Potential exposure to Australian bat lyssavirus is unlikely to prevent future bat handling among adults in South East Queensland

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Summary and Keywords

Objectives: Despite ongoing public health messages about the risks associated with bat contact, the number of potential exposures to Australian bat lyssavirus (ABLV) due to intentional handling by members of the general public in Queensland has remained high. We sought to better understand the reasons for intentional handling among these members of the public who reported their potential exposure in order to inform future public health messages.

Methods: We interviewed adults who resided in a defined geographic area in South East Queensland and notified potential exposure to ABLV due to intentional handling of bats by telephone between 1st January 2012 and 31st December 2013.

Results: The participation rate was 54%. Adults who reported they had intentionally handled bats in South East Queensland indicated high levels of knowledge and perception of a moderately high risk associated with bats with overall low intentions to handle bats in the future. However, substantial proportions of people would attempt to handle bats again in some circumstances, particularly to protect their children or pets. Fifty-two percent indicated that they would handle a bat if a child was about to pick up or touch a live bat and 49% would intervene if a pet was interacting with a bat.

Conclusions: Future public health communications should recognise the situations in which even people with high risk perceptions of bats will attempt to handle them. Public health messages currently focus on avoidance of bats in all circumstances, and recommend calling in a trained vaccinated handler, but messaging directed at adults for circumstances where children or pets may be potentially exposed should provide safe immediate management options.

Keywords: Australian bat lyssavirus, prevention, Australia,

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46 **Impacts:**

- 47 • Previous potential exposure to Australian bat lyssavirus doesn't always deter members of
48 the public from handling bats again
- 49 • To better prevent the public from intentionally handling bats additional health promotion
50 messages are needed
- 51 • Health promotion messages should include what people should do while waiting for the
52 assistance of a trained handler to manage a variety of situations, particularly those where
53 children or pets may come into contact with bats

Introduction

Australian bat lyssavirus (ABLV) belongs to the family *Rhabdoviridae* and genus *Lyssavirus*, and causes a rabies-like illness in humans. It has caused three fatalities in Queensland, two in the mid-1990s in women aged between 30 and 40 years and one in 2013; an eight year old boy (Allworth et al. 1996, Hanna et al. 2000, Francis et al. 2014). Bats are the reservoir of ABLV with 1% - 7% of flying foxes and insectivorous bats in Australia thought to be infected (McCall et al. 2000). The virus transmits to humans mainly through the saliva of infected bats. Potential exposure to ABLV is defined as a bite or scratch from a bat, or mucous membrane or broken skin exposure to bat saliva or neural tissue and has been a notifiable condition in the state of Queensland since 2005 (Young and McCall 2010, Si et al. 2016).

The most common circumstance of potential exposure in Queensland is intentional contact with a bat by a member of the general public (56% of notified potential exposures over the period 2009-2014) (Si et al. 2016). To prevent potential exposures to ABLV, messages warning people not to handle bats but to call in vaccinated trained handlers if required, are broadcast through local and state media at least annually and are featured on Queensland Health (Queensland Health 2017) and other websites (Queensland Government 2016).

Despite these public health messages, the number of notifications in Queensland has remained high (Young and McCall 2010), with notified potential exposures in 2012-2013 totalling 677 (Si et al. 2016). This study sought to better understand the reasons for intentional handling among members of the public who reported their potential exposure in order to inform future public health communications.

Materials and Methods

Adults who notified potential exposure to ABLV due to intentional handling of bats between 1st January 2012 and 31st December 2013 were interviewed if they provided consent and resided in the defined geographic area of South East Queensland (Figure 1). People who were potentially exposed during the study period due to professional or volunteer carer duties or accidental contact with bats were excluded. Invitation to participate was prospective and as close as possible in time to the notification of the potential exposure. The questionnaire was conducted by telephone and computer assisted, with responses entered electronically in real time. The questionnaire asked about demographic information, knowledge of bats and disease transmission, perception of risk to human health from bats, the reason for handling the bat on this occasion and whether they would attempt to handle a bat again in the future in a variety of situations.

Descriptive analyses summarised participants' responses to the questionnaire. Overall scores for knowledge, risk perception and future intention to handle bats were then calculated.

The response to 12 knowledge questions were coded 1= correct answer and 0= incorrect answer or don't know. The responses were summed to give an overall knowledge score with a higher score indicating higher knowledge about bats and ABLV.

The responses to nine risk perception questions were coded: 0 = no risk, 1=low risk, 2 = moderate risk, 3 = high risk. The responses were then summed. To account for questions where individuals answered "don't know", each raw score was divided by that individual's highest possible score. The resulting risk perception score was a decimal between 0 and 1, with values closer to 1 indicating perception of higher risk associated with bats.

Responses to 12 questions about the intention to handle bats in different situations were coded 0 = no intention to handle and 1 = intention to handle and then summed to give an overall score for the intention to handle a bat again in the future. The higher the score, the

more situations in which an individual indicated they would handle a bat. All scores were categorised (as they did not approximate a normal distribution) and compared across the other scores and the demographic variables using the chi-squared test.

Data were analysed on R version 3.3.2 (R Core Team 2017). The study was approved by Queensland Health Central Human Research Ethics Committee (HREC/11/QHC/57).

Results

During 2012 and 2013, there were 61 adults residing in the study area potentially exposed to ABLV due to intentional handling of bats who agreed to participate in the study. The participation rate was 54%.

Thirty-three participants (54%) notified their potential exposure on the same day as it occurred. The median time from potential exposure to notification was 0 days and the maximum time between potential exposure and notification was 22 years. Most participants were aged 45 years or older (n=43; 70%) and were male (n=36; 59%). Twenty participants (33%) were in paid employment at the time of survey.

The most common reason for intentionally handling the bat was to remove it from fruit tree netting or barbed wire fencing (n=27; 44%). Nineteen participants (31%) were otherwise concerned about the bat's welfare and 15 (25%) handled the bat to protect their children or pet.

Participants rated a variety of situations in terms of the risk to human health. Bats interacting with people, live bats lying on the ground and bats interacting with pets were identified as the most risky scenarios (Table 1). High proportions of participants indicated they would still personally attempt to handle bats in a variety of situations including those they deemed the

125 riskiest (Table 2). Thirty-two participants (52%) indicated that they would again handle a bat
126 if a child was about to pick up or touch a live bat and 30 (49%) would handle if a pet was
127 interacting with a bat. Similarly, 23 (39%) identified a dead bat as high risk but 44% of cases
128 would handle it if they found a dead bat lying on the ground in their backyard. While 27
129 participants were potentially exposed while rescuing a bat from fruit tree netting or fencing,
130 fewer (n=22) indicated they would do this again.

131 The median knowledge score was 10 (possible range 0-12), with an interquartile range of 8-
132 12. The median risk perception score was 0.62 (possible range 0-1), with an interquartile
133 range of 0.37-0.80. The median intention to handle score was 2 (possible range 0-12), with an
134 interquartile range of 1-6.

135 Of the demographic factors, only age group was associated with any of the aggregate scores
136 (Table 3). Adults 45 years and older were less likely to score in the highest quartile of
137 knowledge score than younger adults (RR 0.4, 95% confidence interval 0.2-0.7), but no
138 difference in risk perception or future intention to handle was apparent across the age groups.

139 Those with the highest quartile of knowledge score were less likely to have the highest
140 quartile of risk perception score (RR = 0.4; 95% CI = 0.2 - 0.9) compared to those with the
141 lowest quartile of knowledge score. Intention to handle score was not significantly
142 associated with any of the demographic variables or with knowledge or risk perception
143 scores.

144 **Discussion**

145 Social marketing principles suggest that knowledge of the target audience's needs and
146 motivations should be considered in addressing specific behavioural issues (National Social
147 Marketing Centre 2011). This study has explained some reasons for intentional risk

148 behaviour in relation to the handling of bats which may enable better design of health
149 messaging.

150 Participants in this study reported intentionally handling bats for reasons of bat welfare or to
151 protect their children or pets. This finding is common to the conclusions of other studies.

152 Particularly, a similar survey of the general public without prior potential exposure to ABLV
153 (Young et al 2014) found participants indicated they would intentionally handle bats to
154 protect their family, friends, pets and themselves from harm, or protect the bat from harm.
155 Quinn et al (2004) interviewed sixteen people who notified a potential exposure to ABLV
156 from either intentional or accidental handling. These authors found concern for bat welfare
157 was the strongest reason for intentional handling of bats. Paterson et al (2014) surveyed 49
158 people who had previously handled bats. The most common reasons given were that the bat
159 was sick or injured or that it was trapped in netting or a fence.

160 The current study of adults with a recent potential exposure to ABLV in South East
161 Queensland found participants had high levels of knowledge and perception of a moderately
162 high risk with respect to bats. Older adults seemed to have lower knowledge scores than
163 younger adults. This finding is supported by the survey of the general public where adults 65
164 and over seemed to have lower knowledge scores than younger age groups (Young et al
165 2014). The reason for this is unknown, but may be because of restricted access to current public
166 health messaging for these age groups who are more likely to be without home internet
167 access and less likely to use the internet than younger age groups (ABS 2016).

168 In the current survey higher knowledge was associated with lower perception of risk. This is
169 in contrast to the findings of the survey of the general public where knowledge was unrelated
170 to risk perception (Young et al 2014). This finding was unexpected. A possible reason for
171 the inverse association is that discussing the risk of ABLV with public health staff has

allowed participants of this study to categorise the proposed scenarios into a risk framework and identify those of lesser risk. Public health staff routinely discuss the routes of transmission of ABLV with people reporting a potential exposure and provide them with an information sheet that also contains this information.

Neither knowledge nor risk perception were associated with intention to handle bats in the future in this study. This again contrasts with the findings of the survey of the general public where risk perception was significantly associated with intention to handle (Young et al 2014). This difference may be because of a lack of power as the current study population was quite small, or may reflect that those with a previous potential exposure will handle bats in certain scenarios irrespective of how risky they perceive the situation to be.

In nearly all circumstances in the current study, the majority of participants indicated they did not intend to handle a bat again. However, for each scenario posed, there was still a significant proportion of participants who indicated they would again handle a bat. This proportion exceeded a third for the vast majority of scenarios, being highest for when ‘a child is about to pick up or touch a live bat’ (52%) and when ‘a pet is directly touching or fighting a live bat’ (49%).

Compared to the general public without a potential ABLV exposure (Young et al 2014), the current study participants seemed as likely to indicate intent to handle a bat to protect a child (52 vs 52%), or a pet (51 vs 49%), or when the bat was lying on the ground in their backyard (30 vs 34%) but less likely to indicate intent to handle a bat in most other scenarios. The experience of potential exposure to ABLV thus seemed to have lowered participants’ intention to handle bats in some situations, but not in others. Paterson et al (2014) also found a substantial proportion of those who had previously handled bats (32%) indicated they would again handle a trapped or injured bat.

This study was limited by its small sample size, the participation rate of 54% and that the study area itself was limited to metropolitan and suburban areas in South East Queensland. The findings may therefore not be generalizable across all geographical regions or populations. However, the findings are supported by other Australian studies as described above.

Most participants (n= 50, 81%) completed the questionnaire at a time after initial contact with their public health unit, meaning they were likely to have received information about ABLV prior to completing the questionnaire, while the other 11 (19%) completed the questionnaire at the time of initial public health management. This is a potential source of information bias. However, comparison of the aggregate scores of these two groups (data not shown), found no significant difference in knowledge, risk perception or intention to handle scores between participants interviewed after or during initial public health management.

Conclusions

Although basic knowledge is high and risk perception of bats is moderately high among people who had reported they had intentionally handled bats, these factors do not seem sufficient to prevent them from handling a bat again in circumstances where they feel they are unable to wait for the assistance of a trained and vaccinated handler, particularly where they feel the need to protect a child or a pet. For a substantial proportion of people, this also includes where bat welfare is felt to be at risk. These findings prompt several recommendations for future public health messaging:

1. Messaging targeting adults should specifically address circumstances where children or pets may be potentially exposed, and acknowledging that there are many people who will act despite the risk in these situations, safe immediate management options should be provided. We suggest utilising a scenario-based approach. For example, “where a live bat is lying on

220 the ground”, key messages might focus on removing children or pets from the bat rather than
221 the bat from the child or pet.

222 2. Campaigns should be developed that target children, warning them not touch bats, and thus
223 aiming not only to prevent children being potentially exposed, but also to prevent adults from
224 handling bats to rescue their children.

225 3. Consideration should be given to including the promotion of fencing and netting that
226 reduces bat entrapment as minimising the number of bats that get caught in fences and netting
227 would reduce the opportunities for potential exposure to ABLV. Existing community group
228 efforts towards safe fencing and netting for wildlife (eg Wildlife Friendly Fencing) may assist
229 with developing this line of messaging in public health campaigns.

230 4. Finally, messaging should include that bat welfare is at greater risk when untrained people
231 try to rescue entrapped bats than if they wait for a trained handler. This is because the bat
232 will be euthanased for ABLV testing if the person rescuing it is bitten or scratched in the
233 process.

234 While the mechanisms and media to be utilised in such campaigns are outside the scope of
235 the current study, maximising the reach of any new campaigns is an important principle in
236 order to maximise the impact of these messages.

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TABLE 1. Risk perception of bats in different scenarios: Proportion (number)

<i>Scenario</i>	<i>High Risk</i>	<i>Moderate Risk</i>	<i>Low Risk</i>	<i>No Risk</i>
Bats interacting with humans	63 (38)	16 (10)	18 (11)	1 (1)
Bats interacting with pets	49 (29)	27(16)	20 (12)	3 (2)
Live bats lying on the ground	49 (29)	27 (16)	16 (10)	6 (4)
Bats living in the ceiling of your house	41 (25)	21 (13)	25 (15)	11 (7)
Dead bats	38 (23)	20 (12)	30 (18)	10 (6)
Bat manure or droppings on your washing	35 (21)	18 (11)	35 (21)	11 (7)
Bat manure or droppings in a swimming pool	28 (17)	20 (12)	30 (18)	21(13)
Bats living in a tree in your backyard	21 (13)	23 (14)	36 (22)	18 (11)
Bat manure or droppings on your car	10 (6)	23 (14)	41 (25)	25 (15)

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303 **TABLE 2. Intention to handle a bat in different scenarios: Proportion (number)**

<i>Scenario</i>	<i>Yes</i>	<i>No</i>
A child is about to pick up or touch a live bat	52 (32)	47 (29)
A pet directly touching or fighting a live bat	49 (30)	50 (31)
A dead bat on the ground in your backyard	44 (27)	55 (34)
A bat having come into your house	36 (22)	63 (39)
Live bat trapped in a net over a fruit tree	36 (22)	63 (39)
A live baby bat lying on the ground	34 (21)	65 (40)
A live bat lying on the ground in your backyard	34 (21)	65 (40)
Live bat trapped in wire mesh fencing	27 (17)	72(44)
A live bat lying in the street	18 (11)	81 (50)

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307 **Table 3. Association between demographic characteristics and knowledge, risk perception and intention to handle scores: Relative Risk**
308 **(95% confidence interval), * $P<0.05$**

	<i>Highest quartile knowledge score</i>	<i>Highest quartile risk perception score</i>	<i>Highest quartile intention to handle score</i>
<i>Gender</i>			
Female	1.05 (0.5 - 1.8)	1.4 (0.8 – 2.3)	1.1 (0.6 - 1.8)
Male	1	1	1
<i>Age group</i>			
45 years and over	0.4 (0.2 – 0.7)*	1.15 (0.6- 2)	1.3 (0.7 – 2.6)
44 years and younger	1	1	1
<i>Current paid employment</i>			
Yes	1.5 (0.8 – 2.8)	0.8 (0.5-1.5)	1.02 (0.6 – 1.7)
No	1	1	1
<i>Knowledge score</i>			
Highest quartile		0.4 (0.2- 0.9)*	1.02 (0.6 -1.7)
Lowest quartile		1	1
<i>Risk perception</i>			
Highest quartile			1.03 (0.6 – 1.7)
Lowest quartile			1