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# Evidence or delusion: a critique of contemporary rhino horn demand reduction strategies

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## ABSTRACT

Considerable effort has been devoted to reducing rhinoceros (i.e., rhino) horn demand by changing consumer behavior. Implementing organizations often claim that their campaigns are based on reliable insights into rhino horn demand and that there is no scientific support for any medicinal effects of rhino horn. In this opinion piece, we evaluate the scientific evidence supporting this claim and discuss how campaigns using a delusive and paternalistic approach may backfire. As the use of rhino horn in traditional medicine has a thousand-year history, it is unlikely that such deeply entrenched beliefs will be swayed by a one-sided representation of the limited scientific evidence evaluating its efficacy. Difficulties in interviewing rhino horn consumers have further contributed to lacking information about their values and characteristics. We call for more scientific evidence and a more culturally nuanced approach to rhino horn demand reduction campaigns.



## KEYWORDS

Rhino horn; xi jiao; medical effect; behavior modification; demand reduction; Vietnam

## Introduction

The rhinoceros (henceforth rhino) poaching crisis is attracting significant media and political attention across the globe (SRI, 2020). Much effort has been devoted to reducing demand for rhino horn through consumer behavior modification campaigns (Greenfield & Verissimo, 2019; Olmedo et al., 2018). Several campaigns, including those by five major non-government organizations (NGOs) (CHANGE/WildAid, Education for Nature Vietnam [ENV], Humane Society International [HSI] in collaboration with the Vietnam CITES Management Authority [hereafter just HSI], TRAFFIC, WildAct) are based on the medical theme, which broadly criticizes the use of rhino horn to treat diseases based on a lack of scientific evidence supporting its efficacy (Smith, 2018), although rhino horn has been used in traditional Chinese and Vietnamese medicines for centuries (Bending, 2018; Cheung et al., 2018; Nowell, 2012). Campaign messages framed by this theme include ‘*Rhino horn is not medicine. It does not cure anything.*’, ‘*Rhino horn has no medicinal efficacy.*’, ‘*Rhino horn is like human nails.*’, and ‘*Rhino horn is not a panacea.*’

A number of problems have been identified with this medical theme (Dang et al., 2020; Nowell, 2012; Patton, 2011). Patton (2011), for example, reviewed scientific studies on the medicinal properties of rhino horn and found no evidence for the claims made in demand reduction campaigns using this theme that rhino horn is similar to human hair or nails.

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According to Patton (2011), “The claims made that rhino horn has no medicinal qualities seem to be based on rather flimsy evidence but that does not mean to say they are wrong” (p. 2). Nowell (2012) further wrote that “rhino horn’s long history of use in traditional medicine suggests that it has proved efficacious in the experience of many people, and some scientific research supports this, although negative results have also been reported” (p. 2).

Despite recent criticism (Dang et al., 2020; Smith, 2018), the medical theme remains a popular narrative adopted by international media and used by conservation organizations (e.g., BBC, 2019a; CapeTalk, 2019). In the prevalent discourse, consumers of illegal wildlife products in China and Vietnam are depicted as the ‘Asian Super Consumer’ (Margulies et al., 2019) or even as fools with respect to their beliefs in the benefits of rhino horn (ENV, 2014). Conservation organizations often claim that their demand reduction strategies are designed based on insights from evidence-based research (TRAFFIC, 2014, 2017; WildAid, 2016), whereas consumer beliefs are labeled unscientific (Smith, 2018).

Motivations for using rhino horn differ among Chinese and Vietnamese consumers, although the two markets have close ties (Crosta et al., 2017; Vigne & Martin, 2018). In China, rhino horn is mostly supplied to the art and antiques market (Gao et al., 2016; TRAFFIC, 2017). Rhino horn is also used in traditional Chinese medicine, but often as an ingredient combined with other wildlife products and herbs in decoctions (Patton, 2011). In Vietnam, rhino horn is mainly used as a single substance in the treatment of various ailments (Truong et al., 2015). Although the Chinese art and antiques market is believed to be one of the main drivers of rhino poaching (Crosta et al., 2017; TRAFFIC, 2017), conservation campaigns mostly focus on the use of rhino horn for medical purposes where Vietnam is considered the major market (Milliken & Shaw, 2012). Hence, in this opinion piece, we focus on the use of rhino horn in Vietnam and criticize the medical theme in contemporary rhino horn demand reduction campaigns. First, we evaluate the evidence for any possible medicinal effects of rhino horn by reviewing recent studies published after 2011 (i.e., after Patton’s review of evidence for medicinal effects). Second, we review consumer surveys conducted by NGOs as the basis for designing demand reduction strategies. We then discuss problems with the medical theme and these consumer surveys based on insights from recent scientific studies of self-reported users of rhino horn. Finally, we briefly summarize some theoretical, methodological, and practical considerations necessary in conducting studies to supply information for informed and appropriate design of campaigns to reduce the demand for rhino horn.

## Entrenched Beliefs

The use of rhino horn in traditional medicine is deeply rooted in Asian culture (Bending, 2018; Cheung et al., 2018; Nowell, 2012). The earliest written record of rhino horn used as a medicinal ingredient in China is from 2,600 BC (Patton, 2016). Chinese traditional medicine spread to other Asian countries where it was adopted and modified. However, the medicinal properties of rhino horn described in the literature remain similar (Nowell, 2012). Its main function is to detoxify the body and it is used to treat symptoms expressed as “internal heat,” including hangover, fever, convulsions, and ulcers (But et al., 1991). According to traditional Chinese lore, rhinos living in tropical forests eat toxic plants and herbs, but suffer no ill effects because their horns have the ability to detoxify their bodies (Patton, 2016).

Since 1993, a ban on the trade in rhino horn has been in effect in China, although it is not rigorously enforced (Crosta et al., 2017). In 2018, however, the Chinese government issued a directive allowing the use of rhino horn in medical research and traditional medicine (The Government of China, 2018). According to this directive, rhino horn can be prescribed by authorized traditional medicine clinics for treatment of terminal illnesses. Although China has subsequently postponed implementing the directive under pressure from environmental groups (BBC, 2019b), this implies that there still is widespread and apparently government-sanctioned conviction about the medicinal properties of rhino horn in China.

In contemporary Vietnam, the most popular use of rhino horn is for hangover treatment and body detoxification by males in the high-income bracket in urban areas (Dang & Nielsen, 2018; Truong et al., 2015). Several studies have highlighted a deeply rooted belief in the medicinal properties of wildlife products such as rhino horn and tiger bone in Vietnamese society (MacMillan et al., 2017; Milliken & Shaw, 2012). Attitudes among members of the public in Vietnam regarding the use of rhino horn are generally positive and attract no stigma (Dang & Nielsen, 2018).

In a recent study evaluating consumer campaign exposure and attitudes toward the reference group (e.g., doctors, business leaders, celebrities, family members) selected to make the information transfer (i.e., deliver the message) in such campaigns, we found that rhino horn consumers generally do not trust demand reduction campaigns framed by the medical theme (Dang et al., 2020). Specifically, consumers felt that scientific evidence for the claim of no medicinal properties was lacking. Respondents also generally did not trust conservation organizations and individuals delivering the campaign messages and considered both driven by profit (Dang et al., 2020). Hence, these and many other consumers are unlikely to be convinced by the level of information currently provided in conservation campaigns. It is also clear that an oversimplification of science, as in the case of the fingernail metaphor used in demand reduction campaigns, has little influence on consumer beliefs (Smith, 2018). Notably, there are important differences between Western medicine and Asian traditional medicine with respect to the conceptions of health, illness, and treatment (Park et al., 2012). Although Western medicine, in theory, is based on scientific technology, anatomy, and the use of chemicals to treat viruses, bacterial infections, genetic disorders, and individual traumas, Asian traditional medicine posits that good health is attained by maintaining a balance between *yin* and *yang* of different systems and functions, and a good flow of *qi* in the human body (Wong et al., 1993). Traditional medicine is also believed to have minimal adverse side effects, which is contrary to some perceptions of Western medicine (Lee & Cheung, 1989).

## Evidence or Delusion

Few scientific tests of the medicinal properties of rhino horn have been conducted (Nowell, 2012; Still, 2003) and the claim that rhino horn has no medical effect has mainly been based on two studies (Patton, 2011). The first study was conducted by the Swiss multinational pharmaceutical company Hoffmann-LaRoche in 1980 and the second by the Zoological Society of London in 2005. However, no peer-reviewed publications in international scientific journals or even detailed reports describing the protocol and methods used in these studies are publicly available. It is thus impossible to evaluate the scientific rigor and validity of their results. The Zoological Society of London acknowledged that no valid test of

the medicinal properties of rhino horn had been undertaken (Rookmaaker, 2011). The Rhino Resource Center has recommended not to refer to either of the two sources (Patton, 2011). As stated by Rookmaaker (2011), “the two reports often quoted to support the statement that rhino horn has no medicinal value do not stand up to academic scrutiny and alternatives should be quoted in their place” (p. 5).

Although the burden of proof normally rests on proving the medicinal effect of a substance under investigation, it is in this case perhaps more important, in the eyes of consumers, that there is no clear evidence that it does not work. To the contrary, several studies have found that wildlife horns and antlers, including rhino horn, do exhibit certain medicinal properties (But et al., 1990; Tsai, 1995). Nowell (2012) identified six clinical studies concluding that various wildlife products had significant anti-pyretic effects and that two products had anti-inflammatory effects. One of these studies was conducted by the Chinese University of Hong Kong and found that rhino horn, as well as the horns of the saiga antelope, water buffalo, and common cattle, reduced fever in rats subject to high dosage (But et al., 1990). At low dosage, rhino and saiga horn were still effective in reducing temperatures.

Given that the reviews by Nowell (2012) and Patton (2011) are relatively dated, we searched for more recent studies (published in the period from 2012 to 2019) testing effects and medicinal properties of rhino horn. As rhino horn is rarely prescribed as a single substance in treatment (Patton, 2011), we searched for studies on rhino horn used in isolation as well as in traditional medicine prescriptions that often are decoctions containing herbs and other substances. This literature search was conducted in December 2019 in online databases including Scopus, Web of Science, and Google Scholar. Using keywords such as “rhino horn” and “xi jiao” (which means rhino horn in Mandarin), we identified at least two peer-reviewed publications that involved tests of rhino horn in clinical trials (Table 1). Comparing antipyretic, sedative, and procoagulant activities of seven types of animal horn, Liu, Wang, et al., 2016 found that rhino horn had the strongest antipyretic effect in lowering the fever of rabbits. In a randomized controlled trial on 20 rats, Xuan et al. (2016) found positive effects of Xijiao Dihuang Decoction (XJDHD), a traditional Chinese medicine containing 30 g of rhino horn, when combined with Yinqiao powder, in reducing the damage to endothelial cytoskeleton induced by influenza virus infection.

**Table 1.** Scientific studies on medicinal effects of Xijiao Dihuang Decoction.

Publication	Methods	Results/Conclusions
Fei et al. (2018)	Randomized controlled trial on 50 rats.	XJDHD has the neuroprotective effect that might help rehabilitate patients with stroke.
Liu, Pei, et al., 2016	Integrated systems pharmacology.	XJDHD boosts the immune system, restrains inflammatory responses, repairs the vascular system, and blocks virus spread.
Liu, Wang, et al., 2016	Proteomic analysis.	Seven horns (incl. goat horn, Asian rhino horn, African rhino horn, saiga antelope horn, Tibetan antelope horn, water buffalo horn, and yak horn) showed antipyretic, sedative, and procoagulant effects.
Liu et al. (2019)	Randomized controlled trial on 742 rats.	Oral administration of XJDHD protected mice from lethal liver failure.
Xia et al. (2017)	Randomized controlled trial on 40 rats.	XJDHD could increase platelet number and prevent its apoptosis through the mitochondrial pathway.
Xuan et al. (2016)	Randomized controlled trial on 20 rats.	XJDHD combined with Yinqiao powder (XDY) could reduce the damage to endothelial cytoskeleton induced by influenza virus infection.
Zhang et al. (2017)	Randomized controlled trial on rat cells.	XJDHD might be used as neuronal protection strategy for the ischemia injury and related diseases.

We also identified five other studies showing positive effects of XJDHD (Fei et al., 2018; Liu, Pei, et al., 2016; Liu et al., 2019; Xia et al., 2017; Zhang et al., 2017). In these studies, rhino horn was replaced with water buffalo horn, although rhino horn used to be a main ingredient in XJDHD (Liu, Pei, et al., 2016). Overall, it must be acknowledged that some of these studies (e.g., Xia et al., 2017; Xuan et al., 2016) could be biased by their small sample sizes and the fact that all were conducted by Asian scientists. In addition, it is unclear whether it was the horn or the Yinqiao powder in the XJDHD that had the observed medicinal effects. Although these issues may be claimed as part of the reason why the results of these studies contradict those conducted by Western researchers from Hoffman-LaRoche and the Zoological Society of London, at least they have been published in scientific journals (one of them in *Nature* – scientific reports (Liu, Wang, et al., 2016)) with a detailed description of the research process enabling evaluation of their scientific rigor and validity. According to these results, it is basically incorrect to equate drinking rhino horn powder to biting human nails, as postulated in some campaigns (e.g., “Save a rhino, say no to rhino horn” (WWF, 2013); “Nail Biters campaign” (WildAid, 2016); “Nail it for Rhinos” (WWF, 2015)). However, other substances, including Western medicine, may be more effective.

### Insights or Assumptions

Understanding the target audience is a critical step in the design of behavior modification campaigns (Eagly & Chaiken, 1993; Nuno et al., 2018). This requires formative research to identify the right audience and gain insights into their beliefs, attitudes, and behaviors (Truong & Dang, 2017; Veríssimo et al., 2020). However, some organizations design campaigns based on their own experience (Smith, 2018). Only four organizations (TRAFFIC, WildAid/CHANGE, HSI, Breaking the Brand) claimed to have conducted studies of their target audiences in relation to rhino horn use (Olmedo et al., 2018). To examine the insights gained from these studies, we searched and reviewed publications, technical reports, and presentations from these four organizations. Our search included the previously mentioned online databases using as keywords the organization names in combination with the words “rhino,” “demand,” and “behavior,” as well as a general Google search and visit to the websites of these organizations. However, we only found one technical report by TRAFFIC, the Chi Briefing Paper, with detailed narratives or insights about rhino horn consumers (TRAFFIC, 2017). The three other organizations only provided generic information about their target audience (Breaking the Brand, 2015, 2019; HSI, 2016a; WildAid, 2016) (Table 2).

As none of these studies has been published in refereed scientific journals, the methods used and their scientific rigor are impossible to assess. We suspect that most demand reduction campaigns have been designed based on assumptions rather than reliable evidence about the target audiences. For those organizations that have conducted actual surveys of their target audiences, the sample size is another point of criticism (Dang et al., 2020).

### Campaigns Can Backfire

To a certain extent, some rhino horn demand reduction campaigns in Vietnam have backfired and casted negative publicity on implementing organizations (Dang et al., 2020;

**Table 2.** Example narratives about rhino horn consumers.

Organization	Insights or narratives
TRAFFIC	<p>"He believes that rhino horn is a badge of wealth, power, social status and hard work" (TRAFFIC, 2013).</p> <p>"Rhino horn is believed to be able to support cancer treatment and prolong the patient's life. [...]</p> <p>Rhino horn is believed to be able to treat various diseases" (TRAFFIC, 2017).</p> <p>"Mr. L believes that rhino horn is an effective agent for detoxification or hangover cure" (TRAFFIC, 2017).</p>
WildAid/ CHANGE	"People that use rhino horn believe it helps relieve fever, improve sexual competency, detoxify the body, and in recent years in Vietnam, serves as a magical cure for cancer and hangovers, with no conclusive medical scientific evidence" (WildAid, 2016).
HSI	"Driving the crisis is the demand for rhino horn for its use in traditional medicines and health tonics despite the horn having no medicinal value" (HSI, 2016b).
Breaking the Brand	<p>"Their motivations to consume are entirely selfish (status gain, miracle cure)" (Breaking the Brand, 2015).</p> <p>"The current consumption spike has always been a fad and related to status and prestige gain, not medical use" (Breaking the Brand, 2019).</p> <p>"Horns are now being injected with toxin that will bring pain and suffering to anybody who consumes it" (Breaking the Brand, 2019).</p>

Smith, 2018). This situation was predicted after HSI claimed the success of their campaign in 2014 (HSI, 2016a). Huynh (2014) criticized two claims made by HSI and Lynn Johnson, founder of the Breaking the Brand campaign. The first claim was that rhino horn has no medicinal effect and cannot cure anything (i.e., rhino horn is composed of the same material as human nails). The second claim was that rhino horns injected with toxin will reduce demand by causing harm to consumers (i.e., consumers will be poisoned by drinking poisoned horns). As discussed above, the first claim does not appear to be correct even though it may be accurate that rhino horn is no cure for all ailments, but neither is that expected by consumers (Dang et al., 2020). The second claim is also incorrect, as poisoned rhino horns likely do no harm to consumers. When studying the distribution of a colored dye replacing the toxin injected in rhino horn, the dye was only found in the drilling holes and no other parts of the horn. This means that poisoning horns is unlikely to be an effective deterrent (Ferreira et al., 2014). Building on misinformation and deceit may make campaigns backfire, as Vietnamese consumers will lose any trust they may have had in future campaigns and the implementing organizations (Huynh, 2014).

### A Call for More Evidence

Studies of self-reported users of rhino horn show that most of them are well-educated, high-income individuals working as self-employed business owners or holding senior positions in the government or private companies (Dang & Nielsen, 2018; Dang et al., 2020; Truong et al., 2015). Rhino horn consumers are not ignorant as depicted by most conservation organizations (Smith, 2018). These consumers are fully capable of searching the internet for scientific evidence about the medicinal efficacy of rhino horn. They may understand how conservation campaigns work and the motivations and business orientations of implementing organizations, as well as the possible financial motivations of celebrities, business leaders, and others who participated in these campaigns. A majority of the consumers who participated in a recent study specifically requested scientific evidence about the effects of rhino horn in treating diseases (Dang et al., 2020) just like many researchers support the application of evidence-based use of Chinese traditional medicine (Shea, 2006).



Instead of basing campaigns on misinformation and mistruths or strategies involving poisoning rhino horn (Ferreira et al., 2014), demand reduction campaigns should present evidence from credible scientific studies – and perhaps most effectively if involving human subjects – evaluating the medicinal benefits of rhino horn compared with recognized medical alternatives in clinical settings. Specifically, research should be conducted using rigorous methods such as randomized controlled trials to show whether alternatives, including other animal horns (Lavers, 2017; Still, 2003) and Western medicine, are more effective in the right dosage as well as cheaper and without negative conservation implications. Campaigns based on an oversimplification of the science will not work and neither will campaigns based on simplistic narratives about consumer preferences (Hinsley & 't Sas-Rolfes, 2020).

Studies of actual buyers, users, or those who intend to buy or use rhino horn are critical for the development of behavior change strategies to reduce demand. However, most users are senior and wealthy individuals who are aware of the illegal nature of using rhino horn and notoriously adverse to investigations about their sensitive behaviors (Truong et al., 2015). Interviewing these individuals is difficult because they often do not want to talk to young investigators or individuals outside their social networks (Dang et al., 2020). Specialized interview methods, such as the unmatched-count technique and the randomized response technique, are increasingly used for identifying resource users and addressing sensitive behaviors in conservation. But, having received only limited testing in terms of respondents' perceived anonymity and trust, these are not a panacea for eliminating sensitivity (Nuno & St. John, 2015) and we do not consider them appropriate for the particular group in question. In our experience, engaging with this group requires, at a minimum, local researchers who are embedded in the right social circles. When successfully having established the necessary trust, snowball sampling may be applied to expand the sample and establish quantitative methods such as choice experiments that can be used for evaluating consumer preferences and tradeoffs with respect to rhino horn use (e.g., Hanley et al., 2018), the determinants of use, and to assess the elasticities of demand (e.g., Moro et al., 2013; Walegign et al., 2019). Researchers can also employ theoretical frameworks, such as the theory of planned behavior (Ajzen, 1991) or the theory of interpersonal behavior (Triandis, 1977), to understand and predict consumer behaviors. Many other options are available, but conservation organizations should follow proven methods in behavioral economics or social marketing and engage with research institutions to study their target audience, evaluate campaign impacts, and publish the results in refereed scientific journals. Most importantly, we call for more nuanced and culturally appropriate demand reduction campaigns that acknowledge cultural differences and the wit of contemporary rhino horn consumers.

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