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Research Article

The Role of Media During COVID-19 Global Outbreak: A Conservation Perspective

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Abstract

The COVID-19 pandemic is fast driving the ways of life and economies. In this study, we used Zimbabwe as a case study to assess how different forms of media are being utilised to access information of the COVID-19 disease (across age, educational level, and employment status). We investigated people's perceptions of the origins of COVID-19, its implication on the continued consumption of meat from wildlife species by humans, and management strategies of wildlife species that harbour the coronavirus. We gathered 139 responses using an online structured questionnaire survey. Social media platforms were used to acquire information on the COVID-19 pandemic when compared to traditional sources (television, radio, and newspapers). Most respondents thought that the COVID-19 virus was created by humans (n = 55, mostly the young and middle-aged) while others believed that it originated from animals (n = 54, mostly middle-aged with postgraduate qualifications). The majority (73%) of respondents who cited COVID-19 origin as animals also supported a ban on consumption of meat from the species. The middle-aged respondents (in comparison to the young and older respondents) and those who were employed (compared to the unemployed) were more likely to support the ban in wildlife trade. The likelihood of visiting wildlife centres given the consequences of COVID-19 was significantly lower in the old-aged respondents when compared to the young and the middle-aged respondents. Our results emphasize the need for science to penetrate social media circles to provide appropriate information. The observed perceptions about visiting wildlife centres could negatively impact conservation funding.

Keywords

wildlife, conservation, perceptions, media, Zimbabwe, COVID-19

The COVID-19 disease is an illness caused by a novel coronavirus (CoV) called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (Huang et al., 2020). It was first identified in Wuhan City, Hubei Province, China in December 2019. The pandemic has spread at an alarming rate infecting millions of people. Cases rose from one confirmed case in January 2020 to 31 cases by 18 February 2020 in Wuhan (Jung & Shin, 2020). The cases continued to increase globally and by August 2020 more than 22,000,000 people had been infected while more than 772,000 had lost their lives. By 10 November 2020 there were 1,257,523 confirmed death cases according to the World Health Organization website. The COVID-19 pandemic is more than a health crisis as it is affecting many aspects of societies and their

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economies in unprecedented ways (McKibbin & Fernando, 2020). The impact of the pandemic will vary from country to country due to unique economic systems, cultures, and livelihood sources. Assessments of COVID-19 impacts on all sectors of society, economies, and vulnerable groups are therefore crucial in informing and tailoring the responses of governments and partners to recover from the crisis. It is against this background that this study aimed to assess people's perceptions regarding COVID-19 effects on wildlife management and tourism.

Corona Viruses are zoonotic pathogens transmitted to humans through direct contact. All the CoVs that caused epidemics in the past are said to have originated in bats and transmitted to humans through an intermediate animal host (Alanagreh et al., 2020). For example SARS-CoV was transmitted through contact with civet cats (Guan et al., 2003) and the Middle East Respiratory Syndrome (MERS)-CoV through contact with camels (Alagaili et al., 2014). The genome sequence of SARS-CoV-2 is 96% identical to a bat CoV RaTG13 (Nadeem et al., 2020; Yan-Rong et al., 2020). However, SARS-CoV-2 is thought to have originated from a seafood market in China and bats were not available for sale on this market (Wu et al., 2020). Furthermore, receptor-binding domain (RBD) of the RaTG13-CoV is different from the one in SARS-CoV-2, exhibiting a low binding ability to the human ACE2 (angiotensin-converting enzyme 2) and providing possibility of intermediate hosts, such as turtles, pangolins, and snakes (Nadeem et al., 2020; Zhang et al., 2020). The genome sequence of the pangolin coronavirus is 99% similar to SARS-CoV-2 and the RBD has only one amino acid difference and hence pangolins are the most probable intermediary species for the transfer of SARS-CoV-2 (Yan-Rong et al., 2020; Zhang et al., 2020). Infected pangolins have been reported to exhibit symptoms similar to humans suffering from COVID-19 (Nadeem et al., 2020).

Considering the emphasis on wildlife being the source of COVID-19, perceptions of the public towards wildlife are of primary concern to conservation (Beedell & Rehman, 2000;).Perceptions refer to the beliefs or opinions people hold based on how things seem. Previous studies have established a negative relationship between perceptions of danger of a species and people's willingness to conserve it, for example in insects (Tarakini et al., 2020) and fish (Danylchuk et al., 2017). Hence negative perceptions about the pangolin are worrying, as it is already categorised as critically endangered under the IUCN Red List of Threatened Species. The situation may be worse for wildlife species existing outside protected areas, as they may be extirpated easily by the general public which fear them. Bats and other wildlife species alike may not be important for tourism but they provide important ecosystem services such as arthropod suppression, seed dispersal, and pollination of a wide variety of ecologically and economically important plants (Kunz et al., 2011). Their loss may destabilize ecosystems.

While communicating the health risks posed by zoonotic diseases is vital in mitigating the spread of the disease, misinformation can potentially influence public perception of a given taxa (Macfarlane & Rocha, 2020). In acknowledgement of this, the Director-General of the World Health Organization has said; "*We're not just fighting an epidemic; we're fighting an infodemic*" (Pennycook et al., 2020). During this pandemic, the public have been exposed to all sorts of information on the disease from various media platforms ranging from traditional (radio and TV) to non-traditional sources, mainly social media (e.g. Whatsapp, TikTok, Facebook, Twitter, and YouTube) (Cinelli et al., 2020). However, non-traditional sites because of their unregulated nature, may disseminate news without any filters or verifications. Social media has been used by some people to diffuse misinformation, disinformation, rumours, and conspiracy theories about the SARS-CoV-2, for example that COVID-19 is from 5 G network radiation (Brindha et al., 2020). Such infodemics may cause people to overreact or underreact. In the same vein, repeatedly linking wildlife to a particular zoonotic disease can potentially reduce societal support for conservation or lead to persecution of suspected disease reservoirs. As such it is important to understand how the media is influencing the public's perceptions towards wildlife (Gandiwa et al., 2014) and its conservation following the COVID-19 pandemic.

Theoretical Framework

The theory of planned behaviour (TPB) (Ajzen, 1991) attempts to explain behaviours over which people have the ability to exert self-control. The TPB tries to predict an individual's intentions to engage in a particular behavior at a specific time and place. The TPB has been used in a wide range of disciplines including health (covering intensions of smoking, drinking, breast-feeding etc.), agriculture such as the adoption of soil erosion control measures (Wauters et al., 2010), and evaluation of perspectives in wildlife conservation (Miller, 2017). Within the context of the current study, the TPB framework is being used to investigate willingness by people to consume meat from wildlife species and visit wildlife centres given the perceived risks of contracting the COVID-19 disease. The study investigates if the behavioral achievement of visiting wildlife centers depends on both motivation (i.e. intention to eat meat from wildlife species and enjoy various tourism adventures) and ability (i.e. control of their action given the risks of contracting COVID-19). It was also

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envisaged that the same framework could be useful in identifying groups of people that are more vulnerable to the COVID-19 related infodemics.

This study used the case of Zimbabwe, a southern African country to investigate possible effects of COVID-19 on the tourism industry. Zimbabwe has more than 14% of its areas set aside for wildlife conservation (Zimbabwe Park and Wildlife Authority, 2019) and about 8% of its gross domestic product from tourism activities (Chigora et al., 2019). While Zimbabwe has experienced pandemics in the past (mostly related to hygiene and water e.g. Cholera and Typhoid), none of the previous cases caught media attention in similar magnitudes as the COVID-19. Any negative perceptions towards wildlife following the COVID-19 pandemic might negatively affect wildlife based tourism and ultimately the economy. However, without knowing people's perceptions towards wildlife among different socio-demographic groups (e.g. gender, age, education, and employment status), it is difficult to know whether awareness programs are needed, and if they are needed which groups to target. It was hypothesised that people's perceptions of wildlife management will be influenced by sources of COVID-19 information, age, employment status, and education.

Methods

The study was conducted in Zimbabwe, a southern African country with a population of about 14.9 million people (Nyoni, 2019; Zimstat, 2015). The country is rich in biodiversity, and has some endemic species including seven species of reptiles, five amphibians, and 232 plants being endemic/near endemic (Mapaura, 2002). Wildlife conservation is important in Zimbabwe as it brings most tourists visiting areas such as Hwange, Gonarezhou, Mana Pools, Matobos, and Nyanga National Parks. There are also several smaller areas across the country where wildlife species are kept in enclosed structures for purposes of captive breeding, re-habilitation, education, and research. Wildlife based tourism has also benefited the country through trophy hunting, game viewing, job creation, travel, and hospitality (Muchapondwa, 2003). These wildlife areas host wildlife species that are known to be affected by viral diseases such as rabies, avian influenza, and rift valley fever (Kock, 2005).

Zimbabwe recorded its first COVID-19 case on the 20th of March 2020 according to official records from the Ministry of Health and Child Care and since then, the number of cases and deaths has been rising. Although the outbreak is still evolving in Zimbabwe, there is high potential for intense community transmission based on the living conditions.

Sampling

We used a questionnaire administered online during March and April 2020 which took approximately five to eight minutes to complete (Appendix). We purposely targeted various groups of people in Zimbabwe to acquire their views on COVID-19 and impacts on conservation. Our online questionnaire was therefore distributed to online platforms (emails, whatsapp, Facebook, and twitter) in high schools, religious institutions, environmental organisations, the health fraternity, policy makers, those working in various private and public entities as well as those who are self-employed. Using information on the geographic location from the questionnaire, we excluded one response from outside Zimbabwe. Due to the increasing availability of internet services in Zimbabwe, especially mobile networks (Amon et al., 2020), it was possible to have responses from most districts in the country. It was impossible to conduct complementary direct interviews (especially to those people who did not have appropriate gadgets to respond online – such as smartphones and computers). This was due to the lockdown restrictions that were still in place at that time in Zimbabwe (i.e people were not allowed to go outside of their homes except for essential services). The questionnaire was written in English as it is the universal language used in the country to communicate across tribes. Structured questions were used to provide quick and relatively accurate ideas on people's ideas concerning our subject. The "other" option was provided for some questions to enable respondents to explain other views besides those provided. We collected five socio-demographic variables from the respondents. These were 1) gender (male/female), 2) age in years (16–20; 21–25, 26–30, 31–35, 36–40, 41–45, 46–50, and 50 years and above), 3) the town/city/district of the respondent's residence, 4) the highest level of education attained, and 5) the respondent employment status (employed, entrepreneur and unemployed).

We also wanted to assess the people's perceptions on the source of the COVID-19 disease, being guided by what we obtained in the press during the time of survey design (i.e wild animals, domestic animals, manufactured in a laboratory, and God's punishment to humanity). For the respondents who thought that the COVID-19 disease originated in wildlife species, we probed them to suggest a possible action for the concerned species. Responses included total destruction of the species, prevention of further contact with humans, stopping the consumption of its meat, ban wildlife trade. For the two above mentioned questions, we included "not sure" and "others" as a response. We also asked if the respondent would be affected in the way in which they eat meat from wildlife species given the reported

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associations of SARS-CoV-2 with some wild animals. We restricted the respondents to give a yes/no answer.

Since some media suggested close links between COVID-19 disease and animals in wildlife sanctuaries/zoos, we asked respondents if they were still willing to visit such enclosed wildlife centres and wildlife protected areas (options for "yes" and "no" were provided).

Lastly, we asked the respondents to state the dominant source of information they had access to (responses included radio/television, newspapers, Ministry of Health website, Whatsapp, Twitter, Facebook, and other).

Data Presentation and Analysis

Due to paucity of data in some classes of our age, source of COVID-19 information, employment, and highest level of education attained, we re-categorised them. Age was recategorised to young adults (16–25 years), middle aged (26–45 years) and older respondents (46 or more years). The sources of COVID-19 information was re-categorised into formal (including Ministry of Health websites and radio/television), and social media (including Facebook, Whatsapp and Twitter). For the employment variable, we re-classified "entrepreneur" as employed to retain two classes of employed and unemployed. Lastly, the highest level of education was categorised as no tertiary education (all levels from Diploma, Advanced level and below); undergraduate; and postgraduate qualification (those who obtained a Master's degree or further).

We tested for associations between gender, education, employment status, and age with major sources of COVID-19 information, perceived origin of COVID-19 and effects on respondent consumption of wildlife meat using Chi-squared tests. Spatial associations were also tested for similarities in responses given. Considering the socio-demographic variables, we used binomial regression models to explore the factors that influenced respondents to 1) support the ban in wildlife trade; 2) visit an enclosed wildlife centre after the COVID-19 pandemic and whether or not they would support a ban in wildlife trade; and 3) change the way they eat meat from wildlife species considering their perceived option of dealing with the species from which COVID-19 originated. For the regressions, we used the Akaike Information Criterion (AIC) to select the model that best suited our data. The R statistical package was used to conduct the binomial regression models (R Development Core Team, 2020).

We used spatial techniques to explore the relationships between responses and other spatial phenomena such as distance of a respondent residence to a protected area. Hotspot analysis was carried out to establish geographical similarities in the responses given through the survey. Hotspot analysis of the geographical locations of responses was done using a combination of two indicators of spatial association, the Getis-Ord and the Moran I index. The spatial statistics were used to distinguish between two different kinds of spatial effects, that is, spatial interaction (spatial autocorrelation) and spatial structure (spatial heterogeneity). A positive Getis-Ord score as well as a positive Moran I value are indicative of clustering of near-similar responses given (Mitchell, 2005). The ArcGIS version 10.7 was used to generate statistics related to spatial correlation of data sets in terms of dispersion or clustering.

Ethical Considerations

The study received an ethical clearance from Chinhoyi University of Technology.

Results

We managed to have 139 respondents completing our online survey. These constituted 75 males (54%) and 64 females (46%). The distribution of respondent's employment categories, highest education attained, and major source of COVID-19 information across age categories is summarised in Table 1. There were no significant associations between age, gender and employment with major sources of COVID-19 information and effects on respondent eating of wildlife meat ($p > 0.05$ in all cases). The COVID-19 disease was believed to have originated from wild animals (by 39% of respondents), made by humans (40%), domestic animals (6%), God sent (7%), and those who had no idea constituted 8%. The perceived source of COVID-19 was significantly associated with respondent age (Fishers $\chi^2 = 17.299$, $df = 8$, $p = 0.019$). Of the 55 respondents who believed that the COVID-19 disease was created by humans,

Table 1. A Summary of Socio-Demographic Characteristics of Respondents Who Participated in This Study.

	Employment category		Highest education attained			Source of information	
Age	Employed	Unemployed	no tertiary	Postgraduate	Undergraduate	Social media	Official media
Young	14	7	17	2	2	18	3
Middle	91	10	39	19	43	71	30
Older	15	2	8	4	5	10	7

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92.7% (n = 51) were from the young and middle age categories. Also, out of the 54 respondents who believed that COVID-19 disease originated from wild animals, 77.8% (n = 42) of them were middle-aged. The perceived source of COVID-19 was also significantly associated with respondent highest level of education attained (Fishers $\chi^2 = 55.512$, df = 8, $p < 0.001$), with all the respondents who attained postgraduate education level (n = 25) indicating the source of COVID-19 as wild animals. The perceived source of COVID-19 was also significantly associated with decisions on what should be done to the wildlife species implicated. The majority of those who perceived the disease to have originated from animals (73%) supported a ban on the eating of meat from wildlife species in which the viruses similar to the SARS-CoV-2 were detected. Forty-seven percent of those who perceived that the disease was made by humans supported a ban on trade of wildlife species, and 45% of those who had no idea where it came from also supported the ban. The majority of those who thought it was God sent (60%) supported total destruction of wildlife species. Perceptions of what should be done with wildlife species were also significantly associated with education (Fishers $\chi^2 = 38.274$, df = 6, $p < 0.001$). No respondent with postgraduate qualification advocated for total destruction of the wildlife species in which the SARS-CoV-2 was detected.

Individual decisions on what to be done about the wildlife species responsible for transmitting COVID-19 showed that 11% were not sure, 8% supported banning contact with the species, 5% supported total destruction of the species, 29% supported a ban in wildlife trade, and 47% supported a ban in eating wildlife. Individual decisions on what should be done to the species responsible for transmitting COVID-19 was significantly associated with employment status (Fishers $\chi^2 = 16.795$, df = 6, $p = 0.011$); perceived origins of COVID-19 (Fishers $\chi^2 = 77.718$, df = 12, $p = 0.010$); and education (Fishers $\chi^2 = 38.274$, df = 6, $p = 0.011$). The majority (88%) of respondents who were employed advocated for a ban in consumption of meat from wildlife species connected to the disease. Only 12% of the employed were in support of banning contact of humans and the wildlife species.

The probability of respondents to support a ban in wildlife trade was significantly affected by age (*Wald* $\chi^2 = 10.233$, df = 2, $p = 0.006$), and employment status (*Wald* $\chi^2 = 6.14$, $df = 1$, $p = 0.013$). The middle-aged respondents were more likely to support the ban when compared to the young and older respondents (Figure 1A, Table 2). Also, respondents who were employed were more likely to support the ban when compared to the unemployed (Figure 1B).

The likelihood to visit enclosed wildlife centres was significantly influenced by respondent age (*Wald* $\chi^2 = 21.885$, df = 2, $p < 0.001$) and their inclination in support of the ban of wildlife trade (*Wald* $\chi^2 = 8.618$, df = 1, $p = 0.003$). The likelihood of visiting such wildlife centres was significantly lower in the older respondents when compared to the young and the middle-aged respondents (Figure 2A, Table 2). Those who supported a ban in wildlife trade had greater probabilities of visiting these wildlife centres, when compared to those who did not support it (Figure 2B).

The perceptions of young respondents residing in close geographic proximity to protected areas were more similar than perceptions of those residing further away from these areas. The spatial weights matrix generated indicated that there was low clustering (Figure 3) among the different age groups that would continue visiting wildlife centres. The inverse was observed in

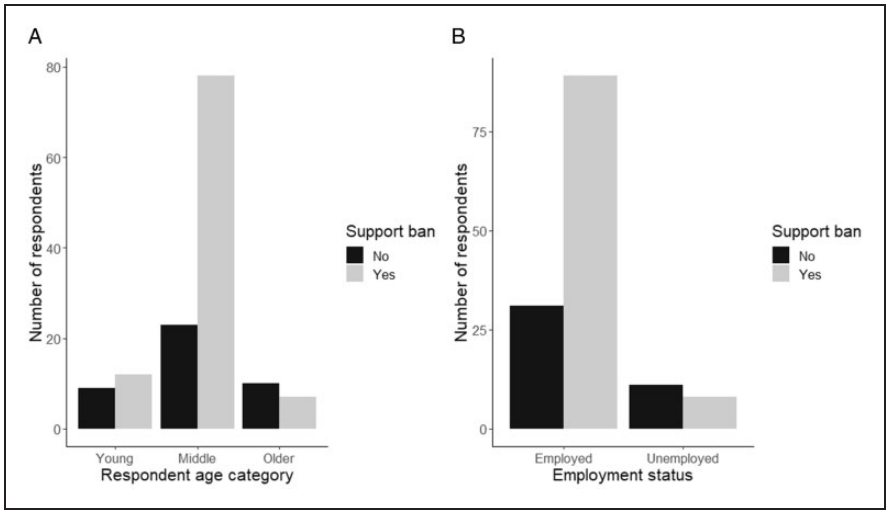


Figure 1. Support of the ban of wildlife trade. Illustration of respondent support to the ban of wildlife trade across (A) age categories and (B) employment following the COVID-19 pandemic in Zimbabwe.

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Table 2. The Results of the Binary Logistic Model Showing Selected Variables That Were Significantly Associated Informant Responses.

Model	Variable	Estimate	Std. Error	z value	*P* value
Species trade ban	Intercept	0.746	0.5	1.495	0.135
	Middle aged	0.644	0.53	1.208	0.2272
	Older	−0.973	0.7	−1.395	0.1632
	Unemployed	−1.331	0.54	−2.472	0.0134
Visiting wildlife centers	Intercept	2.39	1.04	2.29	0.0221
	Middle aged	−1.646	1.09	−1.513	0.1303
	Older	−3.678	1.17	−3.131	0.0017
	Support trade	1.482	0.5	2.94	0.0033
Changing wildlife consumption	Intercept	−1.504	0.78	−1.924	0.0544
	Official media	−1.209	0.49	−2.459	0.0139
	No consumption	1.447	0.83	1.742	0.0814
	No trade	0.234	0.89	0.262	0.7935
	Destroy species	3.455	1	3.457	0.0005

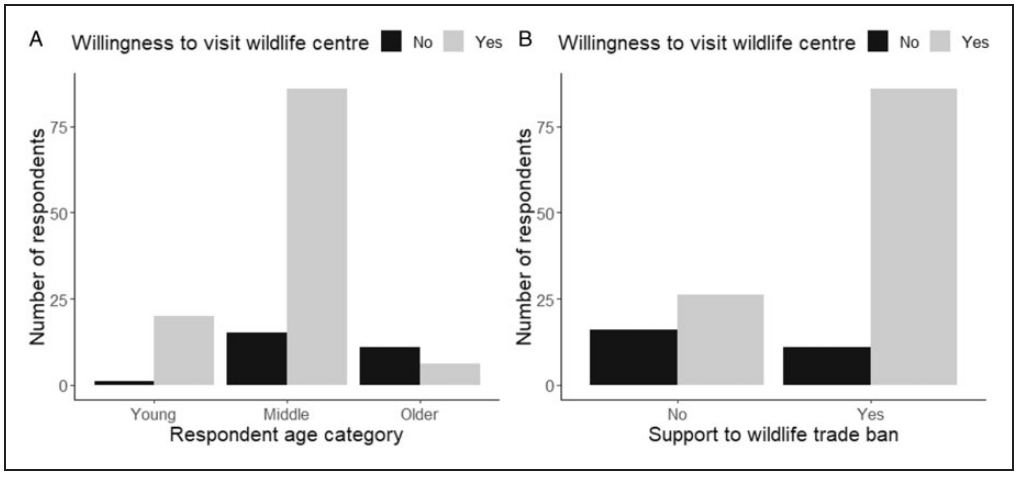


Figure 2. Willingness to visit wildlife centres. Illustration of willingness of Zimbabwean respondents to visit enclosed wildlife centres across (A) age categories and (B) their support to wildlife trade ban after knowledge of the COVID-19.

Bulawayo (0.75), Harare and Chinhoyi (0.82), compared to Masvingo and Hwange (0.1) and other cities across the study area.

The probability of respondents being affected in the way they eat meat from wildlife species was significantly associated to the dominant source of COVID-19 information they cited ($Wald\ \chi^2 = 4.271,\ \mathrm{df} = 1,\ p = 0.039$) and the respondent idea of dealing with species from which the virus originated from ($Wald\ \chi^2 = 29.620,\ \mathrm{df} = 3,\ p < 0.001$). The respondents who obtained most of their information from social media were more likely to change whether or not they would eat meat from wildlife species than those who obtained it from official sources (Figure 4A, Table 2). The respondents who suggested the destruction of the species from which SARS-CoV-2 originated, and those who advocated for a stop to the eating of the species meat had higher probabilities of changing their consumption of wildlife meat when compared to those who suggested a ban to the species trade, and those who suggested no human contact to the species (Figure 4B). Figure 5 illustrates the spatial patterns of the major sources of COVID-19, with the majority of respondents relying on social media for information related to the COVID-19 pandemic.

The furthest respondent lived 185.78 km away from a protected area (between Shurugwi and Mapfungautsi Forest Land), whilst the shortest was 33.47 km (between Bulawayo and the Matobo Hills National Park). Spatial dependence was observed as responses were dependent on spatial location. Of all the respondents who cited wild animals as being the source of COVID-19, 16.54% (n = 7) stayed less than 98 km from a protected area.

Discussion

Management of wildlife is highly dependent on people's willingness to conserve it. During pandemics, people are

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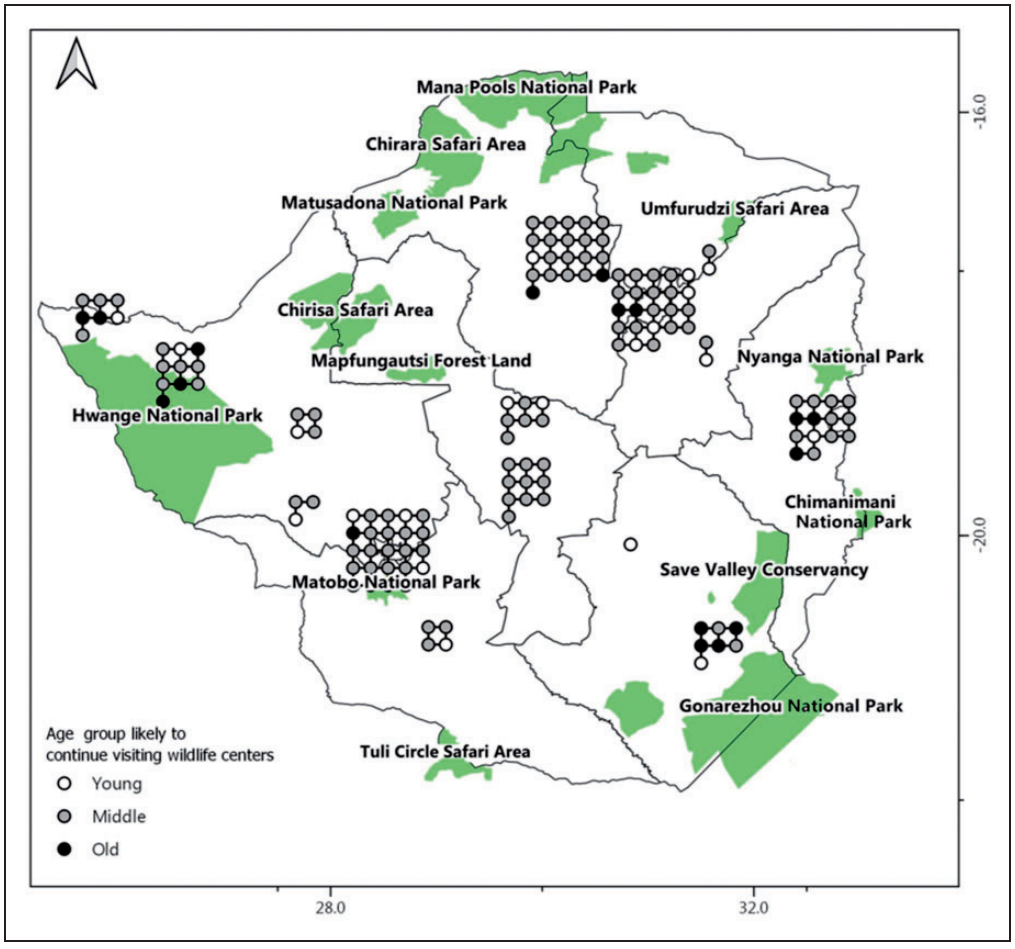


Figure 3. Map of Zimbabwe Showing Protected Areas and the Likelihood of Respondents to Visit Wildlife Centers Across Age Groups.

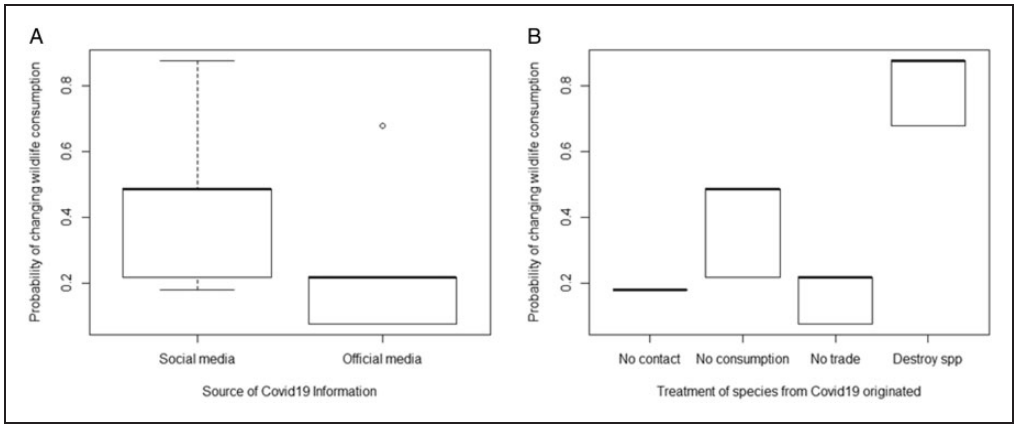


Figure 4. Probability of changing wildlife consumption. The probability of respondents to change their consumption of wildlife species depending on (A) the major source of information used and (B) the proposed action to be taken on the wildlife species from which SARS-CoV-2 originated.

exposed to various kinds of information which may influence their perceptions and ultimately their behaviour. The study attempted to determine people's perceptions towards wildlife following the COVID-19 pandemic and how these perceptions can potentially influence wildlife conservation.

According to this study, COVID-19 was perceived by a greater and almost equal proportion of respondents to

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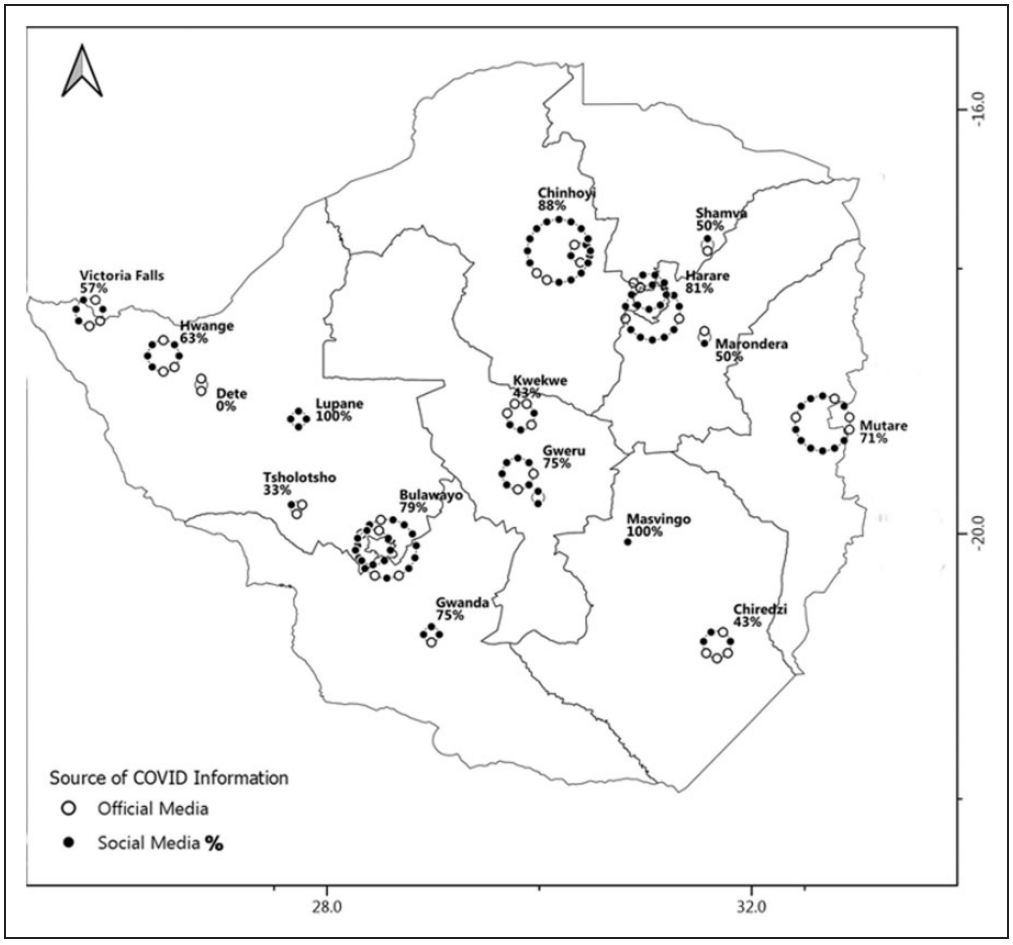


Figure 5. Sources of Information Utilized by Respondents Across Zimbabwe.

have originated from humans (in a laboratory) and wildlife species respectively. Media and its role in communication during the COVID-19 outbreak potentially improves people's understanding of the crisis by significantly reducing uncertainty and reassuring the victims. As a result, if properly administered, there could be less criticism towards an epidemic, creating an environment of mutual understanding of resolving the issue (Lyengar, 1990). While traditional media reports have not given explicit information on the source of the virus, social media has been awash on the possible source of the virus especially that it was manufactured in a laboratory (Cinelli et al., 2020). While science has provided evidence for zoonotic origins of the virus (Zhang et al., 2020), suggestions of the virus being made by humans are mainly based on theories with no scientific basis.

The majority of the young respondents perceived the disease to have been made by humans whereas the middle aged respondents perceived the source of the disease to be wildlife. The study also revealed that all respondents who had attained a postgraduate education perceived the source of COVID-19 to be zoonotic. These findings indicate differences in cognitive abilities across age and education level suggesting that the young and less educated are more vulnerable to misinformation compared to middle aged and the educated respondents (Roets, 2017). These findings are in line with observations by previous studies that the higher the education level attained, the higher the cognitive abilities (Bennett et al., 2003; Dufouil et al., 2003). There is therefore a need to assess groups that are more vulnerable to conspiracy theories or fake news and how this can be effectively managed. In addressing misconceptions and wrong beliefs about the disease that are antagonistic to wildlife conservation, conservationists may consider targeting these groups especially in cases of limited resources to address all populations. Disease prevention and minimisation of spread can also be a factor brought about by information flows that fully consider the power of messaging (Pieri, 2019).

Public's Reactions to the Pandemic

Most of the respondents in this study advocated for a ban in the eating of wildlife meat as a response to the

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pandemic. The probability of advocating for a ban in wildlife meat consumption was higher for those who perceived wildlife species to be the source of the disease. If such suggestions of stopping the consumption of meat from wildlife are coming from the people themselves, there could potentially be a reduction in the demand of wildlife meat which may be a positive development for wildlife conservation (Roe & Booker, 2019). These perceptions may also inspire support of stricter measures on preventing poaching and authorities may get public support since poaching will be conceived not only as a wildlife management issue but a global human health threat (Ntuli et al., 2020). A significant proportion of respondents also advocated for a ban in wildlife trade. This was expected as has been observed in previous outbreaks of zoonotic diseases. Following the outbreak of SARS, China temporarily imposed a ban on the trade of wildlife (Xie et al., 2020). With the outbreak of COVID-19, the Chinese government temporarily banned the trade of wild animals again (Hou et al., 2020; Xie et al., 2020). The general public in China reportedly supported the government in its efforts to reduce contact between humans and with wildlife species (Hou et al., 2020). This also has positive implications on wildlife management as reduced interests in wildlife trade by the public will reduce exploitation of wildlife for money. However, the high probability of visiting wildlife centres by those who supported a ban in wildlife trade may indicate that advocacy for ban in wildlife trade is not necessarily influenced by COVID-19 but other factors. There is a possibility that those who had always advocated for a ban in wildlife trade for one reason or another, may maximise on the COVID-19 pandemic opportunity to be heard. This confirms previous findings by Mejova and Kalimeri (2020) who noted how the pandemic has been greatly used by different sectors of society to push individual agendas such as political attacks, donation solicitations, business promotion and animal rights campaigning. Revived advocacies for banning wildlife trade by many people may result in governments introducing stricter rules to prevent illegal wildlife trafficking; minimize or eliminate wildlife trade which will ultimately improve wildlife conservation (Roe et al., 2020).

Some respondents, though the proportion was smaller, advocated for total destruction of species perceived to be sources of the SARS-CoV-2. This suggests that there are dangers of human persecution of some species in response to the COVID-19 pandemic. Conservationists might therefore consider educating the public on dangers of eliminating the species and efficient methods of preventing future infections. Outreach programmes may focus on those people with low levels of education as advocated by Tarakini et al. (2020). Considering that the threat of species total destruction mainly came from the less educated, a relatively higher proportion could have been detected if it were not for the study's limitations to those who have internet access, those with appropriate information technology gadgets, and those who are English literate. Destruction of species which are sources of COVID-19 by people may be a significant threat which wildlife conservationists need to assess and also work towards preventing. Indeed, the Convention on the Conservation of Migratory Species of Wild Animals (CMS) (2020) has reported that there are communities that have already sought to cull bats in an "effort" to combat the disease.

The likelihood to visit enclosed wildlife centres was significantly influenced by age and inclination to banning wildlife trade. The likelihood of visiting such wildlife centres was significantly lower in the older respondents when compared to the young and the middle-aged respondents. The older people may feel more vulnerable as has been emphasized by health authorities and governments that they are at greater risk of dying of COVID-19. However, the older people are crucial to tourism as they constitute a significant portion because of their level of wealth, higher discretionary income and greater free time to travel (Littrell et al., 2004). A significant reduction in the older people visiting wildlife centres may negatively impact the tourism sector at national levels. Most of these wildlife centres' (e.g. captive breeders, anti-poaching, research and environmental education) are sustained by money paid by tourists. Wildlife centres may need to educate the elderly populations on how their safety from COVID-19 is guaranteed in these centres. Furthermore there may be a need to redesign iconic wildlife tourism experiences for the good of both wildlife and humans. For example, in the Democratic Republic of Congo, tourism programme managers are re-evaluating tourism activities because of the need to reduce human contact with habituated apes (Newsome, 2020). Conservation groups indicate that COVID-19 presents an increased risk in the conservation status of African gorilla populations which are already critically endangered. However, noting the skewed distribution of our respondents across the age categories (i.e 21 young, 101 middle-aged and 17 older respondents), we cannot deny that there is a small likelihood that the age effects we detected are merely due to the small size. More data is therefore needed to verify these trends, more so through utilisation of other data collection methods and also engaging people who are offline and those that do not have appropriate gadgets to participate online.

The Role of Media in Framing COVID-19 Information

The framing of a topic usually involves the selection of certain aspects within a perceived reality, moulding and

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mainstreaming them in a way that promotes a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation for the item described (Entman, 1993). Age, gender, employment status, and perceived source of disease were all not significantly associated with major sources of COVID-19 information. These findings suggest that all age groups, gender and employment categories were equally exposed to all sources of information for COVID-19. This is possibly due to family structure in these communities (consisting of different age groups, gender and employment types) through which people live and share information. This makes it easier for wildlife conservation outreach programs and similar campaigns to reach various categories with their information not being biased to specific groups in society. However, social media was used by the majority of respondents as a source of information on COVID-19 in comparison to traditional methods like radio, TV, newspapers, and ministry of health reports. Apart from being an invaluable method for tracking epidemics in the 21st century, various types of social media have been used by experts to investigate public awareness, attitudes and reactions about specific diseases thus informing the decision making process (Smith et al., 2016). The observation also confirms previous findings that people use social media in seeking information about crises (Spence et al., 2006;). This implies that traditional methods of information dissemination were less effective and people could trust social media for important information delivery. It is therefore highly recommended that wildlife conservationists make use of social media platforms to enhance their impact. This realisation has also seen the World Health Organisation (WHO, 2020) signing up on TikTok social media to reach a wider audience. This further underscores the need to regulate information posted on social media considering the huge numbers depending on it for important information. The public may fail to distinguish authentic information to misinformation. This finding highlights the important role played by social media in influencing societal opinions, perceptions and behavior.

The most common perceived source of COVID-19 was that it was made in a laboratory (by 40% of respondents in this study). Such perceptions highlights the importance of proper media framing of the virus. In the same regard, Macfarlane and Rocha (2020) has argued that much of the ongoing media framing has been poorly crafted especially for bats and pangolins. Message framing of zoonotic diseases requires close collaboration between different stakeholders to avoid inadequately contextualized associations which can mask the intrinsic, ecological and economic importance of wildlife.

Study Limitations

We acknowledge that the data we collected were mainly from people who had access to the internet and appropriate devices which allowed them to respond to the online survey. Such criteria could have left out the views of those without access to such devices, and those who are not English literate. However, due to the countrywide lockdown restrictions, it was difficult for us to use other data collection means. Also, as the level of internet penetration has greatly improved to 60% of the population according to (POTRAZ, 2020) and that many smartphones could be used for this online survey, we therefore feel that these results offered us a good opportunity to assess the immediate response of people to the COVID-19 pandemic.

Implications for Conservation

The findings of the study revealed that perceptions about COVID-19 may both positively and negatively impact wildlife conservation. Advocacy for the stopping of wildlife meat consumption is expected to reduce demand for wildlife meat and poaching through reduced market demand and reduction in poaching. Support for a ban in wildlife trade may also protect wildlife from illegal wildlife trafficking and transfer of diseases across wildlife. However, the advocacy for total destruction of species implicated as sources of COVID-19 may result in human persecution of the species which may ultimately affect their survival. Wildlife conservationists are therefore recommended to conduct outreach programs to prevent persecution of species like pangolins and bats. Outreach programs should target less educated communities as they were the biggest threat. The reduced interest in visiting wildlife centres by older people may negatively impact wildlife based tourism which is sustained by money paid by tourists. Wildlife conservationists might need to rethink some of the activities in these centres that may cause human contact with wild animals exposing them to diseases. Outreach programs are also critical in informing the older people on measures put in place for their safety. Finally, conservation outreach programs need to consider using social media as it proved more efficient than traditional methods. However, there is a need for further research on mechanisms that should be put in place to regulate information on social media platforms to prevent spread of misinformation which may ultimately dilute desired facts.

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Appendix

The questions guide that were used in the designing of an online survey to assess people's perceptions about COVID-19 and wildlife conservation in Zimbabwe.

1. **Sex**

Male. . .. . .Female. . .. .

2. **Age** (years) please specify. . .. .

3. **Town/city/district of residence** please specify . . ..

4. **Highest education level attained**

Primary. . .. . .Secondary. . .. . .Tertiary. . .. .

5. **Employment**

Health. . .. . .Education. . .. . .Business. . .. . .Farming. . .. . .Other (please specify). . .. .

6. **Where do you think the Coronavirus which caused COVID-19 came from? Tick appropriate answer.**

Wild animals (please specify the name of animal). . .. . .Domestic animals (please specify the name of animal)- . . .. .Humans. . .. . .A biological weapon designed by scientists. . .. . .Other (please specify)- . . .. .Not sure. . .. .

7. **If you think it came from a specific wild animal, what would you recommend for the species? Tick appropriate response**

Its Total Destruction. . .. . .Prevent Human Contact with Species. . .. .

stop eating species. . .. . ban wildlife trade . . .. . .other (please specify) . . .. not sure. . .. .

8. **Did COVID- 19 disease negatively affect your desire to visit enclosed wildlife centres and protected areas? Tick your appropriate responses**

Yes. . .. . .No. . .. .

9. **Did the case of the COVID-19 disease negatively affect your desire to eat wildlife meat and fish?**

Yes. . .. . .No. . .. .

10. **What are your main sources of information on COVID- 19 disease? Tick all appropriate answers.**

Radio . . .. .TV. . .. . .Whatsapp. . .. . .Facebook. . .. . .Other (specify as many sources as possible). . .. .

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