

Research Bank

Journal article

Generating new directions for reducing dog and koala interactions : A social marketing formative research study

Rundle-Thiele, Sharyn, Pang, Bo, Knox, Kathy, David, Patricia, Parkinson, Joy and Hussenoeder, Felix

This is an Accepted Manuscript version of the following article, accepted for publication in *Australasian Journal of Environmental Management*.

Rundle-Thiele, S., Pang, B., Knox, K., David, P., Parkinson, J. and Hussenoeder, F. (2019). Generating new directions for reducing dog and koala interactions : A social marketing formative research study. *Australasian Journal of Environmental Management*, 26(2), pp. 173-187. <https://doi.org/10.1080/14486563.2019.1599740>.

It is deposited under the terms of the [Creative Commons Attribution-NonCommercial-NoDerivatives License](#), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited, and is not altered, transformed, or built upon in any way.

Generating new directions for managing dog and koala interactions: A social marketing
formative research study

ABSTRACT

Koala populations are declining. Conservation of this Australian icon requires a whole of community approach. To effect change, researchers and practitioners must effectively engage the target community, be open to different ways of thinking, and be receptive to new ideas and directions that match the times. Rather than limiting the focus to traditionally applied research pathways, this paper reports application of social marketing to decrease dog and koala interactions. A comprehensive program of formative research including a systematic literature review, expert interviews, online surveys and co-design sessions were employed to identify novel ideas and audience-focused strategies that can be applied to reduce dog and koala interactions. Results indicate that dog owners seek a non-koala focussed, dog training program that shows them what to do and a targeted approach alerting them to koala presence in addition to education and awareness efforts favoured by experts. This study indicates the need for more human centred research, which has been absent to date, given identified incongruence between expert and community views. We propose that audience-focused behaviour management strategies will, in turn, increase target audience adoption, campaign reach and promote effective community engagement with programs.

Keywords: Social Marketing, Formative Research, Koalas, Dogs, Management, Co-Design

Introduction

Koala population levels are steadily decreasing (Redlands Koala Conservation Strategy, 2016) with University of Queensland trend modelling estimating an 80% decline since 1996 (Rhodes et al. 2015). Urban development, fragmentation of habitat, traffic and domestic pets such as dogs all impose significant threats to koalas and other forms of wildlife (Department of Environment and Heritage Protection, 2008; Holderness-Roddam et al., 2014). The Koala Action Group QLD Inc. estimate that 600 koalas have been attacked by dogs over the past 15 years in Redland City mainland and North Stradbroke Island. Therefore, interventions to reduce the prevalence of interactions between dogs and koalas are necessary. The aim of this study is to generate new directions for the development of an innovative program which aims to reduce dog and koala interactions, using a social marketing approach.

A review of the literature indicates that risk management and control measures that can lower the likelihood of dog interactions include (but are not limited to) reducing pets' roaming periods (Bonnington et al., 2013), denning dogs, buffer zones (Holderness-Roddam and McQuillan, 2014), provision of wildlife corridors, and placing a pole against a fence for koala egress (Queensland Government, 2017; Redlands Koala Conservation Strategy 2016; Holderness-Roddam and McQuillan, 2014). Local, State and Federal Governments, conservation groups, researchers and environmental advocates seek greater community engagement, education, and awareness of koala conservation initiatives (Lunney et al., 2012; p.1; Ng et al., 2014; 16, p.1).

The range of traditional tools employed to influence behaviour (e.g. education, communication, legislation, fines, taxes and other sanctions) are not necessarily sufficient (APSC, 2007). Further, many campaigns aiming to change behaviour have been criticised for being paternalistic (Zharakhena and Kubacki, 2015). For example, research indicates that education is capable of changing the behaviour for 8% of the population (Snyder et al. 2004),

which suggests that consideration of other behavioural change approaches and research pathways is warranted (Brown et al., 2010). To effect change, practitioners must be open to different ways of thinking, effectively engage the target community, and be receptive to novel ideas and current directions, rather than limiting the focus to traditionally applied approaches and research pathways (Brown et al., 2010).

The education approach assumes that people will make their decisions on the basis of being fully informed about the environmental benefits of performing the desired behaviour. The implicit assumption here is that motivation to comply is already strong and it is merely a lack of comprehensible information that prevents the behaviour being adopted (Tapp and Rundle-Thiele, 2016). In contrast to traditionally applied education and communication approaches, social marketing is a way of thinking. Social marketing is based on the core philosophical understanding that exchange occurs between two or more parties and acknowledges that when entering into exchange each party is furthering their perceived self-interest to achieve their own ends (Stead and Hastings, 2007). Exchange is a term used when a person gives up something in return for getting a benefit (French and Blair-Stevens, 2006) and in its simplest form can be explained with a monetary purchase of a good or service. Social marketing aims to deliver behaviour change by delivering compelling exchange offerings to move and motivate the audience targeted for change (Domegan, 2008). Drawing on commercial marketing roots, social marketing programs are developed with competition in mind. Efforts are made to ensure the change program that is developed is superior to competing offers in the eyes of the audiences targeted for change. When implemented to its fullest extent, social marketing offers incentives to invite voluntary exchange (Andreasen, 2003). Conditions are made favourable for appropriate behaviour through choice options that deliver comparative advantages (products and services) and/or alternation to the social and built environment surrounding the individuals targeted for change.

A review of the literature indicates limited research attention on managing dog and koala interaction and a lack of human centred research enquiry. Thus, prior literature on wildlife and domestic pet interaction is domestic pet (typically cats) and not pet owner focussed. The current study responds to this gap in the literature, providing a social marketing enquiry that is centred on understanding the types of programs and focus that dog owners would value in order to change their dog's behaviours. Co-design groups empower community members by making them partners and contributors rather than mere recipients, thereby facilitating the successful implementation and sustainability of community-based interventions.

This study showcases how novel ideas and directions can be identified in consultation with dog owners, with a view to engaging a wider cross section of the community in behaviours and activities that will benefit koalas over the longer term. Therefore, this study demonstrates how research enquiry can be extended beyond pets enabling the engagement of the owners who are responsible for their pets, ensuring that interventions appeal to pet owners, which in turn will enhance study outcomes.

Method

The formative research study, conducted over a four month period, was focussed on understanding dog owners' views in the Redland City Council area, which is located in Southeast Queensland in Australia. According to Seabrook et al. (2011), an 80% decline in koala numbers in Southern Queensland has been observed since 1995. A multi-method study was undertaken. The study was comprised of a systematic literature review and expert interviews to look back and understand what had previously succeeded, consumer co-design sessions to ensure that our program was centred on the individuals targeted for change, and online surveys to quantify behaviours to inform program planning.

Systematic Literature Review

This study followed systematic literature review procedures previously used (for example see Carins & Rundle-Thiele, 2014; Kubacki et al., 2015). Six databases (EBSCO All databases, Emerald, ProQuest All databases, Ovid All databases, ScienceDirect, and Web of Science) were searched. The initial search identified no interventions that directly focussed on koala and dog interaction necessitating an expansion of our literature review search to all forms of wildlife. The final search used the following terms *dog OR cat OR pet OR domestic AND confine OR restrain OR predat* OR attack OR hunt OR roam AND wildlife*. The symbol “*” was used as a wildcard to represent possible variations (e.g. predator or predation). A total of 2,286 papers were retrieved. Results were collated and duplicates were removed (n = 1069). The titles and abstracts of the remaining papers were reviewed to exclude irrelevant studies (Ecological paper, n = 606; not written in English, n = 5; not academic papers, n = 22; and formative research only papers, n = 568) to form a final data set of 16 interventions focussed on reducing domestic pet and wildlife interactions. Information on intervention design, implementation, and evaluation was extracted from these 16 papers to inform this study.

Expert Interviews

Interviews were undertaken to gain insights from recognised experts belonging to key stakeholder areas (koala rescue, vets, local council, dog behaviourists, environmental advisors and policymakers). Together with the systematic literature review, expert interviews aimed to look backwards and understand the range of campaigns that had been used to reduce koala and dog interactions. By drawing on expert knowledge the research team were able to understand what would (and would not) assist to effectively reduce dog and koala interactions. A snowball sampling procedure was used.

Experts were initially recommended by the council advisory group and later experts were referred to the team by interview informants (total N=14). A brief, semi-structured

interview guide was developed to gather information about existing or previous campaigns, potential facilitating factors and barriers for program participation and recommendations for the forthcoming program. Experts were interviewed by telephone at a date and time convenient for them. Interviews averaged 20 minutes in duration. Interviews were audio recorded and later transcribed by a professional service. Participants did not receive any incentives.

Data analysis was conducted in two stages. First, examples of previous or current campaigns mentioned during expert interviews were extracted and verified by the research team. Publicly available campaign materials, documentation of campaign effectiveness, relevant collateral and reports were sought. Sixteen previous campaign examples were summarised and compiled (see table 1 for selected the campaigns identified and considered by co-design participants). Second, data was thematically analysed to identify practical strategies and suggestions for increasing audience engagement and program participation.

Dog owner co-design

To look forward and understand how improvements can be made to more effectively engage a wider cross section of the community citizen centred research methods should be employed (Brown et al., 2014; Keen and Brown, 2005). A co-design group is a carefully planned series of discussions designed to obtain insights that can guide program planning (see Dietrich et al, 2015; Dietrich et al. 2017 for full co-design process outlines). The purpose of conducting a co-design group with members of the audience targeted for change (dog owners) was to better understand how to deliver a program they would value. Co-design is a human-centric approach that allows consumers to design a program they would value, bringing their wants and needs to the program planning process (Durl et al., 2017). The co-design process empowers consumers engaging them in program creation (Dietrich et al., 2017).

Three co-design workshops involved a total of 41 Redland City Council dog owners who agreed to be contacted for research purposes. Co-design workshops commenced with

reviews of ten existing campaigns identified in expert interviews that aimed to decrease koala and dog interactions (see Table 1 which includes four of the 10 campaigns reviewed by co-design participants). Campaigns offering similar approaches and content (N=6) were withheld from inclusion in the co-design sessions to maximise free time for groups to generate their own ideas. The aim of including past campaigns is to encourage participants to start thinking about the issue prior to small group formation.

Co-design sessions continued by forming participants into small groups of 3-4 people. Each group was asked to develop an idea or a campaign they felt would engage and motivate them to minimise dog and koala interactions. Participants were provided with a large sheet of white paper, pens, pictures, scissors, glue, sticky tape and post-it notes and were instructed to bring their idea together on the sheet provided. Each co-design workshop ran for 90 minutes. Participants were offered a \$50 retail voucher as a token of appreciation for supporting the research.

Online survey

An online survey drawing on a convenience community sample was conducted to understand dog behaviours in the local council area. Convenience sampling was chosen for speed and low cost ensuring a decision on behavioural focus to inform pilot program planning could be made efficiently. Convenience sampling is a widely used sampling method due to its numerous benefits, such as affordability, easy accessibility, availability, voluntary participation and geographical proximity (Etikan, Musa and Alkassim, 2016). Items included understanding the level and types of dog and koala interactions, understanding dogs' sleeping locations (inside/outside and confined and restrained or not) and assessing dog skills (sit, stay, aversion and more) in the Redland City Council area. The survey was designed based on the Theory of Planned Behaviour. A survey link was sent out through all available Redland City Council communication channels, including emails, social media promotion and newsletter mention

and the Griffith University staff and student email service. An equal chance to win one of 10 x \$50 retail vouchers was offered as an incentive to enhance response rates (Dillman, 1991) and respondents interested in being eligible for the incentive prize entered their email address. Email addresses of interested participants were stored in separate database ensuring data was not identifiable for analysis and reporting purposes. Any respondents residing outside of the Redland City Council area were removed resulting in a final sample of 635 survey responses. Data was downloaded into SPSS and cleaned prior to analysis and descriptive statistics were used to examine the data.

Results and Discussion

A mixed method design was used to gain insights to guide intervention development. Drawing on expert views and past intervention evidence, ten interventions were used in co-design sessions with members of the target audience. Application of the co-design methodology allowed dog owners to generate new ideas and directions for campaign solutions to appeal to dog owners. Insights gained from co-design were then coupled with findings from the online survey of dog owners to quantify behaviours to consider which behaviour offered the best focus to engage the broadest cross section of dog owners. Key findings arising from each study are outlined in turn and results are discussed in light of the literature.

Looking backwards: Systematic literature review and expert interviews

The systematic literature review sought to identify, review, and collate previous peer reviewed scientific literature that examined the effectiveness of interventions aiming to reduce interactions between wildlife and domestic pets. A total of 16 studies were reviewed and analysed to identify any programs or components that bear relevance to the local government area agenda to manage dog and koala interactions. Only six out of the sixteen papers focussing

on domestic pet and wildlife interactions were categorised as interventions, and all six studies were cat and wildlife focussed (Calver et al., 2007; Hall et al., 2016b; Calver and Thomas, 2010; Nelson et al., 2015; Hall et al., 2015; Ruxton et al., 2002). The main findings were that confining and restraining domestic pets was frequently used as a conventional method to reduce pets' interaction with wildlife (for examples see Hall et al., 2015; Nelson et al., 2005; Hall et al., 2016b) with mixed effects observed. It was noted that most of the existing literature focused on ecological or zoological factors, such as predatory instincts (Bonnington et al., 2013; Lilith et al., 2008; Hughes et al., 2013).

The systematic literature review identified that the “human” component had been neglected. For example, consideration of how and why humans, especially pet owners, have made effort (e.g. confine their dogs during night) to conserve wildlife were lacking. There were no existing interventions reported in the peer reviewed scientific literature that explicitly aimed to protect koalas through reduced koala-dog interactions. Calls for more holistic ecosystem management have been made by many ecological researchers (Wohl et al., 2015; Riemann et al., 2016; Martinsohn et al., 2015). The majority of studies identified in our systematic literature review offered ecological or zoological perspectives (for examples see Brickner-Braun et al., 2007; Hall et al., 2016; Ruxton et al., 2002).

Two main findings were drawn from expert interviews. Firstly, experts identified various campaign activities which had been implemented in the past, most of which were education and law (policy) focussed. Examples identified included letter box drops, static education displays, social media (Facebook) groups, a speed zone trial, visitor programs, surveys, microchipping and registration drive events (see Table 1 for selected illustrative examples). Most examples were multifaceted and were comprised of actions or targets concerning a) habitat preservation or restoration, b) community education and awareness, c) traffic calming strategies, and/or d) animal control legislation.





Secondly, experts generated practical suggestions for how to tackle the main barriers to behaviour change. In line with previous studies (Holderness-Roddam and McQuillan, 2014; Lunney et al., 2012; p.1; Ng et al., 2014) the experts interviewed in our study advocated awareness raising and enforceable policy initiatives. Strategies recommended by experts included the provision of basic obedience skills and crate training, preferably for puppies, which would be suitable for the whole family, and is possibly free or subsidised. Experts recommended that any informative or education efforts be presented with scientific backing and historical data about the declining koala population. Experts consistently advocated that local government authorities (LGAs) promote widely a positive stance on monitoring regulations. Importantly, experts stated that when local regulations were consistently enforced and monitored, experts felt that there was greater community compliance.

Generating new ideas and directions: Co-design and dog owner surveys

Human centred research methods were employed to understand what dog owners would value in order to engage with programs aiming to reduce dog and koala interactions. When reviewing past programs (see Table 1 for examples), co-design participants found dog training sessions to be the most useful element in reducing koala and dog interactions.

<Insert Table 1 about here>

Table 1: Selected competing campaign examples used in co-design sessions

<p>Campaign 5 Letter box drop</p> <p>Ranger or wildlife ambulance volunteers put bookmark in neighbouring letterboxes when investigating koala sightings or after collecting injured / sick animal</p>		<p><i>"That would make me more aware, okay, there's a koala around; I need to be more careful. I think this one is actually quite a valid one."</i></p> <p><i>"I think once you're really looking for them [Koalas] then you see them. I think if people knew they were there, they would probably be more likely to try to keep their dog in at night, rather than thinking "we never get them round here"</i></p>
<p>Campaign 9 Positive Response dog training</p> <p>Reward-based training techniques that are consistent, focus on management, gentle reinforcement, public training (e.g. "leave") and repetition</p>		<p><i>"I think it's giving people the tools to be able to think about how to apply wordings more broadly"</i></p> <p><i>"It might even appeal to a lot of people who go, "I don't care about koalas, but I want to train my dog." And, then it directly affects the koalas."</i></p>
<p>Campaign 2 Hawks Nest and Tea Gardens Endangered Koala Recovery Plan</p> <p>Fridge magnets / tree planting / Festivals / Koala spotting talks and walks / Surveys</p>		<p><i>"I couldn't really understand what it was for, looking at it."</i></p> <p><i>"It was simply that it was very focussed on the koala and wasn't making the connection to the dogs. But, I think you need that explicit connection to dogs and koalas."</i></p>
<p>Campaign 3 Koala Connect Project "Meet the Locals" Guide</p> <p>28 page guide explains how to make sure landowner's gardening, fencing, pets and bush block living enhances rather than harms "the locals"</p>		<p><i>"And, a lot of people will just look at it and be, "They're just wanting us to not have dogs," and all this kind of thing. Or, they're just going to be thinking straight away that anybody who's pro looking after koalas is negative towards animals we keep as pets."</i></p>

Following review of existing approaches, small groups were challenged to build a program that would encourage them to engage. A broad range of ideas were generated including whole of school education programs to engage a broader cross-section of the community. A koala alert app was suggested by one dog owner group to offer an interactive platform for the community to monitor koala locations using GPS technology and simultaneously alert dog owners when a koala was present within one kilometre of their property (fig 1). Alerts would advise residents on best practice animal management techniques (e.g. Please monitor your dog), traffic calming strategies (e.g., Drive carefully), and wildlife vigilance (e.g., call xxx if you see an injured Koala).

<Fig 1 about here>

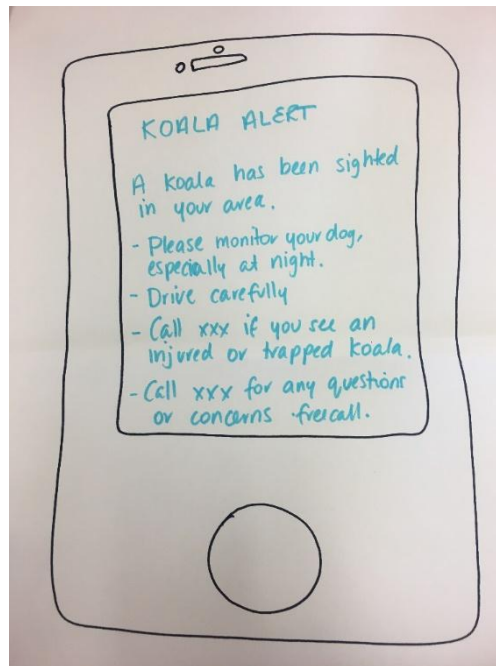


Figure 1 – Sample intervention designed by local dog owners

Several factors that need to be considered when designing a community behaviour change program to reduce dog and koala interactions were identified by co-design participants during the campaign reviews and program design states of the session. Importantly, participants felt a dog (rather than wildlife or more specifically a koala) focus would be relevant given not all owners experienced dog and koala interactions first hand. A koala focus was identified as limiting, given dogs do attack other forms of wildlife. Co-design participants were aware of other reasons for koala population decline such as habitat destruction and car fatalities and recommended that care be taken with communication and education to avoid stigmatisation and blame of dog owners:

“That’s a negative I get from that straight away looking at that picture (see Table 1, Campaign 3). The dog is vicious.”

Co-design discussions demonstrated the need to keep a broad mindset and avoid a koala focus to ensure that any community-based program would resonate broadly:

“And, a lot of people will just look at it and be, “They’re just wanting us to not have dogs,” and all this kind of thing. Or, they’re just going to be thinking straight away that anybody who’s pro looking after koalas is negative towards animals we keep as pets.”

“I just wonder if the campaign should be about positive things rather than negative things, that’s all. On some of the stuff I think, “You must lock your dog up. You must do this. You must do that.” Whereas, at least with number 2 they’ve got tree planting. We destroyed the entire local council area, chopping down every tree so that there’s no koalas, but yet we’re talking about dogs.”

Co-design participants recommended ensuring any behaviour change program was convenient and offered a focus that builds the confidence of dog owners to handle their dogs to avoid interactions with wildlife. Participants felt that dog training sessions were highly appropriate and might be most effective if they were designed to address best practices for managing dogs to reduce the incidence of harm to wildlife (e.g., including lizards, snakes and possums). Broadening of dog training to cover a wider cross section of wildlife was indicated as a means to attract a wide range of dog owners including those who may not perceive koala interactions as an issue. Thus, a dog training program could provide an opportunity to not only teach dogs the obedience skills they need but provide their owners with added support and increased skills to assist them in being responsible pet owners.

Co-design sessions indicated that communication channels and message delivery requires careful consideration. Social media and email were rated as popular communication platforms as were veterinarian practices and dog registration notices. To engage a broad cross section of the target community, co-design sessions highlighted that communications need to be fun, positive and interactive. A partnered and practical approach focused on pragmatics

(e.g., dog training) was recommended by dog owners. Campaign messages should be positive, taking an approach that does not suggest or imply that the blame lies with dogs and their owners. Furthermore, dogs should not be stigmatised as being dangerous, such as through graphics that represent vicious dogs nor should clear links to koalas be made. Should koalas or more broadly wildlife be focussed upon in communication, materials will need to avoid creating a community divide.

The online survey determined the current level of dog and koala interactions, levels of dog training and dogs' sleeping locations in the Redland City Council area. There were 635 local council residents that participated in the survey. Over 80% of survey participants were female, 76% were born in Australia, and nearly all participants described themselves as being non-indigenous. Respondents belonged to different age groups, showing close to an even distribution across age groups and more than three-quarters (80% of respondents) reported living in a house with backyard and front yard.

Survey results indicated that approximately one in ten dogs have killed wildlife (8.5%) and one quarter (24.7%) had chased wildlife. Dog and koala interactions were reported in the online survey by 6% of the 635 sampled dog owners, and one koala death was reported. More than three quarters of dogs sleep inside at night (77.2%). Few dogs sleeping outside at night were leashed ($n = 3$) suggesting one in ten dogs may be free to chase or attack a koala during the koalas most active time. While the majority of respondents reported that their dog had received some previous training (72%), room for improvements in dog abilities were noted. For example, 62% of dogs do not consistently come back when called and 70% of dogs chase things. The results from the online survey provide further support that a community behaviour change program aiming to reduce dog and koala interactions should not be koala focussed given that 94% of the population did not report dog and koala interactions, which provides evidence suggesting as many as 94% of dog owners may ignore koala focussed messaging.

The results of the online survey found that prevalence rates are lowest for training behaviours such as aversion and coming back when called (62-70% of dogs need this training) compared to sleeping where only 10% of dogs sleep outside at night. These findings suggest that a training focussed program would be of great value with the potential to reach a wider cross-section of the community. A program would reach six times more people when it employs a training focus as opposed to a sleeping location focus, thus increasing the likelihood of achieving behaviour change.

Incongruence between expert and community views

Insights gained in the current study highlight incongruence between experts (scientists and behavioural change practitioners) who believe people need to be educated, informed and provided with scientific evidence to act which contrasts with community perspectives generated through the co-design and survey components of this formative program of research. Current findings provide insights to highlight why community engagement may be limited when traditional approaches are applied. In particular, the audience views emerging from co-design discussions suggest that existing change efforts are alienating the very people they are trying to reach creating a defensive reaction, which then prevents engagement with the intervention. Therefore, this study demonstrates how research enquiry can be extended to take a human centred view, thereby enabling broader engagement of the owners who are responsible for their pets, and ensuring that innovations are developed with appeal to pet owners. We propose that audience-focused behaviour management strategies will, in turn, increase target audience adoption, campaign reach and promote effective community engagement with programs.

An ecological approach to reduction of dog and koala interactions

Taken together, the results collectively indicate that prior domestic pet and wildlife interaction reduction interventions have focussed on cats and have advocated conventional

methods to confine and restrain domestic pets. The existing focus on ecology neglects a human centred design approach that can inform behaviour change, which seems promising given that Australians are receptive to the idea that domestic pets are harmful to wildlife (Hall et al., 2016a). A panel of experts recommend basic canine obedience and (enforced) local policy options in addition to environment changes (e.g. habitat restoration) to manage domestic dog and urban koala interactions. Expert led intervention efforts would involve delivering education emphasising scientific backing and historical data about the declining koala population. In contrast, dog owners (the target audience) preferred that potential programs adopt a broader dog or broader wildlife focus as opposed to exclusive emphasis on koalas, and the target community endorsed whole of school education, a smartphone alert application, and a program emphasising skill development that is positively communicated. The online survey revealed that a majority of dogs in the local government area do chase different forms of wildlife, and hence an exclusive koala focus would reach about 5% of the population. However, a canine training approach would reach 70% of the target population. Table 2 summarises the novel ideas stemming from this program of research, including new directions to manage dog and koala interactions with community interventions.

Table 2: Ideas and directions to reduce dog and koala interactions

Education	Marketing	Law
Letter box drops	Dog training program	Speed zones
Static education displays	Convenient options (e.g.	Animal control
Visitor programs	online videos)	Microchipping and pet
School based education	Koala alert app	registration
program	Attaching financial or other	Consistent local law
	incentives	enforcement

Limitations and future research directions

This study must be viewed in light of limitations. Social marketing practice remains reliant on self-report methodologies, which are known to be biased (Kubacki and Rundle-Thiele, 2017). The formative research study reported in this study employed three self-report methods (expert interviews, co-design and surveys) all of which may be impacted by biases such as socially desirable responding where respondents under report dog and koala interactions and deliver answers to please the research team. This provides an opportunity for future research which can be conducted over a longer timeframe. For example, a broader array of methods can be applied to overcome biases associated with self-report including ethnography and observations.

The systematic literature review was restricted to scientific peer reviewed studies conducted in English. Studies exist in the grey literature and may exist in other languages for other wildlife forms thus limiting conclusions drawn in the present study. Finally, the online survey employed a convenience sample. Future research is recommended utilising a probability sample to permit findings to be generalised to the dog owner population in the local council area.

The scope of the current study was multi-faceted, but maintained a focus on program components that can be employed to engage a broad cross section of the local dog owner community. Future research is needed to test components or a full program to evaluate whether the ideas and new directions suggested by dog owners are capable of delivering behavioural change. A program targeting dog training (focussed on wildlife aversion and denning) could be offered and evaluated using a controlled repeated measure design to evaluate whether changes in dog abilities were evident following program completion in the program group. Dog denning is defined as teaching the dog to settle in an enclosed space (RSPCA Qld Animal Training & Behaviour Centre, n.d.) Additional opportunities to extend understanding include a field experiment to compare and contrast a social marketing approach with traditional education approaches. Two comparable communities could be used to assess community reach and engagement with competing programs to understand which engages a broader cross section of dog owners. Outcomes could be assessed in each community and while not perfectly controlled; inferences regarding comparative effectiveness could be gained.

Conclusion

Inclusion of dog owners in research planning was investigated in the current study as a means to extend research focus beyond animals to the humans they live with. A multi-method formative research study was undertaken to centre research on dog owners, and these studies identified that a non-koala focus was desired by dog owners; a view that is in direct contrast to experts who believed provision of scientific information about declining koala populations was needed to engage dog owners. Centring program design on dog owners may offer a means to better engage dog owners in dog and koala interaction reduction – a proposition that offers great potential.

References

- Andreasen, A. R. 2003, 'The life trajectory of social marketing: some implications.' *Marketing Theory*, vol. 3, no. 3, pp. 293-303.
- Australian Public Service Commission 2007, *Tackling wicked problems: A public policy perspective*, viewed 28 May 2017, <www.apsc.gov.au/publications-and-media/archive/publications-archive/tackling-wicked-problems>.
- Bagozzi, RP 1978, 'Marketing as exchange: a theory of transactions in the marketplace', *American Behavioral Scientist*, vol. 21, no. 4, pp. 535-556.
- Bonnington, C, Gaston, KJ & Evans, KL 2013, 'Fearing the feline: domestic cats reduce avian fecundity through trait-mediated indirect effects that increase nest predation by other species', *Journal of Applied Ecology*, vol. 50, no. 1, pp. 15-24. doi:10.1111/1365-2664.12025.
- Brickner-Braun, I, Geffen, E & Yom-Tov, Y 2007, 'The domestic cat as a predator of Israeli wildlife', *Israel Journal of Ecology & Evolution*, vol. 53, no. 2, pp. 129-142. doi:10.1560/ijee.53.2.129.
- Brown, VA, Harris, JA & Russell, JY 2010, *Tackling wicked problems through the transdisciplinary imagination*, Earthscan, London, UK.
- Brown, V. A., Grootjans, J., Ritchie, J., Townsend, M., & Verrinder, G. 2014, *Sustainability and health: supporting global ecological integrity in public health*. Routledge.
- Calver, M, Thomas, S, Bradley, S & McCutcheon, H 2007, 'Reducing the rate of predation on wildlife by pet cats: The efficacy and practicability of collar-mounted pounce protectors', *Biological Conservation*, vol. 137, no. 3, pp. 341-348. doi:<http://dx.doi.org/10.1016/j.biocon.2007.02.015>
- Calver, MC & Thomas, SR 2010, 'Effectiveness of the Liberator(TM) in reducing predation on wildlife by domestic cats', *Pacific Conservation Biology*, vol. 16, no. 4, pp. 244-250.
- Carins, JE & Rundle-Thiele, SR 2014, 'Eating for the better: A social marketing review (2000–2012)', *Public Health Nutrition*, vol. 17, no. 07, pp. 1628-1639.
- Department of Environment and Heritage Protection 2008, South East Queensland, viewed 28 May 2017, <<https://www.ehp.qld.gov.au/wildlife/koalas/koala-threats.html>>.
- Dietrich, T, Rundle-Thiele, SR, Schuster, L & Connor, J 2016, 'Co-designing social marketing programs', *Journal of Social Marketing*, vol. 6, no. 1, pp. 41-61.
- Dietrich, T, Trischler, J, Schuster, L. & Rundle-Thiele, SR 2017, 'Co-designing services with vulnerable consumers', *Journal of Service Theory and Practice*, vol. 27, no. 3, pp. 663-688.
- Dillman, DA 1991, 'The design and administration of mail surveys', *Annual Review of Sociology*, vol. 17, no. 1, pp. 225-249.

Domegan, C. T. 2008, 'Social marketing: implications for contemporary marketing practices classification scheme.' *Journal of Business & Industrial Marketing*, vol. 23, no. 2, pp. 135-141.

Donovan, R & Henley, N 2010, *Principles and practice of social marketing: An international perspective*, Cambridge University Press, Cambridge, UK.

Durl, J., Trischler, J., & Dietrich, T. 2017, 'Co-designing with young consumers—reflections, challenges and benefits.' *Young Consumers*, vol. 18, no. 4, pp. 439-455.

Etikan, I., Musa, S. A., & Alkassim, R. S. 2016, 'Comparison of convenience sampling and purposive sampling.' *American Journal of Theoretical and Applied Statistics*, vol. 5, no. 1, pp.1-4.

Hall, CM, Adams, NA, Bradley, JS, Bryant, KA, Davis, AA, Dickman, CR, Calver, MC 2016a, 'Community Attitudes and Practices of Urban Residents Regarding Predation by Pet Cats on Wildlife: An International Comparison'. *PLoS One*, vol. 11, no. 4. doi:10.1371/journal.pone.0151962

Hall, CM, Bryant, KA, Fontaine, JB & Calver, MC 2016b, 'Do collar-mounted predation deterrents restrict wandering in pet domestic cats? ', *Applied Animal Behaviour Science*, vol. 176, pp. 96-104. doi:http://dx.doi.org/10.1016/j.applanim.2015.12.006

Hall, CM, Fontaine, JB, Bryant, KA & Calver, MC 2015, 'Assessing the effectiveness of the Birdsbesafe (R) anti-predation collar cover in reducing predation on wildlife by pet cats in Western Australia', *Applied Animal Behaviour Science*, vol. 173, pp. 40-51.

Holderness-Roddam, B & McQuillan, PB 2014, 'Domestic dogs (*Canis familiaris*) as a predator and disturbance agent of wildlife in Tasmania', *Australasian Journal of Environmental Management*, vol. 21, no. 4, pp. 441-452.

Hughes, J & Macdonald, DW 2013, 'A review of the interactions between free-roaming domestic dogs and wildlife', *Biological Conservation*, vol. 157, pp. 341-351.

Keen, M., Brown, V. A., & Dyball, R. (Eds.). 2005, *Social learning in environmental management: towards a sustainable future*. Routledge.

Kotler, P 1972, 'A generic concept of marketing', *Journal of Marketing*, vol. 36, no. 2, pp. 46-54.

Kubacki, K, Rundle-Thiele, SR, Pang, B & Buyucek, N 2015, 'Minimising alcohol harm: A systematic social marketing review (2000-2014)', *Journal of Business Research*, vol. 68, no. 10, pp. 2214-2222.

Lee, N. R & Kotler, P 2011, *Social marketing: Influencing behaviors for good*, SAGE Publications, CA.

Lefebvre, RC 2013, *Social marketing and social change: Strategies and tools for improving health, well-being, and the environment*, John Wiley & Sons, San Francisco, CA.

Lilith, M, Calver, M & Garkaklis, M 2008, 'Roaming habits of pet cats on the suburban fringe in Perth, Western Australia: what size buffer zone is needed to protect wildlife in reserves?', *Australian Zoologist*, vol. 34, pp. 1-8.

Lunney, D, Matthews, A, Moon, C & Turbill, J 2002, 'Achieving fauna conservation on private land: Reflections on a 10-year project', *Ecological Management and Restoration*, vol. 3, no. 2, pp. 90-96.

Martinsohn, J. T., Volckaert, F., & Bekkevold, D. 2015, 'A holistic ecosystem approach for marine management and conservation: Opportunities through the application of genetic and genomic approaches.' In *ICES Annual Science Conference*.

Nelson, SH, Evans, AD & Bradbury, RB 2005, 'The efficacy of collar-mounted devices in reducing the rate of predation of wildlife by domestic cats', *Applied Animal Behaviour Science*, vol. 94, no. 3-4, pp. 273-285. doi:<http://dx.doi.org/10.1016/j.applanim.2005.04.003>.

Ng, CF, Possingham, HP, McAlpine, CA, de Villiers, DL, Preece, HJ & Rhodes, JR 2014, 'Impediments to the success of management actions for species recovery', *PLoS One*, vol. 9, no. 4. doi:10.1371/journal.pone.0092430.

Queensland Government, Department of Environment and Heritage Protection 2017, *Koala Threats, Koalas and Dogs*, viewed 28 May 2017 <https://www.ehp.qld.gov.au/wildlife/koalas/koala-threats.html#koalas_and_dogs>.

Redlands City Council 2016, *Redlands Koala Conservation Strategy 2016*, viewed 28 May 2017 <https://www.redland.qld.gov.au/download/downloads/id/2289/redland_koala_conservation_strategy_2016.pdf>.

Rhodes, JR, Beyer, HL, Preece, HJ & McAlpine, CA 2015, *South East Queensland Koala Population Modelling Study*, UniQuest, Brisbane, Australia.

Riemann, B., Carstensen, J., Dahl, K., Fossing, H., Hansen, J. W., Jakobsen, H. H. & Timmermann, K. 2016, 'Recovery of Danish coastal ecosystems after reductions in nutrient loading: a holistic ecosystem approach.' *Estuaries and Coasts*, vol. 39, no. 1, pp. 82-97.

Rothschild, ML 1999, 'Carrots, sticks, and promises: A conceptual framework for the management of public health and social issue behaviors', *Journal of Marketing*, vol. 63, no. 4, pp. 24-37.

RSPCA Qld Animal Training & Behaviour Centre, n.d. Denning. Available on http://www.logan.qld.gov.au/__data/assets/pdf_file/0008/91889/Denning-09.pdf.

Ruxton, GD, Thomas, S & Wright, JW 2002, 'Bells reduce predation of wildlife by domestic cats (*Felis catus*)', *Journal of Zoology*, vol. 256, pp. 81-83.

Seabrook, L., McAlpine, C., Baxter, G., Rhodes, J., Bradley, A., and Lunney, D. 2011, 'Drought driven change in wildlife distribution and numbers: a case study of koalas in south west Queensland.' *Wildlife Research* vol. 38, pp. 509-524.

Snyder, L, Hamilton, M, Mitchell, E, Kiwanuka-Tondo, J, Fleming-Milici, F & Proctor, D 2004, 'A meta-analysis of the effect of mediated health communication campaigns on behavior change in the United States', *Journal of Health Communication*, vol. 9, no. 1, pp. 71-96.

Stead, M, Gordon, R, Angus, K & McDermott, L 2007, 'A systematic review of social marketing effectiveness', *Health Education*, vol. 107, no. 2, pp. 126-191.

Stead, M., Hastings, G., & McDermott, L. 2007, 'The meaning, effectiveness and future of social marketing.' *Obesity Reviews*, vol. 8, no. s1, pp. 189-193.

Tapp, A & Rundle-Thiele, SR 2016, 'Integrating Social Marketing into a Multi-disciplinary environment Behaviour Change: Past present and future', in F. Spotswood (Ed.), *Beyond behaviour change: Key issues, interdisciplinary approaches and future directions*, University of Bristol: Policy Press, pp. 135-156.

Wohl, E., Bledsoe, B. P., Jacobson, R. B., Poff, N. L., Rathburn, S. L., Walters, D. M., & Wilcox, A. C. 2015, 'The natural sediment regime in rivers: broadening the foundation for ecosystem management.' *BioScience*, vol. 65, no. 4, pp. 358-371.

Xia, Y, Deshpande, S & Bonates, T 2016, 'Effectiveness of Social Marketing Interventions to Promote Physical Activity Among Adults: A Systematic Review', *Journal of Physical Activity and Health*, vol. 13, no. 11, pp. 1263-1274.

Zharekhina, L. & Kubacki, K 2015, 'What messages does social marketing advertising send? A content analysis of advertisements aiming to minimise harm from alcohol consumption', *International Journal of Nonprofit and Voluntary Sector Marketing*, vol. 20, no. 4, pp. 285–298