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Title: Beliefs underlying blood donors' intentions to donate during two phases of an avian influenza outbreak

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Abstract

Using a theory of planned behavior (TPB) framework the current study explored the beliefs of current blood donors (N = 172) about donating during a low and high-risk phase of a potential avian influenza outbreak. While the majority of behavioral, normative, and control beliefs identified in preliminary research differed as a function of donors' intentions to donate during both phases of an avian influenza outbreak, regression analyses suggested that the targeting of different specific beliefs during each phase of an outbreak would yield most benefit in bolstering donors' intentions to remain donating. The findings provide insight in how to best motivate donors in different phases of an avian influenza outbreak.

Avian influenza (H5N1) is a virus that primarily causes disease in birds (and to a lesser extent pigs and other mammalian animals; [1,2]). It is also a virus that can be transmitted to and, in some instances, between humans [1] with lethal consequences. To date, around 58% of humans infected to date with H5N1 have died [3]. Treatment for those infected is poor with the H5N1 strain often found to be resistant to antiviral medications traditionally used to treat influenza (i.e., amantadine, oseltamivir, rimantidine) [1,4]. While the peak incidence of avian influenza appears to have passed, confirmed human cases of H5N1 remain [5] and, as such, the potential for a more widespread H5N1 outbreak exists.

A review of outcomes from previous international health scares strongly suggest that any (perceived) outbreak of H5N1 or a similar virus would impact on the willingness of individuals to donate blood or blood products. Shan and Zhang [6] found that, during the Severe Acute Respiratory Syndrome (SARS) outbreak in Beijing in mid 2003, daily blood collections sometimes dropped below 10% of normal levels. This decrease in blood donation is concerning as it is estimated that during a high-risk phase of an H5N1 outbreak, between 8-19% of blood donors may be infected [7] and, thus, excluded from donation. While Zou [7] suggests that during an influenza pandemic hospital admissions may drop, thereby reducing the need for transfusions, he also suggests that the blood supply may be significantly diminished because of a reduced number of donations.

With the exception of plasma that can be stored frozen for up to 12 months, blood products cannot be stockpiled [8] and so health services are heavily dependent on a regular supply of blood from donors [9]. While the demand for blood or blood products may decrease during a high-risk phase of an H5N1 outbreak (i.e., when human-to-human transmission is sustained), a baseline demand for blood and blood products will remain. To maintain a safe and secure blood supply, it is critical to understand how blood donors can be retained in such a situation [10]. The Theory of Planned Behavior (TPB [11]) provides a useful framework

through which to identify the critical beliefs to target to retain blood donors in the event of an outbreak of avian influenza.

The TPB suggests that the proximal determinant of behavior is intention to engage in that behavior. Intention is, in turn, derived from attitudes (perceived positive or negative evaluations of the behavior), subjective norms (perceived pressure from others to perform the behavior), and perceived behavioral control (perceived amount of control over behavioral performance; also believed to influence behavior directly) [11]. Underlying these determinants of intention are salient beliefs that individuals hold about the focal behavior [11]. Attitude is informed by behavioral beliefs (i.e., costs and benefits of behavioral performance). Subjective norm is informed by normative beliefs (i.e., important referents' approval or disapproval of behavioral performance). Perceived behavioral control is informed by control beliefs (i.e., barriers preventing and motivators encouraging behavioral performance). A number of studies have utilised the knowledge of these underlying beliefs to increase our understanding of donation behavior [12] and, more specifically, blood donor behavior [13]. No previous study has, however, documented the critical beliefs underlying blood donors' decisions to donate or not during an outbreak of avian influenza.

Using the TPB as a theoretical framework, we investigated the behavioral, normative, and control beliefs that differentiate those donors who have strong and weak intentions to donate blood during a low and high-risk phases of an H5N1 pandemic. Further, drawing on von Haeften et al [14], we sought to identify the key beliefs that could be targeted in the event of a low or high-risk phase outbreak of avian influenza to strengthen donors' intentions to donate blood.

Preliminary Research

In order to determine the salient beliefs that underpin donors' decisions to donate in a high-risk and low-risk outbreak of avian influenza, a belief elicitation study was undertaken in

line with the protocol developed by Fishbein and Ajzen [15]. Thirty-six donors (20 males and 16 females aged between 18 and 79 years with $Mean_{age}$ = 39.08, Standard Deviation [SD] = 15.61) first read factual background information about avian influenza [16] before reading a fictional newspaper article detailing either a low-risk (i.e., animal transmission) or high-risk (i.e., human-to-human transmission) phase of an H5N1 outbreak (for further information see [17]). After reading each article, participants were asked to list any advantages or disadvantages (behavioral beliefs) they believed would occur as a result of donating blood, individuals who would approve or disapprove of them donating blood (normative beliefs), and factors that may facilitate or inhibit their ability to donate blood (control beliefs) in the context depicted in the newspaper scenarios. Using content analysis, the most frequently occurring responses to each of the questions formed the basis for the development of the belief-based measures in the main study questionnaire (i.e., behavioral, normative, and control belief measures).

Method

Participants

Participants were 172 (103 female, 69 male) residents of Australia who, consistent with donor eligibility requirements [8], ranged in age from 16-72 years with a mean age of 43.06 years (SD = 13.65). Female respondents (comprising 60% of the sample) were over-represented in comparison to the percentage of Australian donors who are female (52%) [13]. Participants self-selected to take part in this study by responding to a request to complete an internet based survey on blood donation in Australia during February-March 2009. To be eligible to participate in the survey, respondents were required to have donated blood within the last 6 months. Eligible participants reported a mean time since last donation of 3.12 months (SD = 2.01), and a range of 1-55 donations across their donor careers (Mean = 14.31, SD = 14.43). Of the 172 eligible blood donors who responded, the majority were either

married or in a common law relationship (65.7%), had either finished high school or attended college (59.9%), and were currently employed (56%).

Procedure and Measures

All participants were initially provided with the same factual background information about avian influenza provided to participants in the preliminary study [16]. Participants were then presented with the fictional newspaper articles detailing a low-risk or high-risk outbreak of avian influenza (for further information, see [17]). The order of presentation of these scenarios was randomized for each participant.

After reading each article, participants were asked to indicate how likely four costs and four benefits would result if they donated blood in the specific situation (behavioral beliefs). For normative beliefs, participants rated how likely seven referents would think they should donate blood in the specific situation. Control beliefs were assessed by asking participants to rate how likely it was that five facilitators and four barriers would either assist them or prevent them from donating blood in the specific situation (see Table 1). All belief-based items were scored on 7-point Likert scales, scored *extremely unlikely* (1) to *extremely likely* (7). The outcome measure of intention was measured on a two item scale ("I would intend to donate blood in this situation" and "I would plan to donate blood in this situation", scored *strongly disagree* [1] to *strongly agree* [7]) and, using Cronbach's alpha and inter-item correlation criteria, was reliable ($\alpha_{\text{Low-risk}} = .96$, $r = .94$, $p < .001$; $\alpha_{\text{High-risk}} = .97$, $r = .95$, $p < .001$).

In addition to the measured constructs, participants also answered demographic questions focusing on age, gender, marital status, level of education, number of months since their last blood donation, and total number of donations made in their donor career. The study received ethical clearance by the Australian Red Cross Blood Service and the University Human Research Ethics Committees.

Statistical analysis

In order to examine which beliefs were associated with intention to donate blood in the different phases of an outbreak, participants were divided into two groups based on the measure of their intention. The score that divided the sample in the two most evenly sized groups (the median), which was 6.00 for all scenarios, was used to group participants. Those donors with intentions toward donating blood in the specific scenario ranging from 1.00 to 5.99 were classified as having weaker intentions to donate, whereas those with intentions ranging from 6.00 to 7.00 were classified as having stronger intentions. In order to check that weak intenders had significantly lower intentions to donate blood across both scenarios than strong intenders an independent-groups *t*-test was performed. To compare the beliefs of donors with stronger intentions to donate blood (referred to as *strong intenders*) with those with weaker intentions to donate (referred to as *weak intenders)* in each of the scenarios, a series of one-way multivariate analyses of variances (MANOVAs) were conducted using Wilks' Lambda criteria to determine significance at $p < 0.05$. To explore where the differences exist between the groups, dependent variables (i.e., beliefs) were examined at the univariate level. Bonferonni adjustments were used to control for familywise type 1 error. Finally, regression analyses were undertaken to determine the critical beliefs that contribute to intention to donate in a low- and high-risk phase of a H5N1 pandemic.

Results

Intention analysis

Weak intenders had significantly lower intentions to donate blood across both phases of an avian flu outbreak than strong intenders. Specifically, in the low-risk phase, strong intenders had higher intentions to donate (Mean = 6.64, SD = 0.46) than weak intenders (Mean = 4.49, SD = 0.92), $t(170) = 20.12$, $p < 0.001$. Similarly, strong intenders in the high-

risk phase had higher intentions (Mean = 6.66, SD = 0.45) than weak intenders (Mean = 4.34, SD = 1.08), $t(170) = 18.44$, $p < 0.001$.

Belief-based Analyses[1]

Behavioral beliefs. For both the low-risk and high-risk outbreak scenarios, a significant multivariate effect of intention on behavioral beliefs was found, $F_{Low\text{-}risk}$ (8, 163) = 11.60, $p < .001$, $\eta^2 = .36$, $F_{High\text{-}risk}$ (8, 163) = 15.89, $p < .001$, $\eta^2 = .44$. At the univariate level, in both scenarios, strong intenders rated all the positive outcomes as being more likely to occur as a result of donating blood in the specific situation than weak intenders (see Table 1). In addition, in the high-risk scenario, strong intenders rated all the negative outcomes as being less likely to occur as a result of donating blood than weak intenders. In contrast, in the low-risk scenario, strong intenders only rated the negative outcomes of 'cause me to be at a higher risk of becoming infected with the virus' and 'subject me to a higher risk of coming into contact with people infected with the virus' as being less likely to occur as a result of donating blood in this situation than weak intenders.

Normative beliefs. For both the high and low-risk outbreak scenarios, a significant multivariate effect of intention on normative behavioral beliefs was found, $F_{Low\text{-}risk}$ (7, 164) = 11.27, $p < .001$, $\eta^2 = .33$, $F_{High\text{-}risk}$ (7, 164) = 15.17, $p < .001$, $\eta^2 = .39$. As shown in Table 1, at the univariate level, in both scenarios, strong intenders perceived that all groups would be more in favour of them donating blood than weak intenders.

Control beliefs. For both the high and low-risk outbreak scenarios, a significant multivariate effect of intention on control beliefs was found, $F_{Low\text{-}risk}$ (9, 162) = 11.02, $p < .001$, $\eta^2 = .38$, $F_{High\text{-}risk}$ (9, 162) = 15.51, $p < .001$, $\eta^2 = .46$. In the low-risk scenario, at the univariate level, strong intenders rated all the facilitator beliefs as being more likely to motivate them to donate blood in this situation, with the exception of 'having a

[1] $F_{Low\text{-}risk}$ and $F_{High\text{-}risk}$ = omnibus multivariate test of significance for the low and high-risk groups; η^2 = effect size.

incentive/reward system for those who donate blood'. Strong intenders also rated all the barriers to donation as being less likely to prevent them from donating blood in this situation than weak intenders. In the high-risk scenario, at the univariate level, strong intenders rated all the facilitator beliefs as being more likely to motivate them to donate blood in this situation. Strong intenders also rated all the barriers, except one ('knowing that there is an increased risk of being infected'), as being less likely to prevent them from donating blood in this situation (see Table 1).

Correlation and Regression Analyses

Previous TPB based research [14] has noted that identifying the beliefs that have the strongest influence on intention can increase the effectiveness of an intervention. As such, and cognizant that donors are likely to simultaneously hold behavioral, normative, and control beliefs about donating during an outbreak of avian flu, additional correlation and regression analyses were undertaken to determine the strongest unique predictors of intention. In both phases, the majority of behavioral beliefs and all normative, and control beliefs were significantly correlated with intention (see Table 2), however, the behavioral belief of 'increase the risk of me inadvertently spreading the virus' was not significantly correlated with intention in the low-risk scenario. Inspection of the correlations between each of the beliefs also indicated that the large majority of beliefs were significantly correlated with each other. Given the large number of relationships between the beliefs and intention, and between each of the beliefs, a stepwise regression was conducted in order to determine the critical targets for an intervention [14]. Consistent with the approach taken by von Haeften and colleagues [14] all behavioral beliefs significantly correlated with intention were entered into a stepwise multiple regression to identify those that made an independent contribution to donors' intentions to donate during a low-risk and high-risk outbreak of avian influenza. The same approach was then taken to identify the key normative and control beliefs. In the final

step of this analysis, all the beliefs that made a significant independent contribution to the prediction of intention were then entered into a final stepwise regression.

In the low-risk phase the behavioral belief ('help to ensure a sufficient blood supply'), the normative referent of 'family' and two control beliefs ('knowing there is shortage of blood stores' and 'receiving concerning reports about the outbreak') independently contributed to respondents' intentions to donate blood (see Table 3), and accounted for 61% of the variance in donors' intentions. In the high-risk phase, two behavioral beliefs ('help to ensure a sufficient blood supply' and 'increase the risk of me inadvertently spreading the virus'), two normative referents ('medical staff or health authorities' and 'family') and two control beliefs ('receiving concerning reports about the outbreak' and 'having requests or appeals for blood donation') independently contributed to respondents' intentions to donate blood (see Table 3) and accounted for 72% of the variance in donors' intentions.

Discussion

An avian influenza outbreak has the potential to change existing donors' blood donation related behaviors. The current study aimed to understand how different phases of a potential H5N1 outbreak would impact on donors' intentions to donate blood and to identify the critical beliefs that would facilitate the maintenance of blood donation in this context. The results revealed that the majority of behavioral, normative, and control beliefs differed significantly as a function of intention in both the low and high-risk phases of an avian flu outbreak. Further, the results of the regression analyses provide important information about the critical beliefs to target when formulating strategies to maintain blood donation behavior amongst current blood donors during such health scares.

An examination of differences in the critical behavioral beliefs of donors as a function of intention to donate during the different phases of an avian flu outbreak suggests that a focus on strategies designed to enhance the effect of highly positive attitudes toward blood

donation and dispel negative attitudes (particularly in the high-risk scenarios) may prove useful for intervention programs designed to retain blood donors. When considering these beliefs in conjunction with normative and control beliefs, different target beliefs emerged for donors in the low and high-risk phases of an avian influenza outbreak. Specifically, in both the low-risk and high-risk phases the results suggest that emphasising the key belief that blood donation helps to ensure a sufficient blood supply would be beneficial. In addition, in the high-risk phase, messages designed to target the negative belief that donating would increase the risk of donors inadvertently spreading the virus would yield further benefits in bolstering donors' intentions.

Investigating the differences in normative beliefs of donors who intend to donate blood during an avian flu outbreak revealed that strong and weak intenders differed significantly on all normative beliefs across both the low and high-risk scenarios. Strong intenders perceived more social approval from all identified referents (e.g., family, medical staff/health authorities) for blood donation during an avian flu outbreak than weak intenders. The regression analyses suggested that, while family support for donating blood should be targeted in both phases of an avian flu outbreak, targeting the support of medical staff/health authorities for blood donation during a high-risk outbreak would yield additional benefits.

For the control beliefs, the findings revealed that donors with strong intentions to donate differed significantly from those with lower intentions on all facilitative control beliefs in the high-risk scenario and all except the facilitating belief of having an incentive/reward system in the low-risk scenario. Further, compared to weak intenders, strong intenders were less influenced in both scenarios by barriers that might inhibit blood donation in these situations. The regression analyses suggested that while, to the extent it is possible, communication in both low and high-risk phases should minimise concerning reports about the outbreak, different control beliefs may be optimal targets for intervention in the different

risk phases. Specifically, in the low-risk phase the results suggest that emphasising a shortage of blood stores should yield maximum benefit. In contrast, in the high-risk phase having explicit requests or appeals for blood donation should motivate donors to donate.

While the results of the current study provide valuable information about the critical beliefs to target when formulating strategies to maintain blood donation behavior during an avian influenza outbreak or equivalent health scares, the findings should be interpreted in light of the study's limitations. Our sample comprised self-selected donors who were asked to consider their behavior in the context of a hypothetical low-risk and high-risk outbreak of avian influenza. To date, H5N1 influenza has not impacted on Australia and an avian influenza pandemic has not been declared anywhere in the world [18]. As such, the scenarios presented were hypothetical and could only be considered in abstract by our donors. However, the fact that different beliefs emerged as key targets for intervention at the different risk levels suggests that donors actively attempted to consider their donation behavior as a function of the different risk scenarios presented to them.

Despite these limitations, this is the first known Australian study to investigate a range of beliefs underlying blood donation decision making in the context of an avian influenza outbreak. The study adopted a theoretical approach to gain this understanding and used scenario-based methodology to determine the important beliefs guiding blood donation intentions. Such methodology is common when examining risk-associated health behaviors [19,20] and adopting such an approach allowed for an examination of the underlying factors influencing blood donation across varying levels of risk extent. The findings from the current study suggest that a differing emphasis on specific benefits and costs, the social approval of important others, and addressing (perceived) barriers to donation may assist in maintaining current donors' intentions and, thus, subsequent blood donation behavior during low and high-risk phases of an avian influenza outbreak. Continued blood donation in such an event

will, in turn, maximise the benefits to the national health of Australians by maintaining a safe, secure, and sufficient supply of blood and blood products.

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Table 1.

Behavioral, Normative, and Control Beliefs for Donors across an Animal Transmission and Pandemic Phase of an Avian Influenza Outbreak

Beliefs	Low-risk scenario		High-risk scenario	
	Strong intenders[b]	Weak intenders[b]	Strong intenders[b]	Weak intenders[b]
	n = 98	*n* = 74	*n* = 87	*n* = 85
Behavioral beliefs - benefits	*M* (*SD*)[c]	*M* (*SD*)[c]	*M* (*SD*)[c]	*M* (*SD*)[c]
Help to ensure sufficient blood supply	6.63 (0.62)	5.47 (1.12)***	6.75 (0.55)	5.51 (1.17)***
Help to save lives	6.66 (0.59)	5.47 (1.19)***	6.72 (0.56)	5.51 (1.19)***
Help those who are sick or in need of blood	6.70 (0.56)	5.66 (1.08)***	6.75 (0.53)	5.61 (1.16)***
Help those infected with virus	6.20 (1.23)	5.16 (1.29)***	6.16 (1.45)	5.07 (1.28)***
Cause me to be at a higher risk of being infected with virus	2.44 (1.79)	3.70 (1.51)***	2.56 (1.75)	4.31 (1.51)***
Behavioral beliefs - costs				
Subject me to a higher risk of coming into contact with people infected with virus	2.49 (1.77)	3.81 (1.54)***	2.55 (1.76)	4.34 (1.53)***
Increase the risk of me inadvertently spreading the virus	4.14 (2.20)	4.49 (1.53)	4.11 (2.24)	5.11 (1.46)***
Increase risk of me spreading virus through donor selection criteria being relaxed.	3.63 (2.07)	4.35 (1.45)	3.64 (2.21)	4.71 (1.49)***
*** $p < .006$[a]				
Normative beliefs	*n* = 98	*n* = 74	*n* = 87	*n* = 85
Family	6.12 (1.34)	4.59 (1.27)***	6.06 (1.36)	4.18 (1.48)***
Friends	6.06 (1.28)	4.68 (1.30)***	5.98 (1.39)	4.19 (1.42)***

Medical staff/health authorities	6.34 (1.05)	4.89 (1.40)***	6.45 (0.91)	4.69 (1.49)***
Australian Red Cross Blood Service	6.47 (0.92)	5.08 (1.38)***	6.60 (0.81)	4.87 (1.55)***
Religious groups	5.14 (1.61)	4.38 (1.40)***	5.20 (1.72)	4.07 (1.40)***
Persons needing blood transfusions	6.47 (1.10)	5.18 (1.46)***	6.57 (1.00)	5.19 (1.48)***
Persons infected with the virus	5.98 (1.53)	4.68 (1.62)***	6.23 (1.42)	4.56 (1.60)***
*** $p < .007$[a]				
Control beliefs - facilitators	$n = 98$	$n = 74$	$n = 87$	$n = 85$
Having general information on blood donation & risks involved	6.30 (0.94)	5.00 (1.18)***	6.37 (0.95)	5.00 (1.23)***
Knowing that there is a shortage of blood stores	6.59 (0.64)	5.32 (1.21)***	6.67 (0.62)	5.16 (1.18)***
Having an incentive or reward system for blood donation	5.11 (1.78)	4.76 (1.37)	5.29 (1.70)	4.52 (1.47)***
Having requests or appeals for blood donation	6.43 (0.86)	5.24 (1.10)***	6.48 (0.81)	5.08 (1.14)***
Having assurances that procedures are in place that ensures safe blood donation during this period	6.58 (0.69)	5.41 (1.26)***	6.70 (0.61)	5.36 (1.27)***
Control beliefs - barriers				
Receiving concerning reports about the outbreak	3.14 (1.83)	4.38 (1.25)***	3.26 (2.05)	4.46 (1.42)***
Knowing that there is an increased risk of being infected	4.09 (1.97)	4.88 (1.49)***	4.55 (1.99)	5.09 (1.40)
Having restrictions on opportunities to donate	3.95 (1.88)	4.84 (1.25)***	3.94 (1.90)	4.76 (1.37)***
Having restrictions on ability to donate	4.12 (1.98)	4.89 (1.39)***	4.18 (1.96)	4.94 (1.35)***
*** $p < .005$[a]				

[a]Bonferonni adjustments used to control for familywise type 1 error.
[b]Weak and strong intention groups were created based on a median split on the intention composite measure for each of the scenarios; thus, the different ratio of *n* values between the intention groups across the three TPB belief-based categories reflects the presence of missing data.
[c]M = mean, SD = Standard deviation.

Table 2.

Correlations between intention and beliefs for the low-risk and high-risk scenarios.

	Low-risk scenario intention	High-risk scenario intention
Help to ensure sufficient blood supply	.60***	.58***
Help to save lives	.57***	.56***
Help those who are sick or in need of blood	.56***	.55***
Help those infected with virus	.38***	.39***
Cause me to be at a higher risk of becoming infected with the virus	-.36***	-.48***
Subject me to higher risk of coming into contact with people infected with the virus	-.37***	-.45***
Increase the risk of me inadvertently spreading the virus	-.12	-.28***
Increase risk of me spreading the virus through donor selection criteria being relaxed	-.21**	-.26***
Family	.63***	.71***
Friends	.61***	.68***
Medical staff/health authorities	.62***	.74***
Australian Red Cross Blood Service	.61***	.71***
Religious groups	.33***	.39***
Persons needing blood transfusion	.52***	.59***
Persons infected with the virus	.42***	.56***
Having general information on blood donation &	.59***	.56***

risks involved		
Knowing that there is a shortage of blood stores	.63***	.66***
Having an incentive/reward system for blood donation	.17***	.28***
Having requests or appeals for blood donation	.59***	.62***
Having assurances that procedures are in place that ensures safe blood donation during this period	.57***	.58***
Receiving concerning reports about the outbreak	-.46***	-.48***
Knowing there is an increased risk of being infected	-.31***	-.27***
Having restrictions on opportunities to donate (e.g., time, location, travel)	-.34***	-.34***
Having restrictions of ability to donate blood (e.g., health status)	-.27***	-.32***

Note. $^{*}p \leq .05$. $^{**}p \leq .01$. $^{***}p \leq .001$.

Table 3.

Critical beliefs of intention to donate in low-risk and high-risk avian influenza outbreak phases.

Predictor	Low-risk scenario	High-risk scenario
Knowing there is a shortage of blood stores	.26**	-
Receiving concerning reports about the outbreak	-.17**	-.18***
Family	.39***	.22**
Ensuring a sufficient blood supply	.21**	.18**
Increase the risk of me inadvertently spreading the virus	-	-.11*
Medical staff/health authorities	-	.30***
Having requests or appeals for blood donation	-	.21***
	$R^2 = .61$, $F(4,167) = 67.35$, $p < .001$	$R^2 = .72$, $F(6,163) = 70.38$, $p < .001$

Note. $^{*}p \leq .05$. $^{**}p \leq .01$. $^{***}p \leq .001$.