Qualitative Risk Assessment - COVID-19 & Australian bats
August 2020

Executive summary

A rapid[1] qualitative risk assessment based on informed expert group opinion was conducted to assess the likelihood, over the next 6-12 months, of SARS-CoV-2 establishing in an Australian bat population following human-to-bat transmission, and the resulting consequences.

The primary pathway for introduction of SARS-CoV-2 into a bat population considered in the assessment was an infected person interacting with bats, including bat carers, researchers and ecological consultants. Visitors to caves were also considered. Where information was lacking or there was considerable variability across these risk scenarios, we took a conservative approach, and reflected this in the uncertainty assessment. We assessed flying-foxes and other Australian bat species separately.

Based on the situation and information available at the time of the assessment, the risk of SARS-CoV-2 establishing in an Australian bat population was assessed as **LOW** with a HIGH level of uncertainty. The high level of uncertainty associated with the estimate is due to information gaps and variability across bat populations and human activities.

As the COVID-19 situation changes and new information becomes available, the assessment may need to be revised; in particular, as the COVID-19 prevalence in the Australian human population increases. At the time of the assessment (July-August 2020), there were 2,495 active cases of COVID-19 in Australia.

<u>Recommendations to mitigate risk</u>

- It is important for anyone interacting with bats to assume that SARS-CoV-2 could be transmitted from humans to bats, and to take appropriate measures to minimise the likelihood of this occurring.
- The findings of our assessment indicate that for situations where the human COVID-19 prevalence is very low, it is reasonable for research and rehabilitation of bats to continue; however additional biosecurity measures over and above routine protocols should be applied (see *COVID-19 and Australian bats – information for bat carers and others interacting with bats* and overseas recommendations from the IUCN SSC Bat Specialist Group for bat rehabilitation and researchers, and the IUCN Wildlife Health Specialist Group and OIE on guidelines on working with free-ranging wildlife).
- The risk will vary depending on specific circumstances, so individuals should assess their own risk and if deemed higher (e.g. large number of bats in care resulting in a higher rate of interaction), take higher level precautions to prevent transmission. Where feasible, it may be appropriate to restrict, postpone or cancel activities until the risk is reduced.

[1] Definition from ECDC (2011): "Rapid risk assessments are undertaken in the initial stages of an event or incident of potential public health concern, whereas formal risk assessments are produced at a later stage of an event, usually when more time and information is available."

- The risk should be reassessed if there is a substantial increase in COVID-19 prevalence in Australia.

Introduction

The risk of transmission of SARS-CoV-2 from humans to bats, and subsequent negative impacts on conservation and public health has been recognised globally, given the probable origin of the virus, or its progenitor, in a bat species in China. Assessment of the risk of human to bat transmission of SARS-CoV-2 has been conducted in the USA and by the IUCN SSG Bat Specialist Group (Runge et al 2020, Nuñez et al 2020). Given that the Australian situation differs markedly to other countries due to the current very low prevalence of COVID-19 and the nature of human-bat interactions, there was a recognised need for an assessment specific to the Australian context. A working group established by Wildlife Health Australia (WHA) developed specific biosecurity information for those interacting with bats,[2] and agreed that a formal risk assessment should be conducted.

A qualitative rapid risk assessment was conducted using a collective group approach as described in this document. The purpose of the assessment is primarily to provide bat carers, researchers, ecological consultants and cavers with a risk estimate for activities involving interactions with bats, in order to inform risk management strategies.

Given the dynamic situation, this document reflects current knowledge at the time the assessment was conducted (July-August 2020). The assessment may need to be revised as new information becomes available or the situation changes.

Background information

SARS-CoV-2 is a SARS-related betacoronavirus. It is closely related to known coronaviruses detected in bats, particularly in *Rhinolophus* spp. (Zhou et al 2020). It is considered likely that the progenitor of SARS-CoV-2 originated in bats; however, the chain of transmission to humans is unknown, and the possible involvement of an intermediate host has been proposed (Lu et al 2020). While alpha- and betacoronaviruses have been found in Australian bats (Smith et al 2016, Prada et al 2019, Peel et al 2020), there is no evidence to date of SARS-CoV, MERS-CoV, SARS-CoV-2 or closely related viruses in Australian bats or other wildlife.

As of 16 August 2020, there were a total of 21,294,845 reported human cases of COVID-19 globally, and 23,035 in Australia (WHO 2020). There are a small number of reports from overseas of human-to-animal transmission of SARS-CoV-2, including pet cats and dogs, tigers and lions at a New York zoo, and farmed mink in the Netherlands (WHA 2020). Experimental infection of Egyptian fruit bats (*Rousettus aegyptiacus*) resulted in a transient subclinical respiratory infection with oral and faecal shedding, and virus detection in an in-contact bat (Schlottau et al 2020). A study is currently underway in the USA to assess the susceptibility of big brown bats (*Eptesicus fuscus*) to experimental infection with SARS-CoV-2 (OIE 2020).

Human to human transmission is primarily via respiratory droplets and contact with contaminated surfaces or objects (DoH 2019, WHO 2020), although the WHO acknowledges that more research into the role of aerosol transmission, particularly in confined spaces, is needed. Virus has been found to remain viable on surfaces for hours to several days, depending on the material, under controlled laboratory conditions (Van Doremalen 2020).

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[2] Wildlife Health Australia: *COVID-19 and Australian bats – information for bat carers and others interacting with bats*

WHA, in collaboration with government and non-government stakeholders, is continually assessing information on the COVID-19 situation in relation to Australian wildlife. The WHA fact sheet: *Novel coronavirus disease (COVID-19)* provides up-to-date information on COVID-19 in relation to wildlife.

Risk question

What is the risk of SARS-CoV-2 establishing in an Australian bat population as a result of human-to-bat transmission?

Time frame

Six to twelve months.

Risk assessment methodology

A qualitative risk assessment approach was chosen due to the lack of quantitative information on the majority of the parameters (e.g. number of human-bat interactions, level of susceptibility of bats to SARS-CoV-2 infection, viral shedding characteristics, etc.) and is consistent with Australian Government risk assessments. The process was based on that used for import risk analysis (DAWR 2016), with the addition of elements (e.g. a matrix for combining introduction and exposure assessments) from other published animal disease risk assessments such as Dufour et al (2011) and Roche et al (2015).

The principle of risk assessment can be defined as "Risk = Likelihood x Consequence". Likelihood of occurrence was assessed in several steps, and then combined with the consequence assessment using an established matrix into an overall assessment of risk, as outlined below:

1. Likelihood assessment
    a. the likelihood of introduction of the virus (hazard)
    b. the likelihood of exposure and establishment
    c. the likelihood of occurrence (1a x 1b)
2. Consequence assessment
3. Overall risk assessment (1 x 2)

The assessment was conducted assuming a baseline level of risk mitigation measures i.e. biosecurity practices in use prior to the COVID-19 pandemic.

The assessment was conducted by a group of six assessors with expertise in bat ecology, veterinary epidemiology, emerging diseases, virology, immunology, wildlife health and disease risk assessment. The risk was assessed collectively by the group, using a combination of scientific literature where available, and the knowledge, experience and expert opinion of the members. Input was sought from outside the group for specific details when needed. An initial draft was sent to three reviewers with expertise in disease risk assessment and decision science.

This is a rapid assessment using the best available information at the time. Risk assessment is challenging for an emerging disease. While our assumptions may not prove to be correct as we learn more about COVID-19, this assessment establishes a framework that will allow the risk to be reassessed as new information becomes available and/or the situation changes.

Our assessment acknowledges that the risk will not be the same across all bat populations in Australia due to factors such as species susceptibility, location, ecology, behaviour, and frequency of contact with people. Likewise, there is significant variability in activities and biosecurity practices undertaken by people interacting with bats, as well as significant variation in the prevalence of COVID-19 in humans in different geographic areas. The level of uncertainty assigned to our assessments reflects this variability.

Hazard Identification

The hazard for the risk assessment is SARS-CoV-2.

Risk assessment

1. Likelihood assessment

This component assesses the likelihood of SARS-CoV-2 establishing in an Australian bat population following human-to-bat transmission. It is divided into two main steps that were assessed separately: a) Introduction or entry; b) Exposure and establishment.

A number of possible introduction pathways were identified, including:

- Interaction between an infected person and a bat
- Migration of an infected bat into Australia from overseas

Only the first pathway was considered of sufficient likelihood, based on the current situation, to take further in the risk assessment. The assessment is based on the assumption that SARS-CoV-2 is not already present in bats in Australia.

Exposure and establishment was further broken down into the individual steps necessary in order for the virus to establish in the bat population (Figure 1). A likelihood score was assigned to each of steps a) and b) based on the scoring system in Table 1 (adapted from DAWR 2017) for the timeframe under consideration, and the level of uncertainty of that assessment was rated using the scale in Table 2. The scores for steps a) and b) were then combined into an overall likelihood of occurrence using the matrix in Table 3. The uncertainty scores were combined by using the highest score for any of the steps (Roche et al 2015).

Where information was lacking or there was potential variation in the factor being considered, we took a conservative approach to the assessment i.e. tended towards a higher likelihood, and this was also reflected in a higher uncertainty rating.

Figure 1: Steps in the likelihood assessment

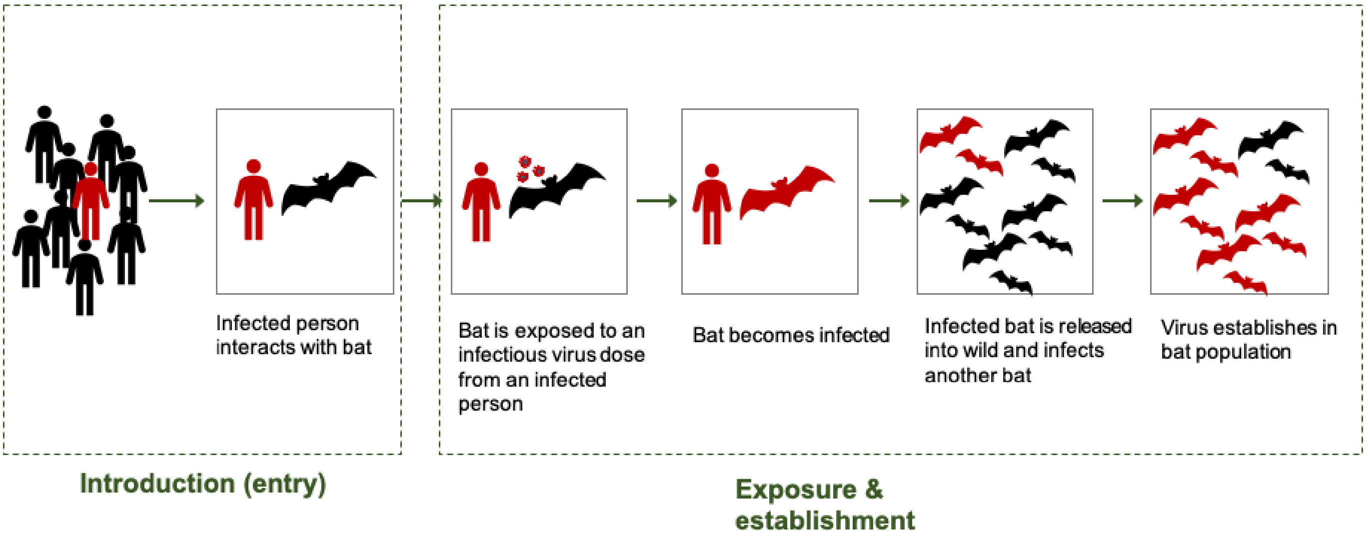

Table 1: Scoring system for assessing likelihood

Description	Definition
Negligible	The event would almost certainly not occur
Extremely low	The event would be extremely unlikely to occur
Very low	The event would be very unlikely to occur
Low	The event would be unlikely to occur
Moderate	The event would be likely to occur
High	The event would be very likely to occur

Table 2: Rating scale for level of uncertainty

Description	Definition
Low	Strong level of confidence in the assessment. Scientific evidence and/or previous experience of similar situations is available.
Medium	Moderate level of confidence in the assessment. Some scientific evidence and/or previous experience of somewhat similar situations is available.
High	Limited level of confidence in the assessment. Scientific evidence and previous experience is lacking; high degree of variation across the scenarios considered; high potential for variability in the outcomes.

a. Introduction (entry) assessment

This step estimates the likelihood that the hazard (SARS-CoV-2) is introduced into the immediate physical environment of an Australian bat. As explained above, the pathway of introduction in this assessment is interaction between an infected person and a bat. The scope was restricted to people with occupational interaction with bats (specifically bat carers,[3] researchers and ecological consultants) and recreational visitors to caves. Veterinarians and veterinary nurses were not specifically included, however much of this assessment may be relevant to these roles. Members of the public also interact with bats; however, this is generally a single instance of short-lived contact. This assessment focuses on situations where more frequent or sustained periods of interaction occur. 'Interaction' includes physical contact, being in close proximity, and indirect contact via surfaces or fomites.

The introduction assessment and level of uncertainty are provided in Table 3.

Table 3: Likelihood and uncertainty scores for introduction

Introduction pathway	Likelihood	Uncertainty
Person* infected with SARS-CoV-2 interacts with a bat(s)	Extremely Low	Low

* Scope limited to a person with occupational interaction with bats or a person visiting a cave for recreation

[3] In Australia, wildlife carers (also called wildlife rehabilitators) rescue and care for sick, injured or orphaned wildlife with the aim of rehabilitation and release back into the wild. Carers are generally volunteers. Bats 'in care' may be kept in the carer's home, in an outdoor enclosure, or in some cases in an established rehabilitation centre.

In assessing the likelihood of release, the primary consideration was the current very low prevalence of COVID-19 in the human population in Australia, and the low number of people interacting with bats. As of 19 August, there were 23,993 confirmed cases of SARS-CoV-2 infection in Australia, of which 7,434 were active, and 5,440,495 tests had been conducted (DoH 2020a). As at 16 August, the rate of infection of total locally-acquired cases in Australia was 73.3 per 100,000 population, and for the preceding two weeks was 14.8 per 100,000 population (DoH 2020b). The actual rate of infection in the population will be higher due to undiagnosed cases. The prevalence is not homogenous across the country; for the two-week period to 2 August, 97% of the reported cases in Australia were in Victoria.

Notwithstanding the very low human prevalence, we have taken a precautionary approach in assigning the likelihood, given the recent dynamic variability in prevalence, and the fundamental significance of this value to the risk assessment.

b. Exposure & establishment assessment

This step estimates the likelihood of susceptible individual bats being exposed to the hazard (SARS-CoV-2), and SARS-CoV-2 subsequently establishing in a wild bat population. It identifies the component steps that must be met in order for exposure and establishment to occur.

We assessed the risk pathways separately for flying-foxes (*Pteropus* spp.) and the other Australian bat species,[4] to take into account differences that could impact the likelihood of exposure and establishment e.g. susceptibility to SARS-CoV-2 infection, numbers and species of bats in care, field capture methods, and ecological and behavioural characteristics such as camp or colony size, social interactions, etc. Similarly, we assessed the categories of people interacting with bats separately, i.e. bat carer, researcher/consultant, and person visiting a cave, because of differences in the nature of the interactions with bats (length, frequency, closeness) and standard biosecurity practices in use.

The assigned scores and levels of uncertainty for each pathway are provided in Table 4, followed by the discussion and rationale.

Table 4: Likelihood and uncertainty scores for exposure/establishment

Exposure & establishment pathway	Likelihood	Uncertainty
SARS-CoV-2 establishes in bat population as a result of initial transmission from:		
Bat carer to a **flying-fox**	Low	High
Bat carer to a **microbat**	Very low	High
Researcher/consultant to a **flying-fox**	Very low	High
Researcher/consultant to a **microbat**	Very low	High
Person visiting a cave to a **microbat**	Very low	High

[4] For the purpose of this risk assessment we grouped the megabats other than flying-foxes (blossom bats, eastern tube-nosed bat, bare-backed fruit bat) with the insectivorous bats due the nature of the interaction with humans for these species. Although not taxonomically accurate, for convenience we have referred to all bat species other than flying-foxes as ‘microbats’.

For each exposure pathway, we considered the component steps, as described below.

1) *Bat is exposed to an infectious dose of SARS-CoV-2 by direct or indirect contact with an infected person.*

For the purpose of this assessment we assumed that an infected person is shedding virus, i.e. is infectious. The number of bats in care in Australia at any given time is not collated and reported, but is considered likely to be in the thousands per year. In NSW – possibly the state with the highest number of bat carers – the number of flying-foxes rescued annually ranged from approx. 2,400 to 9,200 (Mo et al 2020). Biosecurity practices vary significantly among carers; for this assessment we assumed, on average, a basic level of biosecurity. We considered that biosecurity for researchers is likely to range from a medium to high level.

Carers: The likelihood of exposure to the virus from an infected human was considered lower for microbats than flying-foxes, as i) significantly fewer microbats come into care, and ii) microbats are generally held in care for a shorter time than flying-foxes (J. Mclean, pers comm).

Researchers and consultants: A lower level of personal protective equipment (PPE) is generally used with microbats than flying-foxes, and blowing on bats (e.g. to make them move or release their hold) is common practice (J. Welbergen, pers comm). Compared with carers, the average contact between researchers and bats is considerably shorter, less frequent, not as physically close, and is usually outdoors.

Cave visitors: Caves are an enclosed environment with shared airspace and limited air exchange/ventilation, some caves have very large colonies of bats, and high numbers of general public including tourists visit some caves. However, most of the 'show' caves open to the public do not have bats, or bats tend to be higher up in the cave, well away from people (N. White, pers comm). There are codes of practice for recreational and scientific use of caves to avoid disturbance of bats (www.caves.org.au). Close encounters with bats may occur, but only infrequently and usually only to serious club cavers (N. White, pers comm). The high level of uncertainty is due to variability in cave visitation and conditions, seasonal movements of bats, and unknown potential for viral particles to travel in air inside caves.

2) *Bat becomes infected with SARS-CoV-2*

The susceptibility of Australian bat species to SARS-CoV-2 is unknown, hence the high level of uncertainty. In the assessment we considered the following: a) bats are considered to be the likely origin of the progenitor of SARS-CoV-2 (increasing the likelihood of susceptibility); b) the potential for cross-protection from existing coronaviruses in the Australian bat population (decreasing the likelihood of infection due to potential immunity); and c) the available scientific information on molecular analysis of the virus and experimental infection of bats (increasing the likelihood of susceptibility and infection as at least some bat species can be (experimentally) infected with SARS-CoV-2, however with the caveat that these results may not be relevant to Australian bat species).

The likelihood of infection was considered similar for flying-foxes and microbats. It was assessed as marginally lower for a wild-caught bat in a research context than a bat in care due to the higher likelihood of the wild-caught bat being in good health and immunologically competent.

3) *Infected bat is: a) released; and b) transmits SARS-CoV-2 to another bat in the wild after release; and c) there is ongoing transmission sufficient for virus to establish in population*

While a clinically ill bat would not be released into the wild, we considered it unlikely that bats would get sick due to SARS-CoV-2 infection given the evident evolutionary relationship between bats and Sarbecoviruses (Latinne et al 2020) and initial experimental infections with SARS-CoV-2 in bats (Schlottau et al 2020). As bats are usually in care for at least 1-2 weeks and virus excretion is likely to be several days (Schlottau et al 2020), the infectious period could be completed while in captivity, though persistent infections may be possible (Smith 2017, Jeong et al 2017). Only a proportion of rescued bats recover sufficiently in care so that they can be released (e.g. Mo et al 2020 reported a release rate of 65.9% for NSW flying-foxes). For the research context, almost every bat captured is released after short term handling (minutes to hours), the infectious period will occur in the wild, and unlike a bat released from care, has not recently recovered from illness/injury and is unlikely to be suffering from a pre-existing condition. For the cave situation the step of release of the bat is not applicable.

The colonial nature of flying-foxes means that exposure of an infected bat to another bat is likely. For microbats we recognise there are significant differences in roosting behaviour between species and time of year. Highest risk will be for colonial species roosting in high densities in caves. Based on current knowledge of the epidemiology of other coronaviruses in bats, and the prior exposure of Australian bats (and their immune systems) to other betacoronaviruses, our expectation is that the virus would continue to transmit through the bat population.

c. Likelihood of occurrence (introduction, exposure and establishment)

The likelihood of SARS-CoV-2 establishing in an Australian bat population was estimated by combining the introduction score (Table 3) and exposure/establishment scores (Table 4) using the matrix in Table 5 (based on Roche et al 2015).

For all pathways (combinations of introduction and exposure/establishment scores), the likelihood assessment is: **EXTREMELY LOW**, with a HIGH level of uncertainty.

Table 5: Matrix for combining introduction and exposure/establishment

		Introduction					
		Negligible	**Extremely low**	**Very low**	**Low**	**Moderate**	**High**
Exposure & establish-ment	**Negligible**	N	N	N	N	N	N
	Extremely low	N	EL	EL	EL	EL	EL
	Very low	N	EL	VL	VL	VL	VL
	Low	N	EL	VL	L	L	L
	Moderate	N	EL	VL	L	M	M
	High	N	EL	VL	L	M	H

2. Consequence assessment

This step assesses the consequences of SARS-CoV-2 establishing in an Australian bat population following human-to-bat transmission. We considered there would be consequences for conservation and animal welfare, as well as public health, economic and social impacts. However, based on the expertise in our group we only provided a consequence score for conservation and animal welfare. For the other categories we have provided discussion below, and while these weren't formally assessed, we considered them to have a lower consequence than conservation and animal welfare, so that the overall risk estimate is valid within our conservative approach.

We assessed conservation and animal welfare consequences separately for flying-foxes and microbats, based on the definitions in Table 6 (adapted from CABI, 2005).

Table 6: Scoring system for assessing consequences

Description	Definition
Insignificant	No detectable conservation or welfare effects
Very minor	Local short-term population loss, no significant ecosystem effect; OR mild animal welfare effects
Minor	Some localised, reversible ecosystem impact; OR mild animal welfare effects
Moderate	Measurable long-term damage to populations and/or ecosystem, but little spread, no extinction; OR more significant animal welfare effects
High	Long-term irreversible ecosystem change, spreading beyond local area; OR significant animal welfare effects
Catastrophic	Widespread, long-term population loss affecting several species OR extinction of a species, serious ecosystem effects; OR severe animal welfare effects

The consequence assessments are provided in Table 7, followed by the discussion and rationale. The level of uncertainty was rated using the scale defined in Table 2.

Table 7: Consequence and uncertainty scores

Disease scenario	Consequence	Uncertainty
SARS-CoV-2 established in a flying-fox population	CATASTROPHIC	LOW
SARS-CoV-2 established in a microbat population	CATASTROPHIC	LOW

Conservation/animal welfare:

We consider it unlikely that bats will get sick to any significant degree due to SARS-CoV-2 infection. The conservation and welfare consequences are therefore secondary impacts due to human reactions to bats, not primary impacts of the disease itself. Based on experience with other bat diseases such as Australian bat lyssavirus and Hendra virus (Degeling et al 2013, Thiriet 2010), likely human reactions include increased calls for dispersals of flying-foxes (possibly even removal of all bats from urban areas), culling considered as a possible disease response measure, and escalating anti-bat sentiment leading to cruelty, harassment and illegal killing. A backlash against bats due to COVID-19 has already been seen in Australia (and elsewhere), resulting in bad press, calls for culling and incidents of cruelty (Lentini 2020). There are reports of bat killings overseas due to the fear of COVID-19 (NRDC 2020).

These types of actions, adding to existing threats, could conceivably lead to extinction of some species, particularly the endangered spectacled flying-fox (DAWE 2020). Serious ecosystem effects are expected with extinction or population loss of flying-fox species due to their role as long-distance pollinators and seed dispersers (QDES 2020). Persecution of bats is likely to lead to severe animal welfare impacts.

SARS-CoV-2 would complicate the ongoing management and conservation of bats. There could be an erosion of the perceived biodiversity value of bats, resulting in loss of current protections from development, mining, etc. For some threatened microbat species this could result in extinction. If infection was identified in a microbat species, the human reaction is likely to not only target microbats, but also flow over to flying-foxes with the same outcomes.

The low level of uncertainty is due to a high expectation of human reaction, already experienced to some extent; there is higher uncertainty associated with species extinction or widespread population loss.

Public health:

There are no evident direct consequences to public health from SARS-CoV-2 establishing in a bat population. However, applying the precautionary principle, there is at least a theoretical possibility that, having established in bats, the virus could spill back to humans given the necessary conditions. Thus, we considered that establishment of a reservoir in bats could result in sporadic human cases or clusters, leading to ongoing public health demands; however, the medical system in Australia is currently coping well with the pandemic. In the absence of a vaccine, the virus is likely to be maintained in the human population regardless of an animal reservoir. If a vaccine is developed, recombination or mutation of the virus in bats could possibly render the vaccine ineffective for infections originating from bats. Eradication of SARS-CoV-2 from humans is not a current government policy but if it became so in future, a reservoir in bats (or other animals) is likely to prevent this from being achieved.

Direct, close exposure to bat faeces is plausibly the highest risk pathway for transmission to humans. The public health impacts of SARS-CoV-2 establishment in a microbat species are likely to be lower than flying-foxes, as there is less contact between humans and microbats, and therefore less opportunity for disease transmission to humans. The public health consequence of SARS-CoV-2 establishment in microbats in caves is more difficult to determine.

Economic:

Economic consequences, calibrated against other major events such as the pandemic as a whole, bushfires, etc, are considered to be lower than the public health and conservation consequences. The impacts could include costs associated with the public health response, loss of overseas tourism, restriction of travel/closed borders, reputational risk for Australia and potential trade impacts. At a more local level: roost management, disruption of living arrangements of residents near roosts, and risk communication by public health agencies, councils, etc. For microbats, management actions (e.g. closing public/tourist caves) are likely to have a more local impact.

Social:

Public amenity impacts will vary between regions, being highest across urban and city settings where flying-foxes roost and forage, and particularly for houses near bat colonies. These impacts include loss of access to parks and outdoor areas, anxiety due to proximity to flying-foxes, loss of large trees due to roost management, and the implications of contamination of areas with bat faeces. There is likely to be a significant impact on individual people in particular areas. For microbats a significantly lower proportion of people would be affected. There is some precedent for social impacts from previous bat-borne viruses and other health-related environmental issues.

3. Overall risk estimation

The final estimation of the risk of SARS-CoV-2 establishing in an Australian bat population was established by combining the estimated likelihood of occurrence and consequences, using the matrix in Table 8 (based on DAWR 2016). The uncertainty scores were combined by using the highest score for any of the steps (Roche et al 2015).

The final estimation of risk is: **LOW**, with a **HIGH level of uncertainty** associated with the estimate.

Table 8: Matrix for combining likelihood and consequences

		Consequences					
		Insignificant	Very minor	Minor	Moderate	High	Catastrophic
Likeli-hood	High	N	VL	L	M	H	E
	Moderate	N	VL	L	M	H	E
	Low	N	N	VL	L	M	H
	Very low	N	N	N	VL	L	M
	Extremely low	N	N	N	N	VL	L
	Negligible	N	N	N	N	N	VL

N = Negligible risk; VL = Very low risk; L = Low risk; M = Moderate risk; H = High risk; E = Extreme risk

Risk management

Based on the situation and information available at the time of the assessment, the overall risk was assessed to be **LOW** for conservation and animal welfare consequences. This finding indicates that for situations where the human COVID-19 prevalence is very low, it is reasonable for research and rehabilitation of bats to continue; however, **additional biosecurity measures over and above routine protocols should be applied**. These measures are outlined in the following document:

- Wildlife Health Australia: COVID-19 and Australian bats – information for bat carers and others interacting with bats (this is a dynamic document and will be revised as the situation changes).

See also overseas recommendations:

- IUCN SSC Bat Specialist Group:
    - Recommended Strategy for Researchers to Reduce the Risk of Transmission of SARS-CoV-2 from Humans to Bats. MAP: Minimize, Assess, Protect (Nuñez GB et al 2020)
    - Recommendations to reduce the risk of transmission of SARS-CoV-2 from humans to bats in bat rescue and rehabilitation centers. MAP: Minimize, Assess, Protect (Joliffe et al 2020)
- IUCN Wildlife Health Specialist Group and OIE: Guidelines for Working with Free-Ranging Wild Mammals in the Era of the COVID-19 Pandemic (WHSG & OIE 2020)

It is important for anyone interacting with bats to assume that bats have the potential to become infected, and to take appropriate measures to minimise the likelihood of SARS-CoV-2 being transmitted from humans to bats. The risk will vary depending on specific circumstances, so individuals should assess their own risk and if deemed higher (e.g. large number of bats in care resulting in a higher rate of interaction), take higher level precautions to prevent transmission. When geographically localised clusters of cases occur, increased measures are recommended for people interacting with bats who live, work or visit those areas. Where feasible, it may be appropriate to restrict, postpone or cancel activities until the risk is reduced.

This assessment was conducted for the Australian situation, which differs from overseas contexts (Runge et al 2020, Nuñez et al 2020). One of the key factors influencing the outcome of the risk assessment is the current very low prevalence of COVID-19 in the Australian human population, which resulted in an EXTREMELY LOW likelihood of introduction. The outcome would change dramatically if there was a substantial increase in COVID-19 prevalence in Australia, in which case we recommend that the assessment be revisited as a matter of priority.

Authorship and consultation

This assessment was conducted by: Michelle Baker (Australian Centre for Disease Preparedness), Keren Cox-Witton (Wildlife Health Australia), Dan Edson (Department of Agriculture, Water and the Environment), Hume Field (EcoHealth Alliance; The University of Queensland), Alison Peel (Griffith University) and Justin Welbergen (Western Sydney University; Australasian Bat Society). The authors acknowledge the valuable input and review by Jenny Mclean, Nicholas White, Matthew Mo, Andrea Reiss, Terry Walshe, Sandra Parsons, the COVID-19 & Bats Working Group, and the WHA Bat Health Focus Group.

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