Measuring the impact of an entertainment-education intervention to reduce demand for bushmeat

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Abstract

The trade and consumption of bushmeat are a major threat to biodiversity across the tropics. Conservationists have traditionally advocated for stricter regulation and enforcement as a way to control these practices, with less attention given to consumers and the management of the demand. Yet, it is clear that without adequately tackling demand, it is impossible to effectively curb the bushmeat trade. In this paper, we describe an intervention to reduce demand for bushmeat in northern Tanzania. The intervention was centered around the 1-h radio show *My Wildlife – My Community* which included 15-min episodes of the radio drama *Temboni*. Each episode of the radio drama was accompanied by a 45-min interactive call-in show featuring interviews with experts and local information about available community resources. We evaluated this intervention using a Before-After-Control-Impact framework based on longitudinal data from 168 respondents. To account for the fact that respondents volunteered to be exposed to the intervention, in this case the radio show, we used a matching algorithm together with regression to ensure that we could build a credible counterfactual group. Our analysis did not uncover any differences in outcomes between the treatment and control groups, and thus no evidence of the intervention achieving its initial goals. One potential causal mechanism that could have led to this outcome is the low audience penetration rate. Fewer than 40% of respondents listened to the show and among those who did, only about 20% listened to five of more episodes. This research highlights the challenges of implementing and evaluating interventions delivered through mass media in developing countries, and the importance of reporting on interventions even when there is no evidence that they achieved their initial goals. Only through robust evaluation of behavior change interventions and the sharing of lessons learned can conservationists successfully tackle complex issues such as the bushmeat trade.

Introduction

The trade and consumption of bushmeat, defined as the meat of wild animals unsustainably and/or illegally killed for subsistence or commercial purposes, are both a major threat to biodiversity and a key component of millions of livelihoods worldwide (Wilkie *et al.*, 2011; Moro *et al.*, 2013). Across much of the tropics, and in particular in Africa, the rapid increase in bushmeat consumption has led to the loss of much of the medium and large-bodied fauna, such as primates and antelopes (Wilkie *et al.*, 2011). The currently unsustainable level of bushmeat extraction impacts human livelihoods by jeopardizing food security (Wolfe *et al.*,

2005), and its consumption has been implicated in catalyzing the spread of several infectious diseases (e.g. Ebola, Monkeypox). Yet, bushmeat remains a vital source of protein and income for communities in the developing world, with the harvest, sale and consumption of terrestrial wildlife valued at several billions of dollars annually (Brashares *et al.*, 2011).

Conservationists have employed a suite of different tools in an attempt to manage the harvest, sale and consumption of bushmeat, including policy, enforcement, community-based management and alternative livelihoods (Lindsey *et al.*, 2013). Nonetheless, the effectiveness and sustainability of these approaches have often been undermined by poor

governance and corruption (Nielsen & Treue, 2012; Lindsey *et al.*, 2013). As trade and consumption of bushmeat continue relatively unabated, it is clear that innovative approaches are needed. These include focusing our attention on the consumers and on demand management. While effort has been made to understand the patterns and drivers of bushmeat demand in Africa (Moro *et al.*, 2013), there are few examples of interventions focused on influencing the behavior of bushmeat consumers (Martin, Caro & Borgerhoff, 2012). This dearth of past experience is compounded by our lack of ability to learn from past experience, due to a lack of robust impact evaluation (Veríssimo, 2013; Veríssimo *et al.*, 2017), which makes it difficult to distinguish what works from what does not (Baylis *et al.*, 2016).

In this paper, we describe the evaluation of the impact of an education-entertainment intervention to reduce demand for bushmeat in northern Tanzania, East Africa (Bailey, Schmid & Kimario, 2014). The education-entertainment approach, also known as edutainment, consists of weaving educational content and entertainment narratives in order to better communicate with a target audience and ultimately drive behaviour change (Vaughan, Regis & St Catherine, 2000; Khalid & Ahmed, 2014). This strategy hopes to capitalize on the reach of mass media channels, such as radio and television, while making educational content more accessible and interesting to a large audience (Khalid & Ahmed, 2014).

Entertainment education is based on Bandura's social cognitive theory, which hypothesizes that individuals adopt new behaviors by observing and imitating the behavior of role models (i.e., those with whom they identify) (Bandura, 1977, 1997). Seeing individuals similar to themselves engage in a given behavior may increase an individuals' self-efficacy, the perception of one's own ability to carry out a task (Bandura, 1977, 1997; Rogers *et al.*, 1999). Education-entertainment campaigns became popular in the 1970s, initially in Latin America, when educational content was first purposefully and systematically introduced in soap operas (Singhal *et al.*, 2003; Khalid & Ahmed, 2014). This strategy was later exported to Asia and then Africa, in 1980s and 1990s respectively. Since then a growing number of entertainment-education programs have been implemented, mostly in the developing world (Rogers *et al.*, 1999; Vaughan *et al.*, 2000; Khalid & Ahmed, 2014). Education-entertainment campaigns have historically had a strong human development focus, particularly public health (Valente *et al.*, 1994; Kane *et al.*, 1998; Rogers *et al.*, 1999), with few focusing on environmental issues (Chapman *et al.*, 2003). Although the large majority of publications in this area has reported positive outcomes for education-entertainment campaigns, these studies have been heavily criticized for using weak experimental designs and not accounting for respondent self-selection into the treatment (Sherry, 1997). This has generated controversy around the actual impact of education-entertainment interventions and emphasized the need for a stronger evidence base (Sherry, 1997; Rogers *et al.*, 1999).

Here we present an impact evaluation of the entertainment-education campaign *My Wildlife – My Community*, which addressed the issues of poaching and illegal bushmeat

trade in five communities of northeastern Tanzania, where bushmeat consumption was known to commonly occur (Bailey *et al.*, 2014). This is, to the best of our knowledge, the most rigorous evaluation to date of an education-entertainment intervention focused on an environmental topic. We then reflect on the importance of reporting on interventions that did not reach all of their stated objectives, and the ethical imperative to learn that should be felt by all those working on interventions aiming to influence human behavior.

Materials and methods

The intervention of interest was the entertainment-education campaign *My Wildlife – My Community*, which addressed the issues of poaching and illegal bushmeat trade in Tanzania (Bailey *et al.*, 2014). It targeted the communities living in the northeastern Tanzanian regions of Kilimanjaro, Arusha, Manyara and Tanga. The program ran from November 2013 to May 2014 and had 25 episodes, each lasting for 1 h. Each episode consisted of a 15-min episode of the radio drama *Temboni* (village of the elephant) and a 45-min live call-in show. The radio program was broadcast twice a week, in Swahili, on Radio Kili FM, an established regional community radio.

The radio drama *Temboni* focused on the issues of poaching and illegal bushmeat consumption (Bailey *et al.*, 2014). In the narrative, characters were rewarded for positive behaviors and punished for negative choices. They overcame barriers to engage in alternative livelihoods and learned to value wildlife beyond utilitarian use, role modeling the kinds of behavior we wished to see adopted by our target audience. The scripts for the radio drama were co-created by local scriptwriters and PCI Media Impact, a USA-based NGO with experience in entertainment-education strategies. The storyline of the radio drama was pre-tested through multiple focus groups in the target communities (Bailey *et al.*, 2014). In these focus groups, we assessed if the participants identified with the characters, if there was interest in the storyline and if the audience was satisfied with the overall production quality.

Each episode of the radio drama was accompanied by an interactive call-in show featuring interviews with local experts, questions from the audience and information about available community resources (Bailey *et al.*, 2014). The goal of the call-in show was to spark interpersonal communication by contextualizing the issues touched upon in the radio drama and providing the audience with a platform to reflect on the storyline, share opinions and ask questions.

Measuring impact

We evaluated this intervention using a Before-After-Control-Impact (BACI) experimental design based on longitudinal data collected through a questionnaire survey. The survey was administered by staff of the College of African Wildlife Management, at Mweka, to both urban and rural households randomly selected from within each community and who consented to participating in the survey. The sampling was

done by initially listing the households in a community and then drawing at random from that list. The survey protocol was approved by the Virginia Tech Institutional Review Board (14-464).

A total of 249 pre-surveys were collected at baseline in October 2013, divided between the districts of Arumeru in Arusha region (50), Simanjiro in Manyara (48), Moshi in Kilimanjaro (52), Same in Kilimanjaro (49) and Rombo in Kilimanjaro (50). The sample size was determined by the logistical and time constrains of the team, with the post-treatment survey taking place in June 2014. However, we were not able to obtain the full set of longitudinal pre–post surveys for all respondents. This was not only due to respondents not being available, due to migration or death, but also due to errors in the respondent ID numbers in some surveys. Of the 168 final respondents, 64 heard at least one episode of the radio drama, making this the treatment group. Each survey contained 60 questions focused on the knowledge, attitudes and behavior of the respondents toward wildlife, with a particular emphasis on bushmeat. These questions used 5-point Likert scales. The survey also included demographic questions on gender, religion, income, educational level, occupation and household size, together with 11 questions focused on the listener's experience of the radio show.

We looked at differences at baseline between listeners and non-listeners across the dataset (Fig. 1). Respondents in the treatment group had overall higher scores at baseline (median 3.52) than the control group (median 3.25), indicating more favorable knowledge, attitudes and behavior toward wildlife (Fig. 1). This result was expected, given that respondents decided voluntarily to listen to the radio drama. It is thus likely that the treatment and control groups differ in important ways, making them not comparable (Sherry, 1997). For example, we would expect respondents that are already interested in wildlife to be more likely to listen to the radio show, more likely to recall its message and more likely to be influenced by it than an average community member. This means that a direct comparison between listeners and non-listeners would likely overestimate the impact of the intervention. To remove some of this bias, we used a matching framework to build a sample of control respondents that most resembles the listeners.

Improving comparability

We matched respondents on their initial knowledge and attitudes toward bushmeat and poaching, their community of origin and the baseline values for all outcomes of interest (Table 1). Given the large number of variables on knowledge and attitudes, we built a summary variable, based on the mean Likert scores of the relevant 18 survey questions. This required variables to be transformed to ensure that all high scores indicated a positive feeling toward wildlife. The new variable was interpreted as a proxy for the likelihood that a respondent would be interested in listening to the show and the likelihood of recalling the shows message. We also required an exact match on the respondent's community of origin, as that may account for accessibility to bushmeat and
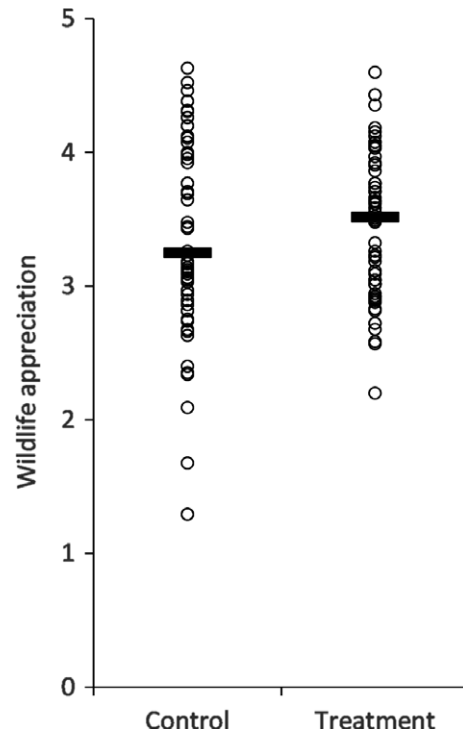
Figure 1 Pre-treatment scores for all 186 respondents for which there were longitudinal data, divided into treatment (listeners) and control groups (non-listeners), in the context of an evaluation of an entertainment education on bushmeat consumption. Each point represents 1 of the 60 variables divided between knowledge, attitudes and behavior, collected in the baseline survey. The black rectangles represent the median for each group.

any differences in social and cultural norms, which are crucial factors in understanding the likelihood of a change in behavior (Ceppi & Nielsen, 2014; Kiffner *et al.*, 2015). Finally, we matched respondents on the baseline values of all outcomes of interest (Table 1). We achieved this by matching respondents on the baseline scores of the 11 survey questions that focused on behaviors related to bushmeat harvest, trade or consumption. By using a matching framework, we ensured that respondents were not only comparable at baseline, but also more likely to evolve similarly over time in the absence of an intervention.

Matching was done in R (R Core Team, 2014), using the package *MatchIt* (Ho *et al.*, 2006). We tested different matching approaches as well as distance metrics. Genetic matching, with a population size parameter of 2000, and replacement were the approach that obtained the most attribute balance between treatment and control samples (Diamond & Sekhon, 2013). This resulted in the 64 respondents in the treatment group being matched with 38 respondents that formed the control group. Using a 10% threshold for the difference in standardized mean difference, 8 of the 13 variables used for matching were balanced. We selected as outcomes questions focused on individual behavior, five questions that focused on bushmeat consumption, two on

Table 1 Questions asked in the pre- and post-surveys of the evaluation of the education-entertainment intervention *My Wildlife – My Community* and subsequently used to match respondents and measure changes in outcomes

ID	Question	Use
Q1	Local communities are being exploited by elephant and bushmeat poachers and traders causing our well-being to be reduced	M
Q2	Wildlife is necessary for a healthy environment	M
Q3	Wildlife belongs to the public not for individual use	M
Q4	Even if wildlife was not protected by government laws I do not think it could get finished	M
Q5	Poaching reduces local income potential from tourism both for today and for our children	M
Q6	Poaching is a serious crime with risks of being put in jail	M
Q7	Government regulations that restrict hunting are an unnecessary intrusion into citizens lives	M
Q8	Hunting without permit is illegal	M
Q9	I think about eating less bushmeat	M
Q10	I would like to not have to eat bushmeat to get protein	M
Q11	I would prefer to only eat domestic meat.	M
Q12	Wildlife has value beyond just food and provides income that is important to my community	M
Q13	I admire hunters who can approach an elephant to kill it	M
Q14	I do not like a hunter who kills innocent animal like a blue duiker	M
Q15	Poachers hurt our community and our well-being	M
Q16	Hunting should not be discouraged	M
Q17	Eating and trading bushmeat limits our future opportunities	M
Q18	The current bushmeat demand cannot be sustained in the long term	M
Q19	Poachers do not become leaders in our community	M
Q20	Bushmeat consumption is very common in my community	M; O
Q21	Poaching is a problem in my community	M; O
Q22	I eat bushmeat daily	M; O
Q23	I eat bushmeat at least once per week	M; O
Q24	I eat bushmeat at least once per month	M; O
Q25	I eat bushmeat at least once per year	M; O
Q26	I discuss bushmeat and poaching with my family	M; O
Q27	I discuss poaching with members of my community	M; O
Q28	I share information about poachers with local authorities	M; O
Q29	Because poaching is a threat to my community I report illegal activities to local authorities	M; O
Q30	I decided to stop eating bushmeat	M; O
Q31	Tourism revenue from wildlife is used to help my community (roads, schools, etc.)	F
Q32	If elephants go extinct in Tanzania the tourism industry will disappear	F
Q33	I am aware of ways to develop a domestic tourism industry for Tanzanian citizens	F
Q34	Wildlife offers potential for local income through ecotourism enterprises	F
Q35	To go just to look at animals seems to me to be a waste of time	F
Q36	I prefer to visit areas outside without wildlife than those with wildlife	F
Q37	I visit national parks to see wildlife	F

M = used for respondent matching; F = used in the falsification test; O = used in outcome measurement.

information sharing and two on interpersonal communication (Table 1). Given the sensitive nature of the topic, we also included in the outcomes two indirect questions that focused on the bushmeat use in the community as a whole and where we would expect social desirability bias to be weaker (Nuno & St John, 2015).

Given the lack of balance across all variables, we estimated the impact of the radio drama for the 11 outcome variables (Table 1) using a Cumulative Link Mixed Regression Model, in R package *Ordinal* (Christensen, 2015). We did this by looking at the interaction between a dummy variable on treatment status (treatment or control) and another on study stage (pre- or post-treatment). In addition, we also included a mixed effects term that used the unique respondent ID to account for the fact that the longitudinal design

of the survey followed the same respondents for pre- and post-surveys. Given the multiple outcome variables examined, we also conducted a falsification test by looking at seven ecotourism-related outcomes, measured in the same survey, and where we would not expect the treatment to trigger any changes.

We then used the odds ratio as an effect size measure for both outcome variables and those in the falsification test. An odds ratio represents the odds that an outcome will occur given a particular exposure, compared to the odds of the outcome occurring in the absence of that exposure (Szumilas, 2010). An odds ratio of 1 means that exposure to the treatment does not affect odds of outcome, while a higher one means that the treatment is associated with higher odds of the outcome, and vice versa (Szumilas, 2010).
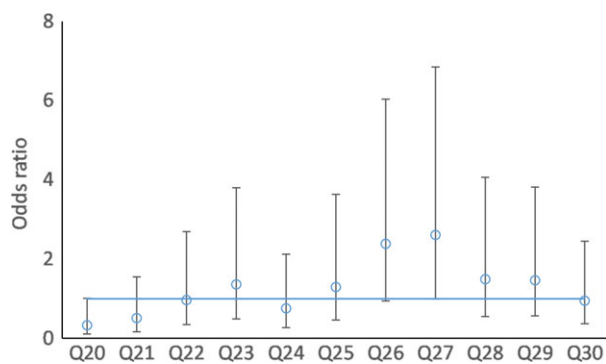
Results

Of the 168 respondents for which we had longitudinal data, the majority was male (60%), Christian (80%) and had completed at least primary school (76%). The median age was 35 years, with farming being the most common primary livelihood (45%), with the majority respondents (58%) owning some land. Respondents were nearly equally split between the five target communities, with the least represented having 16% ($n = 168$) and the most represented 23% ($n = 168$) respondents.

Intervention reach

Although 99% ($n = 168$) of respondents stated in the pre-survey that they used the radio as a key information channel, and 55% ($n = 168$) stated they listened to Kili FM, the penetration of the radio show was limited. Only 38% of respondents ($n = 168$) listened to at least one episode the radio drama, while 33% listened to at least one of the call-in shows that followed the radio drama ($n = 168$). In addition, 78% of the listeners ($n = 50$) only heard 1 to 5 episodes, with only three respondents listening to more than 10. When asked why, most respondents mentioned the lack of time due to other occupations, the lack of a functioning radio or problems with the reception of Kili FM.

Measuring impact

In terms of estimating the impact of the campaign, we looked at a matched comparison of listeners and non-listeners using ordinal regression. The analysis of the odds ratios of the different outcomes measured (Table 1) suggests that
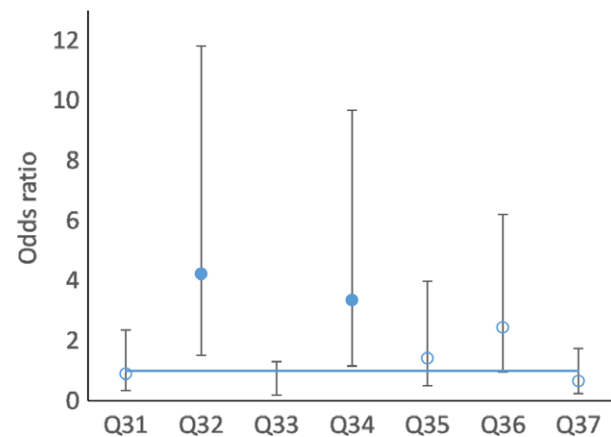
there were no statistically significant differences between treatment and control groups (Fig. 2). Nonetheless, it should be noted that the confidence intervals for two of the outcome variables investigated were close to meeting that threshold. Mean scores for all variables related to knowledge, attitudes and behavior collected during pre- and post-surveys for both treatment and control groups are available in the Supporting Information (Table S1).

We examined the answers to seven ecotourism-related questions, where no changes due to the treatment were expected given that ecotourism is only indirectly related to the issues of bushmeat and poaching. However, the odds ratios of some of the variables (Table 1) revealed some statistically significant changes between treatment and control groups (Fig. 3).

Discussion

The trade and consumption of bushmeat are considered a major global threat to wildlife and public health (Wolfe *et al.*, 2005). Most of the effort to mitigate it thus far has been focused on the supply side of the trade, not on influencing demand and consumer behavior. In this paper, we evaluate the impact of an education-entertainment campaign, a strategy used widely in public health but seldom used in biodiversity conservation (Sherry, 1997; Khalid & Ahmed, 2014). We could not detect changes in behavior, but highlight the importance of robust evaluation to ensure that future interventions build on the learning gathered in the past.

The use of the mass media, such as radio or television, is alluring to practitioners due to its potential to quickly reach millions of people (Khalid & Ahmed, 2014). Yet, it is key

Figure 2 Odds ratios obtained from a cumulative link mixed model of responses by treatment and control groups to questions related to behavior around bushmeat consumption and wildlife poaching in the context of an evaluation of an entertainment education on bushmeat consumption. Although no statistically meaningful differences were uncovered, variables K12 and B6 (Table 1) were within <0.005 of the threshold. Odds ratios indicate similarity between treatment and control when their confidence intervals cross 1. Below this value the treatment is associated with lower agreement on a Likert scale, while above 1 the treatment is associated with higher agreement. [Colour figure can be viewed at wileyonlinelibrary.com]

Figure 3 Odds ratios obtained from a cumulative link mixed model of responses by treatment and control groups to questions on knowledge, attitudes and behavior toward ecotourism (Table 1) in the context of an evaluation of an entertainment education on bushmeat consumption. Odds ratios indicate similarity between treatment and control when their confidence intervals cross 1. Below this value the treatment is associated with lower agreement on a Likert scale, while above 1 the treatment is associated with higher agreement. [Colour figure can be viewed at wileyonlinelibrary.com]

to distinguish reach from impact, as reaching an audience is only the first step and offers in itself no guarantee that any behavioral changes will take place. Furthermore, the use of mass media brings its own challenges when it comes to both implementation and evaluation. One key aspect is that many of the differences initially found in a direct comparison between listeners and non-listeners are likely to be due to the self-selective nature of how people choose to be exposed to the intervention (Sherry, 1997; Vaughan *et al.*, 2000). These are likely to be both observable, such as demographic or behavioral differences, and unobservable, such as psychographic differences. For example, in the context of the present research, those that were willing to listen to a radio drama on wildlife would be expected to be more likely to be supportive of wildlife conservation initiatives. This would make them both less likely to eat bushmeat and more likely to stop eating it after being exposed to the entertainment-education intervention. As such we would expect the results biased toward showing campaign impact. Yet, many mass media interventions rely on direct comparisons between listeners and non-listeners (Sherry, 1997). This situation was mirrored in our analysis, where listeners were found to have higher baseline values for the outcomes variables of interest than non-listeners (Fig. 1).

Counterfactual thinking

In order to find a better counterfactual against which to compare those that were exposed to a given entertainment-education campaign, we need to ensure comparisons are made between groups of people that are as similar as possible in terms of the characteristics that impact their likelihood of changing that particular behavior. In this study we did this by first using a matching algorithm, a popular approach in the impact evaluation literature, and one increasingly used by conservationists to select respondents' samples that were as comparable at baseline as possible (Ferraro & Hanauer, 2014). Given that this approach did not yield balance across all the relevant variables, we then used regression to statistically account for the remaining differences between these groups, a combination of techniques that has been shown to produce more robust results when it comes to causal inference (Ho *et al.*, 2007). This research still faces limitations, such as the reliance on direct questioning and self-reported indicators. Direct questioning is more prone to bias when dealing with issues that are illegal or culturally sensitive (Nuno & St John, 2015), while self-reported indicators have been shown to have some validity issues due to, for example, recall bias (Kormos & Gifford, 2014). Future studies can address the former concern by using specialized methods such as randomized response techniques which allow respondents to remain anonymous while allowing research to obtain data on the prevalence of the behavior of interest (Nuno & St John, 2015). The latter limitation could be addressed by using independent data sources, such as market surveys or enforcement data, to triangulate the results obtained using self-reported indicators (see Veríssimo *et al.*, 2017).

We would also like to encourage practitioners to use falsification tests, where beyond searching for the shifts in the variables they would expect to change, they also test for changes in those variables where no change would be expected. This helps establish the credibility of the causal inference being made by providing further evidence that the causal pathways being investigated are indeed those that are driving any potential change. In the case of the present research, the falsification test supports the idea that the observed results close to the statistical significance threshold were most likely not suggestive of an actual difference between treatment and control groups. This is particularly important information given the limited statistical power of our dataset.

Lessons learned

Although our results find no evidence that the campaign *My Wildlife – My Community* did achieve its initial objectives, there are several key lessons learned that can help inform the implementation and evaluation of future behavior change interventions in this area. One key aspect revolves around low audience penetration, likely the factor that undercut the ability of this intervention to achieve its objectives. This was a surprising result, as the baseline survey had documented that not only radio was widely used, but also that Kili FM was used by more than half of the target audience. Respondents nevertheless mentioned time as well as poor reception and lack of a functioning radio as an important barrier. One potential way of addressing this issue may be the distribution of more advanced radios to local institutions, such as churches, schools or local commerce, where listener groups could gather (Bailey *et al.*, 2014). This could be coupled with the broadcasting of the same content across multiple radio stations, and at different times of the day and the week to increase the number of people reached.

Although these are expected barriers in the implementation of these interventions, particularly in developing countries (Dennis & Boruch, 1989), they are surprisingly seldom mentioned in the education-entertainment literature as an important obstacle to impact. This is possibly linked to a publication bias, where interventions afflicted by this critical problem and thus more likely to fail, are simply not being reported on, something that is not uncommon when in conservation science (Knight, 2006).

In any case, it is clear that issue of bushmeat consumption is a multifaceted one, and one approach in isolation is unlikely to succeed. This means that demand reduction consumption should be coupled with other types of interventions such as improved enforcement and/or alternative livelihoods (Moro *et al.*, 2013). Otherwise it is unlikely that we will be able to achieve our goals in a time scale that is biologically meaningful, particularly given the mounting threats to biodiversity.

The ethical duty to learn

Despite multiple appeals for better impact evaluation in conservation science, there have been limited improvements over

the last decade (Ferraro & Pattanayak, 2006; Baylis *et al.*, 2016). This is likely because there is a strong pressure on conservationists to report successes, regardless of what the actual outcomes are, as a way to guarantee both continued career progression and access to funding (Redford & Taber, 2000; Knight, 2006). Weaker evaluation practices are more vulnerable to uncertainty and thus more open to multiple interpretations, something that can be exploited to at least suggest the possibility of success.

There is a difference between being successful and being effective (Knight, 2006), and this lack of transparency does little more than create an illusion of success at the project level, while sacrificing the future impact of conservation science as a field. The lack of information sharing makes effective approaches harder to find and ineffective ones harder to stomp out, leading to massive waste of time and resources (Redford & Taber, 2000). Nevertheless, when it comes to projects that focus on influencing human behavior, and thus have a potential direct impact on human livelihoods and well-being, such as those around protein sources, there is an additional ethical dimension to bear in mind (Rentsch & Damon, 2013).

Influencing human behavior in the context of biodiversity conservation is an extremely complex endeavor (Veríssimo, 2013). As such, failure is inevitable. Conservationists working in this area must be humble enough to acknowledge that interventions may not only have no impact but can even backfire, worsening the threats they hope to mitigate. In a time where calls for a Hippocratic Oath for conservationists start to gain traction (Bennett *et al.*, 2017), it is key to understand that only through an emphasis on learning and information sharing can we ensure that we 'first, do no harm'. For this to be achieved, we need robust impact evaluation practices. Only through impact evaluation can we ensure potentially harmful interventions do not continue to be implemented and that those that do not succeed can be improved through the learning gained in past experiences. It is time to start considering impact evaluation not only as an inextricable part of any conservation intervention, but also as part of the ethical obligation of all conservationists to ensure that their work always produces some kind of positive result, be it in the form of learning outputs or intervention outcomes.

Acknowledgments

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Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Table S1. Mean results for both pre- and post-surveys for all 60 variables collected, separated per control and treatment groups.