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A survey of traditional Chinese medicine consumers to investigate the impact of China's legalization of rhino horn trade on stigmatization and likelihood of use

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Abstract

Rhino poaching continues to threaten species survival despite decades-long trade bans, with rhino horn use in traditional Chinese medicine (TCM) contributing to global demand. Conservationists have debated over policy alternatives like trade legalization, and insight into TCM stakeholders is needed to support policymaking. The need for more research became made more urgent with China's 2018 decision to initiate the process of legalizing domestic trade. In this study, we conducted a large-scale online survey of TCM consumers in Guangdong province, China. We found that while stigmatization of rhino horn use is limited at present, it is likely to drop further with trade legalization. Prescription usage will be the most likely source of increased rhino horn demand if trade is legalized. Given the terms established in China's 2018 policy document, we stress the importance of engaging constructively with policymakers and TCM stakeholders to influence the process of establishing medical standards and regulatory mechanisms such that clinical access in a future legal trade is stringently controlled.

KEYWORDS
Chinese consumers, conservation policy, demand, medicinal use, poaching, rhino conservation, trade legalization, wildlife use

1 | INTRODUCTION

The rhino poaching crisis has drawn substantial global concern and remains a critical threat to species (Dang & Nielsen, 2020). Rising wealth in Asia has driven the increase in poaching and illegal trade, and China is recognized as a major source of demand (Di Minin et al., 2015; Emslie et al., 2016; Milliken & Shaw, 2012). While international trade continues to be banned by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Chinese government initiated the process of reopening its domestic trade in 2018, the ecological consequences of which are potentially significant (Cheung, Wang, & Biggs, 2018b).

Rhino horn is used in a variety of applications, including as a medicinal ingredient in traditional Chinese medicine (TCM) in herbal decoctions consumed to treat illnesses and improve health (But, Lung, & Tam, 1990). In TCM, rhino horn is primarily used in the treatment of heat-based illnesses by dispelling heat, detoxifying the body and cooling the blood (Cheung, Mazerolle, Possingham, & Biggs, 2018, 2021b). We previously reported in this journal that there continue to be considerable levels of medicinal rhino horn consumption in China, with 14.4% of TCM consumers surveyed in Guangdong province having used rhino horn in the past year (Cheung, Mazerolle, et al., 2021c).

1.1 | Trade bans and the poaching crisis

International and domestic trade bans, accompanied by anti-poaching measures, demand reduction interventions and efforts to tackle criminal networks, are central to the current approach to rhino conservation (Duffy, St John, Büscher, & Brockington, 2015; Nožina, 2020; Olmedo, Sharif, & Milner-Gulland, 2018). CITES has banned all international commercial trade since 1977, except for limited trade of live rhino and hunting trophies for South Africa's white rhino (CITES, 2019a). In China, legal domestic trade was shut down in 1993 when all CITES-listed species were brought under the Law on the Protection of Wildlife (People's Republic of China, 1989, 1993b). A separate policy circular explicitly banned all activities associated with trade in rhino horn, abolished all official rhino horn medicinal standards and outlawed further medicinal use (People's Republic of China, 1993a).

The marked increase in poaching in the last decade occurred in spite of these longstanding trade bans (Hübschle, 2017). Their failure to control poaching has raised questions over the effectiveness of the current conservation approach (Biggs, Courchamp, Martin, & Possingham, 2013; Conrad, 2012), with black market rhino horn prices of USD $30,000–60,000/kg making rhino lucrative poaching targets (Eikelboom et al., 2020). Further, the militarization of anti-poaching and the deployment of shoot-to-kill policies against suspected poachers have raised serious ethical concerns (Duffy et al., 2015; Lunstrum, 2014), while culturally insensitive demand reduction interventions risk alienating key stakeholders (Margulies, Wong, & Duffy, 2019; Smith, 2018). Consequently, an ongoing debate has emerged over alternate policy options like regulated trade legalization.

1.2 | Trade legalization: A contentious policy debate

Some conservationists argue that legal, regulated trade should be explored for certain high-value species like rhino (Challender & MacMillan, 2014). Regulated trade can depress black market prices from their current levels, reducing the financial incentives for illegal actors while generating funds for local community development and conservation programs (Biggs et al., 2013; Di Minin et al., 2015; Rubino & Pienaar, 2020). Horns grow continuously throughout a rhino's lifetime, making sustainable production possible. De-horning is safe (Lindsey & Taylor, 2011) and has been performed for decades to discourage poaching (Milner-Gulland, 1999). South Africa can produce around 5,300–13,400 kg of horn per year through de-horning (Taylor et al., 2017). Furthermore, considerable investment has gone into developing synthetic horns which are intended to be virtually indistinguishable from genuine horn. These are being developed to "flood the market" with mass produced, bio-identical synthetics to force black market prices down (Chen, 2017; Mi, Shao, & Vollrath, 2019).

Conversely, other conservationists have strongly opposed legalization. Much remains to be understood of market characteristics and trade dynamics, and there are concerns that legalization could boost demand and exacerbate poaching by removing the stigma surrounding its illegality (Collins, Fraser, & Snowball, 2013, 2016; Haas & Ferreira, 2016). Recent research in China has found that banning wildlife products may reduce the acceptability and social approval of their consumption (Rizzolo, 2021). A legal trade could also enable poached horn to be laundered into legal stocks. This is particularly concerning given existing levels of corruption along illegal wildlife trade routes (Eikelboom et al., 2020; Smith, Biggs, St. John, t' Sas-Rolfes, & Barrington, 2015; Wyatt, Johnson, Hunter, George, & Gunter, 2018). Rhino de-horning is also associated with animal welfare concerns (Brown, Dean, Possingham, & Biggs, 2019; Derkley, Biggs, Holden, & Phillips, 2019).

Perspectives on the consumptive use of wildlife are often polarized (Hutton & Leader-Williams, 2003), and the rhino horn trade legalization debate continues to be contentious. As with the discourse over ivory trade legalization, international policymaking on the rhino horn trade has become deadlocked (Biggs et al., 2017). Several rhino range states in southern Africa have advocated for international trade legalization, but multiple CITES proposals to permit some regulated international trade have been rejected (CITES, 2019b).

While international trade remains banned, two countries have recently made potentially consequential domestic policy changes. First, a South African High Court ruling in April 2017 struck down its domestic trade moratorium, and the first legal auction took place in August 2017 (Collins, Cox, & Marire, 2020; Rubino & Pienaar, 2020). This change has conservation implications because South Africa is home to 80% of the world's rhino. Second, China's State Council issued an official circular in October 2018 to reopen its domestic trade and conditionally permit medicinal rhino horn use (People's Republic of China, 2018b). China's decision drew broad international criticism (UNEP, 2018; WWF Global, 2018), prompting the issuance of detailed regulations required for implementation to be postponed, though China remains committed to reopening trade (People's Republic of China, 2018a). The implementation of this policy could have serious conservation implications given China's considerable share of global demand (Emslie et al., 2016; Milliken & Shaw, 2012).

More research is needed to support decision-making on this issue (Dang & Nielsen, 2020), including research on the potential impacts of trade legalization. This includes understanding how the perspectives and behaviors of key stakeholders in the trade chain, including TCM practitioners (physicians) and consumers, may be influenced by trade legalization (Cheung, Mazerolle, Possingham, & Biggs, 2021a). In this study, we conducted an online survey with TCM consumers in southeastern China to investigate their attitudes toward rhino conservation and the medicinal use of rhino horn, and whether trade legalization is likely to impact stigmatization and consumption. We hypothesized that trade legalization is likely to:

- Reduce the stigmatization of rhino horn use by TCM consumers;
- Increase the likelihood of unprescribed rhino horn use by TCM consumers;
- Increase the likelihood of rhino horn use by TCM consumers if they have been prescribed to do so by a TCM practitioner; and

- Increase the likelihood of TCM consumers recommending the medicinal use of rhino horn to others (specifically family members).

2 | METHODS

2.1 | Study area

Guangdong is China's largest province by population (108,490,000 in 2015) and one of the wealthiest (household per capita disposable income ~USD $4,170, per capita GDP ~USD $10,900 in 2015; National Bureau of Statistics of China, 2016). Its high Internet penetration rate—which has probably increased from 74.0% in 2016 (China Internet Network Information Center, 2017)—is comparable to that of advanced economies like the United States. A 2014 study found that the consumption of wildlife as food and for medicinal purposes is also higher in Guangzhou (Guangdong's provincial capital) than in other major cities—31.2% of people in Guangzhou consume TCM or health products containing wildlife ingredients annually, compared with 1.5% in Beijing and 2.8% in Shanghai (Zhang & Yin, 2014). Geographical and social variations in health and illness are an established phenomenon in TCM (Hanson, 2011); the most common reasons TCM practitioners prescribe rhino horn are for dispelling heat, detoxifying the blood and treating *wenbing* (温病, wēnbìng), which are "warm-heat" pathogenic diseases (Cheung, Mazerolle, et al., 2018) most associated with acute infections and epidemics in southern China. Notable epidemics of *wenbing*, known as *wenyi* (温疫, wēnyì), include SARS and COVID-19 (Hanson, 2011; Liu & Wang, 2020). Taken together, these factors suggest that rhino horn is likely to be more affordable to, and more widely used by, residents of Guangdong province, making it an appropriate location for our study.

2.2 | Online survey of TCM consumers

We conducted an online survey of TCM consumers in October 2019. Administering surveys through the Internet can reduce social desirability bias and increase the reporting of sensitive information when compared with other modes of questionnaire administration like telephone and paper-based surveys (Kreuter, Presser, & Tourangeau, 2008). We contracted Acorn Asia, a professional market research firm, to administer the survey to 2,188 participants recruited through their volunteer panel network. An additional 70 respondents who completed the survey were excluded during data cleaning (removed

from the dataset because responses were straight-lined, sped-through, inconsistent or contradictory). We recruited individuals who: (a) were aged 18 or over; (b) have resided in Guangdong province for the past year; and (c) have sought medical services from a TCM practitioner or consumed TCM products for medicinal purposes (including prescribed medication, patent medicines, and tonics) in the past year. These recruitment criteria were implemented at the beginning of the survey using screening questions. Our sample consisted of 1,042 male and 1,146 female respondents with an average age of 32.8 years, of whom 1,686 and 502 were holders of urban and rural *hukou* (戶口, *hùk u*; Chinese household registration system), respectively (demographic breakdown in Table 1).

To investigate attitudes toward rhino conservation and the medicinal use of rhino horn, we measured respondents' agreement on a 5-point Likert scale to statements adapted from a 2008 study on people's

attitudes toward tiger consumption and conservation in China (Gratwicke et al., 2008). For our impact of information experiment, participants were randomly divided into a control group and an experimental group of equal size and provided different information as to the legal status of trade. Past conservation studies have similarly investigated the impact of information on people's attitudes and behaviors (Draheim, Rockwood, Guagnano, & Parsons, 2011; Reimer et al., 2014). We presented our control group with the following information:

> Although the Central Government announced in 2018 that the domestic ban on rhino horn trade will be lifted, the domestic trade of rhino horn currently remains illegal because the relevant laws have yet to be changed. 虽然中国政府在2018年宣布将国内禁止犀牛角的贸易禁令取消，但相关法律尚

TABLE 1 Demographic characteristics for our sample of TCM consumers (*n* = 2,188)

Online survey respondent demographics					
Variable		**Result**	**Variable**		**Result**
Sex (*n*)	Male	1,042	Age (years)	Mean	32.8
	Female	1,146		Median	30
Administrative division in Guangdong province (*n*)	Guangzhou	947		Maximum	70
	Shenzhen	403		Minimum	18
	Dongguan	205	*Hukou* household registration (*n*)	Urban	1,686
	Foshan	201		Rural	502
	Zhuhai	66	Highest level of education (*n*)	Junior secondary or less	26
	Shantou	65		Senior/vocational secondary	208
	Zhongshan	52		Technical/vocational college	455
	Jiangmen	41		Undergraduate degree	1,323
	Zhanjiang	32		Master's degree	157
	Huizhou	28		Doctorate or above	19
	Zhaoqing	25	Personal income (*n*)	Under RMB 30 k	135
	Shaoguan	23		RMB 30 k to 50 k	231
	Jieyang	21		RMB 50 k to 100 k	657
	Chaozhou	16		RMB 100 k to 200 k	834
	Qingyuan	15		RMB 200 k to 500 k	275
	Maoming	13		Over RMB 500 k	56
	Meizhou	8	Household income (*n*)	Under RMB 50 k	62
	Shanwei	8		RMB 50 k to 100 k	203
	Heyuan	7		RMB 100 k to 200 k	766
	Yangjiang	6		RMB 200 k to 500 k	904
	Yunfu	6		Over RMB 500 k	253

未修改，所以目前犀牛角在国内的贸易仍然是非法的。

In contrast, the experimental group was only informed of the government's intentions to legalize trade:

> The Central Government announced in 2018 that the domestic ban on rhino horn trade will be lifted, which will legalize its use in TCM. 中国政府在 2018 年宣布将国内禁止犀牛角的贸易禁令取消，这将使犀牛角在中医药上可合法使用。

Once presented with this information, participants in each group were asked a series of questions on their likelihood of future use, likelihood of recommending rhino horn to others (specifically family members) and stigmatization of rhino horn consumption.

A major argument against trade legalization is the concern that trade legalization will reduce stigma and thus boost demand and, by extension, poaching. Stigma is a well-established sociological concept, occurring "when an individual is disqualified from social acceptance due to a specific attribute or flaw" (Goffman, 1963). Stigmatization is the act of negatively labeling or branding an individual who does not meet society's normative expectations (Palamar, Kiang, & Halkitis, 2011). To measure the stigmatization of rhino horn use among TCM consumers in our study, we adapted a seven-item scale (see Appendix S1) originally developed and validated by Palamar et al. (2011) to measure the stigmatization of general (recreational/experimental) illicit drug use in a sample of the general population. This approach contrasted with those of past drug use studies, which traditionally focused on the stigma of drug abuse and addiction (Luoma et al., 2007). Adapting the measures developed by Palamar et al. (2011) was more appropriate for our study because the medicinal use of rhino horn in TCM is not a matter of addiction.

2.3 | Data analysis

We analyzed our data in R using four hierarchical multiple regressions. These were done to investigate the potential impact that trade legalization would have on the likelihood that TCM consumers would: (a) destigmatize rhino horn consumption; (b) consume rhino horn if it were prescribed by a TCM practitioner; (c) consume rhino horn without a prescription; and (d) recommend the medicinal use of rhino horn to a family member. Our models also included past consumption of rhino horn and demographic data as independent variables. We

assessed our data and models to ensure that normality, linearity, homoscedasticity, and multicollinearity assumptions were not violated (Field, Miles, & Field, 2012).

2.4 | Research ethics

This study complied with the Australian National Health and Medical Research Council's National Statement on Ethical Conduct in Human Research and was approved by The University of Queensland (#2019000961).

3 | RESULTS

3.1 | Attitudes toward rhino conservation and medicinal use of rhino horn

The attitudes of our respondents toward rhino conservation and medicinal rhino horn use are summarized in Table 2. More than 90% of respondents ($n = 2,055$, 93.93%) believed that protecting rhinos in the wild is important, though agreement was less pronounced when it came to whether the medicinal use of rhino horn will contribute to species extinction ($n = 1,015$, 46.39%). 32.86% of respondents ($n = 719$) believed that medicinal rhino horn consumption is essential for their health, rising to 54.66% ($n = 1,196$) if it had been prescribed to them by a TCM practitioner. Most respondents ($n = 1,318$, 60.24%) saw such consumption as a part of their Chinese heritage, with very few believing that it is old-fashioned ($n = 355$, 16.22%) or that it is bad for China's global image ($n = 710$, 32.45%). A majority ($n = 1,418$, 64.81%) did not agree that rhino horn is consumed more as a status symbol than for its medicinal effects.

3.2 | Impact of information on legal status of trade

One thousand and ninety two participants were randomly assigned to the control group and told that rhino horn remains illegal despite the Chinese government's intentions to legalize trade. The experimental group was only presented information on the government's legalization plans (without clarification that trade remains illegal) and consisted of 1,096 participants. We found that presenting different information about the legal status of the rhino horn trade in China had a significant but small effect on the stigmatization of rhino horn consumers

TABLE 2 Attitudes toward rhino conservation and the medicinal consumption of rhino horn among TCM consumers ($n = 2,188$)

Question	M	SD	Strongly agree		Agree		Neither		Disagree		Strongly disagree	
			n	%	n	%	n	%	n	%	n	%
It is important to protect wild rhinos.	4.52	0.63	1,279	58.46%	776	35.47%	126	5.76%	4	0.18%	3	0.14%
The medicinal consumption of rhino horn will contribute to the extinction of wild rhinos.	3.36	1.05	318	14.53%	697	31.86%	722	33.00%	359	16.41%	92	4.20%
The medicinal consumption of rhino horn is bad for the planet.	3.15	0.99	214	9.78%	525	23.99%	924	42.23%	435	19.88%	90	4.11%
The medicinal consumption of rhino horn is essential for my health.	3.10	0.95	142	6.49%	577	26.37%	932	42.60%	427	19.52%	110	5.03%
The medicinal consumption of rhino horn is necessary if prescribed to me by a TCM practitioner.	3.52	0.85	212	9.69%	984	44.97%	770	35.19%	178	8.14%	44	2.01%
The medicinal consumption of rhino horn is bad for China's global image.	3.06	1.03	193	8.82%	517	23.63%	825	37.71%	525	23.99%	128	5.85%
The medicinal consumption of rhino horn is part of my Chinese heritage.	3.67	0.88	356	16.27%	962	43.97%	693	31.67%	144	6.58%	33	1.51%
The medicinal consumption of rhino horn is old-fashioned.	2.61	0.98	104	4.75%	251	11.47%	760	34.73%	839	38.35%	234	10.69%
Rhino horn is consumed as a status symbol rather than for its medicinal effects.	2.24	1.09	83	3.79%	220	10.05%	467	21.34%	780	35.65%	638	29.16%

(Table 3). Though the difference was significant ($p = .002$), respondents in both control and experimental groups tended not to perceive stigma toward the consumption of rhino horn ($M_{treatment} = 2.77$; $M_{control} = 2.75$; 5-point Likert scale). Younger people also tended to perceive slightly more stigma toward the medicinal consumption of rhino horn than older individuals ($p = .022$). Although the null hypothesis can be rejected, our model's low R^2 value indicates that it could only explain some of the observed variance.

Participants in both groups were somewhat likely to consume rhino horn if it were prescribed by a TCM practitioner, with the experimental group being more likely to do so than the control group ($M_{treatment} = 3.87$, $M_{control} = 3.77$; 5-point Likert scale). This was found to be a statistically significant predictor in a hierarchical multiple regression ($p = .032$); no other variables were found to be significant. As with the first regression, our model could only explain a small fraction of the variance in the data even though the null hypothesis can be rejected (Table 4).

Without a prescription to do so, respondents in both control and experimental groups are unlikely to consume rhino horn ($M_{treatment} = 2.77$, $M_{control} = 2.75$; 5-point Likert scale). We did not find this to be a significant predictor in a regression. The only statistically significant variable to predict likelihood of consuming rhino horn without a prescription was gender, with men more likely to report a behavioral intention to do so than women ($p = .004$). The model's low R^2 value indicates that the model could only account for a small amount of the variance observed (Table 5).

Finally, we found that participants in both the treatment and control groups are not likely to recommend rhino horn to a family member, with the control group more unlikely to do so ($M_{treatment} = 3.02$; $M_{control} = 2.91$; 5-point Likert scale). A hierarchical multiple regression showed the provision of different information on trade legalization to be a significant predictor for recommending its use to relatives ($p = .055$) (Table 6). Gender was also a significant predictor; men were more likely than women to report an intention to recommend

TABLE 3 Hierarchical multiple regression for the stigmatization of rhino horn users

Variable	Model 1 B	SE	β	p	Model 2 B	SE	β	p	Model 3 B	SE	β	p
Constant	2.793	0.172		**<.001**	2.787	0.173		**<.001**	2.957	0.181		**<.001**
Age	−0.005	0.002	−2.534	**.011**	−0.005	0.002	−2.465	**.014**	−0.005	0.002	−2.293	**.022**
Gender (M/F)	0.051	0.040	1.280	.201	0.050	0.040	1.269	.205	0.036	0.040	0.901	.368
Hukou urban/rural	0.001	0.050	0.029	.977	0.001	0.050	0.026	.979	−0.002	0.050	−0.038	.970
Education	0.017	0.027	0.624	.533	0.017	0.027	0.638	.523	0.025	0.027	0.912	.362
Personal income	−0.023	0.028	−0.807	.420	−0.022	0.028	−0.784	.433	−0.025	0.028	−0.896	.370
Household income	0.041	0.034	1.200	.230	0.041	0.034	1.221	.222	0.045	0.034	1.331	.183
Consumed rhino horn in the past					−0.019	0.053	−0.357	.721	−0.009	0.053	−0.171	.864
Control/experimental group									−0.124	0.040	−3.132	**.002**
R^2				.006				.006				.010
Adjusted R^2				.003				.003				.007
ΔR^2								+<.001				**+.004**
F				2.071				1.793				2.802
df				6 (2181)				7 (2180)				8 (2179)
p-value				.054				.084				**.004**

Note: Stigmatization was measured using a seven item scale (5-point Likert) adapted from Palamar et al. (2011). ***Bold italics*** = significant at 95% confidence interval; **bold** = significant at 90% confidence interval.

TABLE 4 Hierarchical multiple regression for the likelihood of consuming rhino horn medicinally if prescribed by a TCM practitioner

Variable	Model 1				Model 2				Model 3			
	B	SE	β	p	B	SE	β	p	B	SE	β	p
Constant	3.866	0.179		**<.001**	3.847	0.180		**<.001**	3.726	0.189		**<.001**
Age	0.003	0.002	1.530	.126	0.004	0.002	1.666	**.096**	0.003	0.002	1.546	.122
Gender (M/F)	−0.062	0.041	−1.498	.134	−0.063	0.041	−1.530	.126	−0.053	0.042	−1.274	.203
Hukou urban/rural	−0.050	0.052	−0.964	.335	−0.051	0.052	−0.972	.331	−0.049	0.052	−0.929	.353
Education	0.041	0.029	1.454	.146	0.043	0.029	1.501	.134	0.037	0.029	1.308	.191
Personal income	0.010	0.030	0.322	.748	0.012	0.030	0.392	.695	0.014	0.030	0.468	.640
Household income	−0.053	0.035	−1.499	.134	−0.050	0.035	−1.418	.157	−0.053	0.035	−1.492	.136
Consumed rhino horn in the past					−0.063	0.055	−1.145	.252	−0.070	0.055	−1.271	.204
Control/experimental group									0.089	0.041	2.145	**.032**
R^2				.005				.006				.008
Adjusted R^2				.002				.002				.004
ΔR^2								+.001				+.002
F				1.850				1.773				2.129
df				6 (2181)				7 (2180)				8 (2179)
p-value				.086				.088				**.030**

Note: **Bold italics** = significant at 95% confidence interval; **bold** = significant at 90% confidence interval.

TABLE 5 Hierarchical multiple regression for the likelihood of consuming rhino horn medicinally without a prescription

Variable	Model 1 B	SE	β	p	Model 2 B	SE	β	p	Model 3 B	SE	β	p
Constant	2.859	0.215		**<.001**	2.845	0.216		**<.001**	2.853	0.227		**<.001**
Age	−0.001	0.003	−0.243	.808	<0.001	0.003	−0.143	.887	<0.001	0.003	−0.136	.892
Gender (M/F)	−0.142	0.050	−2.864	**.004**	−0.143	0.050	−2.884	**.004**	−0.144	0.050	−2.878	**.004**
Hukou urban/rural	0.027	0.063	0.422	.673	0.026	0.063	0.417	.677	0.026	0.063	0.414	.679
Education	0.031	0.034	0.898	.369	0.032	0.034	0.929	.353	0.032	0.034	0.935	.350
Personal income	0.051	0.036	1.432	.152	0.053	0.036	1.476	.140	0.052	0.036	1.471	.142
Household income	−0.052	0.042	−1.239	.215	−0.050	0.042	−1.184	.236	−0.050	0.042	−1.179	.238
Consumed rhino horn in the past					−0.050	0.066	−0.760	.447	−0.050	0.067	−0.752	.452
Control/experimental group									−0.006	0.050	−0.118	.906
R^2				.006				.006				.006
Adjusted R^2				.003				.003				.003
ΔR^2				+<.001				+<.001				+<.001
F				2.243				2.005				1.755
df				6 (2181)				7 (2180)				8 (2179)
p-value				**.037**				**.051**				**.081**

Note: **Bold italics** = significant at 95% confidence interval; **bold** = significant at 90% confidence interval.

TABLE 6 Hierarchical multiple regression for the likelihood of recommending medicinal rhino horn consumption to a family relative

Variable	Model 1				Model 2				Model 3			
	B	SE	β	p	B	SE	β	p	B	SE	β	p
Constant	3.113	0.207		**<.001**	3.105	0.208		**<.001**	2.980	0.218		**<.001**
Age	<0.001	0.002	−0.183	.855	<0.001	0.002	−0.130	.896	−0.001	0.002	−0.237	.813
Gender (M/F)	−0.167	0.048	−3.495	**<.001**	−0.167	0.048	−3.504	**<.001**	−0.157	0.048	−3.261	**.001**
Hukou urban/rural	0.036	0.060	0.599	.549	0.036	0.060	0.596	.551	0.038	0.060	0.636	.525
Education	0.041	0.033	1.253	.210	0.042	0.033	1.268	.205	0.036	0.033	1.095	.274
Personal income	0.000	0.034	−0.009	.993	0.001	0.034	0.016	.987	0.003	0.034	0.085	.933
Household income	−0.021	0.041	−0.528	.598	−0.020	0.041	−0.499	.618	−0.023	0.041	−0.565	.572
Consumed rhino horn in the past					−0.025	0.064	−0.397	.691	−0.033	0.064	−0.511	.610
Control/experimental group									0.092	0.048	1.924	**.055**
R^2				.007				.007				.008
Adjusted R^2				.004				.004				.005
ΔR^2								+<.001				+.002
F				2.434				2.108				2.309
df				6 (2181)				7 (2180)				8 (2179)
p-value				**.024**				**.040**				**.018**

Note: **Bold *italics*** = significant at 95% confidence interval; **bold** = significant at 90% confidence interval.

rhino horn for medicinal consumption ($p = .001$). This regression also had a low R^2 value.

4 | DISCUSSION

The failure of existing conservation measures to control the rhino poaching crisis has opened an ongoing debate over trade legalization (Biggs et al., 2013; Dang & Nielsen, 2020; Eikelboom et al., 2020). Polarized views over sustainable use have deadlocked both debate and international policymaking (Biggs et al., 2017; CITES, 2019b; Hutton & Leader-Williams, 2003). The need for more research on this issue became more urgent in 2018 when China initiated the process of reopening its domestic trade (People's Republic of China, 2018b). In this study, we contributed novel findings to address some of the existing uncertainties, facilitate more nuanced discourse and support decision-making. We gained insight into how trade legalization is likely to impact Chinese consumers, investigating their attitudes toward rhino conservation and medicinal rhino horn use. We conducted an impact of information experiment by assessing the stigmatization of rhino horn use and likelihood of rhino horn use among respondents who were presented with different information on the legal status of the rhino horn trade.

Whether legalization is likely to lift the stigma attached to the illegal consumption of rhino horn is a significant concern in the trade policy debate. Collins et al. (2013) noted that "it is unclear whether any stigma is associated with rhino horn usage in eastern countries." Here, we adapted composite scales developed to study stigma associated with illicit drug use (Palamar et al., 2011) to measure the stigmatization of rhino horn use among TCM consumers who were given different information on the legal status of rhino horn trade in China. We found that participants in both our control and experimental groups tended not to perceive much stigma toward the consumption of rhino horn. This appears to be consistent with the deep cultural roots of TCM (Cheung et al., 2021), with 60.24% of our respondents believing that the medicinal consumption of rhino horn is a part of their Chinese heritage. However, we did find stigmatization to be lower among respondents in our experimental group (who were not presented clarification that trade currently remains illegal) than those in our control group (who were informed that rhino horn remains illegal despite the government's plans to reopen trade) (Table 3).

In short, while stigmatization of rhino horn use is limited at present, it is likely to drop further with domestic trade legalization. This is consistent with the results of Rizzolo's (2021) recent experimental vignette survey in

China, which found that wildlife product bans reduce the acceptability and social approval of consumption. As such, our results substantiate to an extent the hypothesis that trade legalization would reduce the stigma surrounding rhino horn use, and the concern for conservation then becomes whether or not this would amplify demand so as to exacerbate poaching (Eikelboom et al., 2020; Haas & Ferreira, 2016; WWF Global, 2018). Indeed, respondents in our experimental group were more likely to use rhino horn if prescribed by a TCM practitioner to do so (Table 4), and more likely to recommend rhino horn to a family member (Table 6). However, without a prescription, TCM consumers would be unlikely to seek out rhino horn significantly more than they do at present. Our data on TCM consumer attitudes further contextualizes these findings. While 32.86% of our respondents ($n = 719$) considered the medicinal consumption of rhino horn to be essential for their health, this rose to 54.66% ($n = 1,196$) if rhino horn had been prescribed by a TCM practitioner (Table 2). Health researchers have noted that there is a tendency for Chinese society to exhibit a "doctor knows best" healthcare culture (Leung, Wong, Chan, Choi, & Lo, 2005), with which our results here appear to be consistent.

The provision of different information on the current legal status of rhino horn did not significantly affect TCM consumers' likelihood of consuming rhino horn without a prescription (Table 5). This indicates that while trade legalization would lift stigma, rates of unprescribed consumption among consumers may not be affected in the same manner as prescription usage (Table 4). Our results indicate that if the Chinese government follows through with reopening its domestic trade, the most likely source of increased demand in Guangdong province is prescription usage.

These findings are particularly noteworthy when the stipulations outlined in the 2018 circular are considered. In legalizing trade, clinical access is to be restricted to "qualified" doctors in "eligible" hospitals for the treatment of severe, critical or rare illnesses. However, details regarding the specific conditions for which legal access will be granted remain to be determined, and the criteria for "qualified" doctors and "eligible" hospitals remain undefined (People's Republic of China, 2018b). Given our findings that prescription usage represents the most likely source of increased demand in a legal trade, working closely with the relevant government authorities and TCM stakeholders to establish precise criteria and the necessary regulatory mechanisms regarding legal access by TCM professionals can be an area of focus for conservationists.

The demographic variables that we found to be statistically significant in our regressions can also be used to

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improve conservation actions. We found that younger people tended to stigmatize rhino horn use more, and that men were more likely to report an intention to use rhino horn and recommend it to others. These findings can be used—both at present and in any future legal trade—to optimize regulatory enforcement and deterrence strategies on groups that are more likely to consume rhino horn (Haas & Ferreira, 2018; Nurse, 2015). They can also be used to enhance the targeting and tailoring of demand reduction interventions to improve their effectiveness (Greenfield & Veríssimo, 2019; Olmedo et al., 2018).

4.1 | Study limitations and conclusion

We stress that our results should not be taken as a simulation of the impacts of trade legalization and that our experimental methodology had various limitations. Firstly, we focused on TCM consumers in Guangdong province, and our results are not representative of the entire Chinese populace. Recruiting survey participants online poses methodological challenges. Non-coverage from varied Internet accessibility can skew samples toward greater participation by men, younger people, and individuals with higher income and education (Bethlehem, 2010; Blasius & Brandt, 2010). Drawing a sample from individuals who have registered to take part in web surveys may not be representative of the study population (Lee, 2006). Furthermore, we employed basic measures of attitudes adapted from a previous study of attitudes toward tiger bone consumption in China (Gratwicke et al., 2008). Further research into wildlife value orientations in the context of rhino horn use (Manfredo, Teel, & Dietsch, 2016), especially with the use of measures specifically designed for Chinese or Asian sociocultural contexts (Teel, Manfredo, & Stinchfield, 2007), would be valuable.

As we were unable to control for prior knowledge that respondents may have had of China's trade legalization plans, the ways in which we could present the information on the current legal status of rhino horn to our control and experimental groups were limited. These limitations are likely to have contributed to the low R^2 values seen in our four regressions, in addition to the likelihood that other potentially significant variables (e.g., patient medical history and other medical preferences or motivations) were not measured in the study. We hypothesize that some of the variability in our data is attributable to the rarity of situations in which rhino horn is medically appropriate, and further research should focus on patients with a medical history involving the kinds of severe or life-threatening conditions for which rhino horn is considered medically appropriate by TCM practitioners (Cheung, Mazerolle, et al., 2018).

This is the first study to our knowledge to report that trade legalization is likely to reduce the already limited stigmatization of rhino horn use among TCM consumers. This substantiates to some degree one of the major concerns raised against proposals to legalize trade (Collins et al., 2013). However, we are unable to definitively assess the potential impacts of such trade policy change on poaching without further insight, particularly with regards to the price elasticity of demand for rhino horn among TCM stakeholders (Chen & t′ Sas-Rolfes, 2021). Further research is needed to help determine whether a ban or legalization is more likely to succeed.

In conclusion, the roots of rhino horn use in TCM are deep and complex, and TCM remains an integral part of Chinese culture, society, and identity (Cheung, Doughty, et al., 2021; Jovchelovitch & Gervais, 1999). Although the Chinese government delayed the reopening of domestic rhino horn trade following international criticism, it remains committed to doing so (People's Republic of China, 2018a). Even though the COVID-19 pandemic has placed the global spotlight on wildlife consumption (Volpato, Fontefrancesco, Gruppuso, Zocchi, & Pieroni, 2020) and prompted China to curb wildlife consumption as food (People's Republic of China, 2020), the use of wildlife products in TCM is almost certain to continue for the foreseeable future (Cheung, Doughty, et al., 2021). China's COVID-19 response highlighted the centrality of TCM in its healthcare system, and TCM featured prominently in China's official clinical guidance for frontline medical personnel (including recommendations of endangered species products in certain situations; People's Republic of China, 2020). There is no indication at the present time that the Chinese government's plans to reopen the domestic rhino horn trade will be abandoned, especially since the State Council's 2018 circular explicitly stipulated that clinical use by qualified medical professionals would be one of the few applications permitted (People's Republic of China, 2018b). However, there may be an increased appetite in Beijing in the aftermath of the pandemic to ensure that strict controls are established to prevent the misuse of rhino horn (and other wildlife products) outside of approved settings and conditions. Given our finding that trade legalization is likely to increase rhino horn use by TCM consumers only if so prescribed, conservationists should engage constructively with policymakers and TCM stakeholders to influence the process of establishing medical standards and regulatory mechanisms such that clinical access in a future legal trade will indeed be restricted and stringently controlled.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTION

All authors made a significant contribution to the design and execution of this research. Hubert Cheung conceived the study, collected and analyzed the data, and led the writing of the manuscript. Lorraine Mazerolle guided survey design and data analysis. Lorraine Mazerolle, Hugh P. Possingham, and Duan Biggs contributed critical input to the writing of the manuscript. All authors approved the final manuscript.

DATA AVAILABILITY STATEMENT

Per the conditions of the project's human research ethics approval obtained from the University of Queensland, requests for data used in this study can be made by contacting the corresponding author.

ETHICS STATEMENT

This study complied with the Australian National Health and Medical Research Council's National Statement on Ethical Conduct in Human Research and was approved by the University of Queensland (#2019000961).

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