

# Incidence, Trends, and Significance of Putative Koala Retrovirus-Associated Diseases in Monitored Wild Koala Populations in Southeast Queensland

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**ABSTRACT.** Research indicates that northern koalas (*Phascolarctos cinereus*) are ubiquitously infected with koala retrovirus (KoRV). There is increasing evidence linking KoRV with neoplasia and a range of disorders associated with immunodeficiency, conditions observed at high rates in captive colonies, and sick koalas presenting to wildlife hospitals. However, less is known about the occurrence of these putative KoRV-associated diseases in wild populations. We analysed health data collected at the veterinary examinations of 691 koalas inhabiting three monitored wild koala populations in southeast Queensland between 2013 and 2020. At initial presentation, neoplasia and AIDS-like syndrome were detected at a prevalence of 1.16% (8/691; 95% CI 0.5–2.19%). Longitudinal data from koalas recruited into the monitoring programmes and receiving one or more subsequent examination revealed an incidence rate of 3.5 cases/100 koalas/year (95% CI 2.35–4.9). These findings indicate that a relatively small proportion of the populations studied were affected by these putative KoRV-associated diseases. However, the impact on individuals was severe, with high associated mortality in the diseased cohort. Furthermore, northern koala populations endure multiple threats, suffering severe declines in recent decades. We propose that the significance of putative KoRV-associated diseases on these populations should be considered within this context and that further research into the interactions between KoRV and other drivers of decline is warranted.

## Introduction

Northern koala (*Phascolarctos cinereus*) populations in Queensland and New South Wales account for approximately two-thirds of the total range of this iconic native species and have suffered substantial declines in recent decades (McAlpine *et al.*, 2015; Adams-Hosking *et al.*, 2016; Beyer *et al.*, 2018; Melzer *et al.*, 2000). Consequently, koalas in these regions were listed as “vulnerable” under the Australian Environment Protection and Biodiversity Act in 2012. Multiple threats have been implicated, including habitat loss and degradation, dog predation, vehicle strikes, bush fires, climate change and disease (Rhodes *et al.*, 2011; Beyer *et al.*, 2018; McAlpine *et al.*, 2015).

Koala retrovirus (KoRV) is highlighted as a major pathogen infecting koalas and receives ongoing attention for its suspected role in several diseases impacting populations (Quigley & Timms, 2020). KoRV-A is the endogenous form of this gammaretrovirus and is detected in 100% of northern koalas (Table 1). Other KoRV subtypes, designated KoRV-B through to KoRV-K, are believed to be exogenous, and have a much more variable prevalence geographically (Quigley & Timms, 2020; Joyce *et al.*, 2021). KoRV-B and KoRV-D are generally found to be the most predominant subtypes in southeast Queensland (SE QLD) koalas (Table 1).

Following infection, retroviruses insert into the host genome, with potentially mutagenic effects (Rabson & Graves, 1997). There is mounting evidence demonstrating

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