

emotions during the course of the donation procedure.<sup>1</sup> For example, donors may experience fear and anxiety before donation, and feelings of warm-glow and elation afterwards.<sup>2,3</sup> In the first study to track trajectories of

**Abbreviations:** GEE, generalised estimating equations; mDES, modified differential emotions scale; VVR, vasovagal reaction.

emotional experience during a donor's time in-center, van Dongen and colleagues<sup>4</sup> found that, for most first-time donors, the experience of negative emotions, such as feeling overwhelmed and afraid, increased from the waiting area to the donation chair before venepuncture, and then decreased rapidly throughout the remainder of the donation process. However, across the donation process and on the whole, positive emotions were more intensely experienced than negative ones, with most donors feeling increasingly proud, grateful, and joyful as they moved from the waiting area to the donation chair, and then finally to the refreshment area.

While most donors have a pleasant and uneventful donation experience,<sup>5</sup> vasovagal reactions (VVRs) do unfortunately occur, with first-time whole-blood donors at particular risk. Blood collection agencies report that one in every 13 first-time whole-blood donors experience such a reaction,<sup>6</sup> but self-reports by donors suggest that this rate may be much higher.<sup>7,8</sup> VVRs are defined as a general feeling of discomfort and weakness with anxiety, dizziness, and nausea, which may progress to loss of consciousness (i.e. syncope).<sup>9</sup> These reactions are thought to be triggered by the direct effects of blood loss, orthostatic stimuli (leaving the donation bed, prolonged standing after the donation), and emotional stimuli (fear, threat, disgust, pain, emotional distress, and blood phobia), with the influence of these triggers varying throughout the donation procedure.<sup>10,11</sup> To understand the determinants of VVRs, and develop effective preventative strategies, it is important to consider the breadth of emotional states donors experience during the donation procedure, and when the experience of these emotions influences VVR outcomes.

To date, studies assessing emotional determinants of VVRs have primarily focused on negative emotions. Pre-donation fear has been repeatedly identified as a strong predictor of VVRs,<sup>12-15</sup> with the odds of experiencing a VVR doubling for those who report feeling fearful of seeing blood or feeling pain.<sup>16</sup> Graham<sup>17</sup> found that blood donors who indicated "nervousness" prior to donating were more likely to faint. Further, Olatunji and colleagues<sup>18</sup> surveyed donors before their whole-blood donation and found that expecting to feel anxiety, fear, and disgust during the donation was positively correlated with self-reported vasovagal symptoms. Viar and colleagues<sup>19</sup> found that pre-donation anxiety significantly predicted self-reported fainting symptoms for injection-fearful donors, with both pre-donation anxiety and disgust uniquely predicting fainting symptoms for non-injection-fearful donors. Finally, Thijsen et al.<sup>20</sup> interviewed donors who had experienced a VVR and found that heightened feelings of anxiety and disgust associated with seeing blood and donation equipment were self-identified as the cause of their reaction by some inexperienced donors.

The historical focus on negative emotions, and indeed a limited range of negative emotions, as predictors of VVRs precludes a comprehensive understanding of how the full range of donors' emotional experience might affect VVR occurrence. As illustrated by van Dongen and colleagues' work,<sup>4</sup> donating blood for the first time is likely to elicit a broad range of emotions that shift across the donation process. It is currently unknown whether VVRs are solely predicted by negative emotions, such as fear, or whether positive emotions may contribute to or have a negative effect on a donor's risk of a reaction. Furthermore, since most studies have only assessed emotions in the waiting area, it is unclear whether the timepoint at which emotional states arise during the donation process<sup>1</sup> influences a donor's risk of having a VVR. To address these gaps in understanding, we investigated the role of both positive and negative emotions reported first in the waiting area and then in the donation chair before venepuncture in predicting phlebotomist-recorded VVRs among first-time whole-blood donors.

## 2 | MATERIALS AND METHODS

### 2.1 | Study setting

The study was conducted at three metropolitan, static blood collection centers across Australia. Collectively, at these centers in 2016 (during which data collection occurred), the average age was  $31.6 \pm 11.3$  years, women represented 51.3% of donors, and the average rate of onsite VVRs was 9% for first-time whole-blood donors.

### 2.2 | Participants and study procedure

Following ethical clearance, first-time whole-blood donors were recruited from April to October 2016. After arrival at the blood collection center, a researcher invited the donors to participate in the study, outlined the data collection procedure and expected time requirements, and provided an information sheet and consent form. Each participant was given an electronic tablet, which prompted them to complete a questionnaire in the waiting area before their donation, in the donation chair before venepuncture, in the donation chair during the blood draw, and in the refreshment area after donation. Only the data collected at the first two time points were used in this study as most reactions occurred during the donation (57%) and many participants did not complete the remaining survey time points.

A total of 733 first-time whole-blood donors agreed to participate in the study (89% consent rate), with time concerns cited most frequently as the reason for declining to

participate. However, 291 participants did not complete all the emotion items in the waiting area and before venepuncture (e.g., left the center before arriving at the donation chair due to a deferral), leaving 442 eligible responses for analysis. In comparison to the characteristics of the first-time whole-blood donor panel at the time, women were slightly over-represented in our sample (57.7% vs 54.8% whole-blood panel), and our participants were slightly younger (30.7 [ $\pm 11.7$ ] years; range 18–70 years) than those in the whole-blood panel (34.0 [ $\pm 12.9$ ] years; range 18–70 years). For this reason, sex and age were included as covariates in analyses reported below.

### 2.3 | Measures

At each time point, donors completed the 20-item modified Differential Emotions Scale (mDES)<sup>21</sup> to capture how the donor feels at that specific moment in time. The scale consists of 10 items including positively-valence states (e.g., “How much love, closeness, or trust do you feel right now?”) and 10 items including negatively-valenced states (e.g., “How scared, fearful, or afraid do you feel right now?”). Responses were indicated on a 5-point scale, with endpoints of *Not at all* (1) and *Extremely* (5).

In addition to the survey data, demographic (age, sex) and onsite donor adverse events data were extracted from the Australian Red Cross Lifblood database. In 2016, VVRs were recorded by severity and location (e.g., VVR – mild and delayed) using a standardized form. However, as most reactions were mild (i.e., no loss of consciousness; 93%), reaction severity was not modeled and VVRs were coded as a dichotomous outcome variable (yes/no).

### 2.4 | Statistical analysis

All analyses were performed using statistical software (IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.). Characteristics of the sample are described by means ( $\pm SD$ ) for continuous variables, totals (percentages) for categorical variables, and medians (interquartile ranges [IQRs]) for ordinal data. Univariate differences were examined using *t*-tests and chi-square goodness-of-fit tests.

The distributions of all variables were examined before statistical analysis. Due to low ratings (<5% of the sample scored >1), the items *angry/irritated/annoyed*, *ashamed/humiliated/disgraced*, *contemptuous/scornful/disdainful*, *disgust/distaste/revulsion*, *guilty/repentant/blameworthy*, and *hate/distrust/suspicion* were removed from analyses. Further, the items *sad/downhearted/unhappy* and *embarrassed/*

TABLE 1 Sample characteristics by VVR group<sup>a</sup>

	VVR	No VVR	Total
<i>n</i> (%)	56 (12.7)	386 (87.3)	442 (100)
Age (years)	27.2 ( $\pm 9.36$ )	31.2 ( $\pm 11.96$ )	30.7 ( $\pm 11.73$ )
Female	32 (57.1)	223 (57.8)	255 (57.7)

<sup>a</sup>Data reported as frequency (percentage) or mean (standard deviation).

*self-conscious/blushing* were removed due to the presence of severe skew unable to be resolved via mathematical transformation.

Correlations between the emotion items were also examined using Spearman's rho. The item *inspired/uplifted/elevated* was removed from further analysis as it showed higher correlations with the other items (e.g.,  $r_s = .77$  with the item *hopeful/optimistic/encouraged*). Multicollinearity was checked by examining variance inflation factor values.

The generalized estimating equations (GEE) method<sup>22</sup> was used to assess the association of the remaining 11 emotion states (main effects) and VVR occurrence. Exploratory models adjusted for age and sex. We tested for interactions between time point and each mDES item. Statistical significance was defined at  $p < .05$ .

## 3 | RESULTS

In our sample, 56 (12.7%) donors had a registered onsite VVR. The proportion of women in the VVR group was similar to that in the non-VVR group, 57.1% and 57.8% respectively,  $\chi^2(1) = 0.01$ ,  $p = .929$ . However, donors in the VVR group (27.2  $\pm$  9.37 years) were significantly younger than those in the non-VVR group (31.2  $\pm$  11.96 years),  $t(83.42) = 2.86$ ,  $p = .005$ . Table 1 provides an overview of the sample characteristics by VVR group.

Table 2 displays the medians and interquartile ranges of the emotion states by timepoint for the VVR and non-VVR groups separately. In general, positive emotional states were more strongly endorsed than negative emotional states.

Analyses were conducted to determine the association of emotion states and onsite VVR occurrence (see Table 3). The occurrence of a VVR was significantly associated with less intense *love/closeness/trust* states (OR: 0.53, 95%CI: 0.35–0.81) and more intense *scared/fearful/afraid* states (OR: 1.96, 95%CI: 1.18–3.26).

Interaction effects were computed to examine differences in the effect of each emotion state between the two time points (waiting area, before venepuncture) on the likelihood of experiencing a VVR. A significant interaction was found for *scared/fearful/afraid*,  $p = .017$ , and

**TABLE 2** Descriptive statistics for emotion states experienced in the waiting area and before venepuncture for VVR and non-VVR groups<sup>a</sup>

Emotion item	In the waiting area		Before venepuncture	
	VVR	No VVR	VVR	No VVR
Amused/fun-loving/silly	2 (1–3)	3 (2–3)	2 (1–3)	2 (1–3)
Angry/irritated/annoyed	1 (1–1)	1 (1–1)	1 (1–1)	1 (1–1)
Ashamed/humiliated/disgraced	1 (1–1)	1 (1–1)	1 (1–1)	1 (1–1)
Awe/wonder/amazement	2 (1–3)	2 (1–3)	2 (1–3)	2 (1–3)
Contempuous/scornful/disdainful	1 (1–1)	1 (1–1)	1 (1–1)	1 (1–1)
Disgust/distaste/revulsion	1 (1–1)	1 (1–1)	1 (1–1)	1 (1–1)
Embarrassed/self-conscious/blushing	1 (1–2)	1 (1–2)	1 (1–1)	1 (1–1.75)
Grateful/appreciative/thankful	3 (2–4)	3 (2–4)	3 (2–4)	3 (2–4)
Guilty/repentant/blameworthy	1 (1–1)	1 (1–1)	1 (1–1)	1 (1–1)
Hate/distrust/suspicion	1 (1–1)	1 (1–1)	1 (1–1)	1 (1–1)
Hopeful/optimistic/encouraged	3 (2–4)	3 (3–4)	3 (2–4)	3 (2–4)
Inspired/uplifted/elevated	3 (2–4)	3 (2–4)	3 (2–4)	3 (2–4)
Interested/alert/curious	3.5 (3–4)	3 (3–4)	3 (3–4)	3 (3–4)
Joyful/glad/happy	3 (2–4)	3 (2–4)	2.5 (2–3.75)	3 (2–4)
Love/closeness/trust	3 (2–3.75)	3 (2–4)	2 (2–3.75)	3 (2–4)
Proud/confident/self-assured	3 (2–4)	3 (2.75–4)	3 (2–4)	3 (2–4)
Sad/downhearted/unhappy	1 (1–1)	1 (1–1)	1 (1–1)	1 (1–1)
Scared/fearful/afraid	2 (1–3)	1 (1–2)	2 (1–3)	1 (1–2)
Serene/content/peaceful	3 (2–3)	3 (2–4)	2.5 (1.25–3)	3 (2–4)
Stressed/nervous/overwhelmed	2 (2–3)	2 (1–2)	3 (2–3)	2 (1–2)

<sup>a</sup>Data are reported as median (interquartile range) unless otherwise indicated. The scale for all the emotion items was 1 (*Not at all*) to 5 (*Extremely*).

*stressed/nervous/overwhelmed*,  $p = .01$ . The odds ratio of experiencing a VVR was 1.96 for *scared/fearful/afraid* reported in the waiting area, which decreased to 1.08 reported before venepuncture. On the other hand, the odds ratio of experiencing a VVR was 0.99 for *stressed/nervous/overwhelmed* reported in the waiting area, which increased to 1.73 reported before venepuncture. In other words, more intense *scared/fearful/afraid* states in the waiting area and *stressed/nervous/overwhelmed* states in the donation chair before venepuncture increased the likelihood of a VVR.

As noted above, these results adjust for age and sex given differences between our sample and the general population. Similar results emerge in a model that does not adjust for age and sex, reported in the Supplementary Materials.

The correlations between the three significant emotion states at the two time points were further investigated (see Table 4). Measured in the waiting area, *scared/fearful/afraid* was significantly positively related to *stressed/nervous/overwhelmed* for donors who had a VVR,  $r_s = .688$ ,  $p < .05$ , and those who did not,  $r_s = .604$ ,  $p < .05$ . *Love/closeness/trust* was significantly negatively

correlated with *scared/fearful/afraid*,  $r_s = -.107$ ,  $p < .05$ , and *stressed/nervous/overwhelmed*,  $r_s = -.122$ ,  $p < .05$ , only for donors who did not have a VVR. Looking at the emotion states before venepuncture, *scared/fearful/afraid* was significantly positively related to *stressed/nervous/overwhelmed* for donors who had a VVR,  $r_s = .583$ ,  $p < .05$ , and those who did not,  $r_s = .653$ ,  $p < .05$ . *Love/closeness/trust* was only significantly negatively correlated with *scared/fearful/afraid*,  $r_s = -.173$ ,  $p < .05$ , for donors who did not have a VVR.

## 4 | DISCUSSION

This study investigated the role of emotions experienced in the waiting area and before venepuncture in predicting VVRs for first-time whole-blood donors. To our knowledge, this is the first study to take a comprehensive approach in assessing both negative and positive emotions, and to capture donors' emotional experiences both in the waiting area and in the donation chair before venepuncture. Consistent with previous research,<sup>12–16</sup> our findings document that *scared/fearful/afraid* states

**TABLE 3** Generalized estimating equations (GEE) analysis of emotion states in the waiting area and before venepuncture on the occurrence of an onsite vasovagal reaction in first-time whole-blood donors<sup>a</sup>

Variable	OR	95% CI	p value
<i>Main effect</i>			
Amused/fun-loving/silly	1.00	0.71–1.41	0.991
Awe/wonder/amazement	1.37	0.97–1.93	0.076
Grateful/appreciative/thankful	0.96	0.63–1.46	0.842
Hopeful/optimistic/encouraged	0.83	0.56–1.24	0.364
Interested/alert/curious	1.19	0.80–1.76	0.401
Joyful/glad/happy	1.04	0.63–1.74	0.869
Love/closeness/trust	<b>0.53</b>	<b>0.35–0.81</b>	<b>0.004</b>
Proud/confident/self-assured	1.17	0.81–1.67	0.404
Scared/fearful/afraid	<b>1.96</b>	<b>1.18–3.26</b>	<b>0.009</b>
Serene/content/peaceful	1.22	0.91–1.64	0.180
Stressed/nervous/overwhelmed	0.99	0.63–1.57	0.966
<i>Interactions</i>			
Amused/fun-loving/silly			
Waiting area	1	Reference	Reference
Before venepuncture	1.03	0.74–1.44	0.848
Awe/wonder/amazement			
Waiting area	1	Reference	Reference
Before venepuncture	0.82	0.55–1.22	0.327
Grateful/appreciative/thankful			
Waiting area	1	Reference	Reference
Before venepuncture	0.96	0.61–1.53	0.865
Hopeful/optimistic/encouraged			
Waiting area	1	Reference	Reference
Before venepuncture	1.29	0.71–2.31	0.403
Interested/alert/curious			
Waiting area	1	Reference	Reference
Before venepuncture	0.94	0.59–1.50	0.802
Joyful/glad/happy			
Waiting area	1	Reference	Reference
Before venepuncture	0.75	0.45–1.24	0.258
Love/closeness/trust			
Waiting area	1	Reference	Reference
Before venepuncture	1.42	0.87–2.31	0.159
Proud/confident/self-assured			
Waiting area	1	Reference	Reference
Before venepuncture	0.87	0.55–1.37	0.543
Scared/fearful/afraid			
Waiting area	1	Reference	Reference
Before venepuncture	<b>0.56</b>	<b>0.34–0.90</b>	<b>0.017</b>
Serene/content/peaceful			
Waiting area	1	Reference	Reference

(Continues)

TABLE 3 (Continued)

Variable	OR	95% CI	p value
Before venepuncture	1.01	0.68–1.49	0.960
Stressed/nervous/overwhelmed			
Waiting area	1	Reference	Reference
Before venepuncture	<b>1.75</b>	<b>1.11–2.78</b>	<b>0.017</b>

<sup>a</sup>Adjusted for donor age and sex.

TABLE 4 Correlations between love/closeness/trust, scared/fearful/afraid, and stressed/nervous/overwhelmed experienced in the waiting area and before venepuncture for VVR and non-VVR groups<sup>a</sup>

Emotion item	1	2	3
Waiting area			
1. Love/closeness/trust		-.107 <sup>b</sup>	-.122 <sup>b</sup>
2. Scared/fearful/afraid	.071		.604 <sup>b</sup>
3. Stressed/nervous/overwhelmed	.066	.688 <sup>b</sup>	
Before venepuncture			
1. Love/closeness/trust		-.173 <sup>b</sup>	-.098
2. Scared/fearful/afraid	-.125		.583 <sup>b</sup>
3. Stressed/nervous/overwhelmed	-.019	.653 <sup>b</sup>	

<sup>a</sup>Above diagonal = non-VVR group; below diagonal = VVR group.

<sup>b</sup> $p < .05$ .

experienced in the waiting area are an important predictor of VVR risk. We document further that *stressed/nervous/overwhelmed* states in the donation chair before venepuncture are an additional significant predictor of VVR occurrence. We also found that higher levels of *love/closeness/trust* were associated with lower VVR risk.

A key observation of this study was the changing influence of emotional states on the risk of VVRs during the donation process. The odds ratio of experiencing a VVR associated with *scared/fearful/afraid* decreased from the waiting area to before venepuncture, while the odds ratio for *stressed/nervous/overwhelmed* increased over these time points. Further, whilst we did find a significant relation between the two emotion states at both timepoints, they were only moderately correlated indicating that *scared/fearful/afraid* in the waiting and *stressed/nervous/overwhelmed* before venepuncture need to be considered separately when designing interventions aimed at reducing VVRs. For example, two-staged strategies could be implemented to first decrease donors' *scared/fearful/afraid* states in the waiting area, and then reduce *stressed/nervous/overwhelmed* states before venepuncture. Studies conducted outside of the blood donation context have demonstrated the need to target stress and anxiety separately to optimize effectiveness of

interventions.<sup>23</sup> Music interventions<sup>24</sup> and guided breathing<sup>25,26</sup> may be promising routes for reducing fear and stress, respectively. Deployment of single-question assessments of fear and stress could be used to help target these interventions to at-risk donors. Research assessing the efficacy of such interventions in the blood donation context, and the ideal time when they should be delivered, is needed.

In this study, we also observed that higher levels of *love/closeness/trust* states lowered the risk of an onsite VVR. Donors who experienced a VVR reported lower intensities of *love/closeness/trust* compared to those who did not experience a VVR. To reduce the risk of VVRs, blood collection agencies should look to improve feelings of *love/closeness/trust* among first-time donors. A potential intervention strategy is to provide social support to first-time donors. For example, Pagliariccio and colleagues<sup>5</sup> found that training phlebotomists to support donors by providing an informative interview about the procedure and emotional support during the donation had a significant beneficial effect on self-reported vasovagal symptoms. Similarly, Hanson and France<sup>27</sup> found that providing a supportive person during the donation process significantly reduced self-reported vasovagal symptoms. Another potential method is loving-kindness meditation, which has been shown to increase feelings of social connection and positivity towards others.<sup>28</sup> Taken together, there appears to be an opportunity to minimize VVR risk by increasing feelings of *love/closeness/trust* through interventions focusing on providing social/emotional support to donors and/or loving-kindness meditation. Further research identifying the antecedents of *love/closeness/trust* (or lack thereof) among first-time donors will assist in catering interventions to this cohort.

While disgust has been identified as a significant predictor of vasovagal symptoms in the blood donation context by Olatunji and colleagues,<sup>18,19</sup> the current study revealed very low levels of experienced disgust, precluding analysis linking experienced disgust to the likelihood of an onsite VVR. Specifically, only 14 (3.2%) participants reported feeling any *disgust/distaste/revulsion* in the waiting area, which decreased to 9 (2.0%) participants before

venepuncture. Methodological differences between the two studies (e.g., a focus on anticipatory vs. currently experienced disgust; the particular measure of disgust) may explain deviations between studies; future work should seek to clarify the prevalence and role of disgust in donor behavior.

Our study had several limitations. First, it was limited to first-time whole-blood donors in an Australian blood donation setting. More research is needed to replicate our findings in donor populations in different blood collection agencies and with different donation types such as plasmapheresis. However, first-time whole-blood donors are a known high-risk group for VVRs<sup>29,30</sup> and our study provides new insights into the emotional experiences that predict VVRs. Second, our sample was relatively small as we focused on phlebotomist-registered reactions. To develop a comprehensive picture of the relationship between emotional experience and VVRs, additional studies could focus on donor-reported VVRs to investigate if any other emotions are at play. Third, our sample consisted of a greater proportion of women and was slightly younger than the average donor population at the three centers. This sex and age difference may have contributed to a higher VVR rate observed in our study (12%) compared to the sites' average (9%). However, there is little reason to believe that the slightly elevated VVR rate in this study accounts for observed effects, especially since the modeled risk of VVR accounted for age and sex. Fourth, whilst the vast majority of donors that were approached agreed to participate, some did decline, potentially reducing generalizability. Reasons for declining were not comprehensively recorded, though a small number of those who declined to participate cited heightened feelings of anxiety or nervousness as their reason for declining. Future research should seek to include such donors to improve generalizability of findings to donors across the entire range of emotional experience.

A final set of considerations surround the measurement of emotions. Despite assessing 20 emotion states during the donation process, we were only able to include 11 emotion states in our final model, most of which were positively-valenced. The vast majority of our study participants indicated that they were not experiencing any level of the negatively-valenced emotions, such as *disgust/distaste/revulsion*. Assessing the predictive effect of these emotions on VVR risk would require a substantial sample size. Moreover, we deployed a measure that includes several emotion descriptors in a single item to measure a particular emotion (i.e., the mDES).<sup>21</sup> While this approach has precedence in the field of emotion research and is warranted given methodological constraints on time and participant burden, it would be of interest for future research to deploy disaggregated items

to assess internal reliability. Moreover, the items deployed in the current study did not specify the eliciting source or target of a given emotion; therefore, it remains to be identified in future work about what or to whom the *love/closeness/trust*, *scared/fearful/afraid* and *stressed/nervous/overwhelmed* states were experienced.

This study provides novel insights into the impact of a broad range of emotional experiences on VVR occurrence among first-time whole-blood donors. Findings highlight the important role of *scared/fearful/afraid* states in the waiting area and *stressed/nervous/overwhelmed* states before venepuncture in predicting VVR risk. Further, we found that higher levels of *love/closeness/trust* were associated with lower VVR risk—an effect that was stable over time. These results lay the groundwork for VVR prevention interventions that pinpoint particular negative states across the first stages of the donation process, and increasing the positive emotional states of *love/closeness/trust* throughout.

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## CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest relevant to the manuscript submitted to TRANSFUSION.

## ORCID

Amanda Thijsen  <https://orcid.org/0000-0002-3310-2703>

Barbara Masser  <https://orcid.org/0000-0001-9385-6497>

Lisa A. Williams  <https://orcid.org/0000-0002-0021-5613>

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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