Article:
Okumah, M orcid.org/0000-0002-2937-8467, Yeboah, AS and Asante-Wusu, I (2020) Unpacking the moderating role of age and gender in the belief–behaviour link: a study within the context of water resources pollution. Journal of Environmental Planning and Management, 63 (14). pp. 2607-2626. ISSN 0964-0568

https://doi.org/10.1080/09640568.2020.1742099

Unpacking the moderating role of age and gender in the belief–behaviour link: a study within the context of water resources pollution

Murat Okumah[a*], Ata Senior Yeboah[b] and Isaac Asante-Wusu[c]

[a] Sustainability Research Institute, *University of Leeds,* Leeds, LS2 9JT, England, UK
[b] Department of Planning, Faculty of Built Environment, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana
[c] Department of Geography, Environment & Society, University of Minnesota, 414 Social Sciences Building, 267 19th Avenue South, Minneapolis, MN 55455

[*]corresponding author: ee15sa@leeds.ac.uk

ABSTRACT

In Ghana, water resources represent a symbol of cultural authority, spiritual strength and a major source of wealth and power. To preserve these resources, taboos and customary practices were instituted as precepts in precolonial Ghanaian societies to regulate access. However, recent studies claim that the proliferation of Western religions has significantly diminished the potency of these centuries-long belief systems, with a potential impact on the role of beliefs on behaviours. Applying conditional process modelling to survey data from four rural communities in Ghana, we explore whether some beliefs influence pro-environmental behaviours in relation to water resources pollution; and examine the potential factors that moderate this link. Results show that some belief factors predict pro-environmental behaviour. However, this link depends on gender and age. The present study thus advances our understanding of the complex ways in which beliefs interact with sociodemographic variables to influence the adoption of pro-environmental behaviours.

KEYWORDS

Beliefs; Conditional Process Modelling; Ghana; Pro-environmental Behaviour; Water Resources Management

1. BACKGROUND

Water resource pollution is a major environmental problem affecting ecosystems and human health. Past studies have linked the deteriorating quality of water resources to anthropogenic factors such as unsafe methods of farming, and poor management of household waste (Hutchins, 2012; OECD, 2017; United Nations, 2016; United Nations Environment Programme, 2017). Studies exploring the drivers of pollution have suggested that beliefs are a major driver of behaviours that contribute to water resource pollution. For instance, a study by Adamptey et al., (2014) found that long-held perceptions about the

regenerative capacity of some mineral resources (e.g., diamonds) influence people to undertake mining activities, even when the mineral resources in the mine pit has been exhausted. Eventually, these perceptions contributed significantly to the deterioration of land and water resources in the studied communities. While these studies show that some beliefs contribute to the deterioration of land and water resources, other studies highlight the role of myths, norms and religious practices in the conservation of water resources. For example, Gupta et al., (2016) argue that some rural communities have, for centuries, respected aquatic life as they symbolise divinity and offer protection in some of the pools associated with temples in India. As a result, these beliefs have contributed to the formation of social norms regarding access and use of water resources. For example, a ban on fishing-related activities by the Buddhist had contributed significantly to the conservation of some water resources and aquatic life (e.g., rare animal species).

In Ghana, water resources are valuable as they represent a symbol of cultural authority, spiritual strength and a major source of wealth and power. The cultural significance of water resources in precolonial, colonial and postcolonial Ghanaian societies reflects in the notion of the fluid as a symbol of "coolness" and "purity"; virtues that are hardly interchangeable with any other fluid (e.g., Akyeampong, 1996). Therefore, to preserve these sacred virtues, various forms of taboos, myths, and customary practices were instituted as precepts in precolonial Ghanaian societies to regulate access to the fluid (Braun, 2015). For example, farming close to rivers and streams or defecating in and around watercourses were frowned upon (Awuah-Nyamekye et al., 2014); and offenders could face banishment, curse or public disgrace. In some communities, particular days of the week – for example, Tuesdays – were regarded as a sacred day of the sea god, a day for the "provider of life" to retire from his/her daily blessings (Sarfo-Mensah and Oduro, 2007). These taboos operated well in areas where the majority of the population were considered worshippers of idols and deities.

The symbolic significance of water as a cultural good along this religious logic in precolonial Ghanaian societies implied that power and gender politics over the use and access to the resource became a critical development issue, as it connected the social and spiritual worlds in the pursuit of life (Greene, 2002). For instance, the use of water in performing libation – a ritual medium of communicating with the gods and ancestral spirits – connects the living, the dead, and the unborn to the Supreme Being. Libation was mainly performed by the male sex, whereas women and children were not 'fit' to perform such rituals. Furthermore, the authority to use the resource reveals the powerplay of gender. For example, Akyeampong's (2001) analysis of the eco-social history of the Anlo people of south-eastern Ghana suggests that, as arrowheads of patriarchal traditional institutions, chiefs (who were mainly men) became the overall custodians of the resource and possessed executive, legislative and judicial powers to not only enact and enforce water regulations but also had the sole authority to resolve all claims and

disputes related to water access, use, and rights. In essence, age and gender were critical elements of the belief systems, and these systems were enmeshed in the cultural and religious significance of water.

Thus, critically examined, water constitutes an ideal metaphor for encapsulating the spectrums of power relations and belief systems which allow for the subjugation of women and young people. This derives from the fact that whilst various taboos in precolonial societies played a major role in conserving and preserving the "purity" of the resource, it was actively used as a tool for discrimination, elevating men's interests over those of other segments of society in relation to access to the resource (Owusu et al., 2016; Osei-Tutu, 2017; Aniah et al., 2014; Resurreccion et al., 2014). For instance, in some rural communities in Ghana and some parts of Africa, it is considered a taboo for a menstruating woman to draw water from rivers or streams, based on the culturally-inspired notion that she is unclean and might potentially contaminate the water (MacLean et al., 2020; Sarfo-Mensah and Oduro, 2007). However, due to the advent of colonialism and its concomitant proliferation of Western religions (especially Christianity) in Ghanaian societies, the potency of these centuries-long belief systems that regulated rivers as "sacred sites" among the Anlo people, for example, says Sandra Greene (2002), has significantly diminished. According to Greene, the penetration of Christian beliefs in Anlo has resulted in the erasures and alterations in the perceptions of women about place, space, and their bodies regarding the antiquated belief systems that regulated behaviours in relation to water rights, access, and use. Similarly Yeleliere et al. (2018: 8) conclude that "Customary law for the enforcement of norms on water usage [in Ghanaian societies] has now paled into irrelevance and is practiced only in rural communities". This suggests the potential of a decreasing role of myths, taboos and traditional leaders in water resources management.

Despite this conclusion, there is limited scientific evidence that interrogates this claim. Although existing studies provide insights into the belief-behaviour link, the complex interaction between belief and behaviour remains poorly understood because existing studies have mostly applied descriptive techniques that fail to unpack this complexity. For instance, Fielding et al., (2005) studied whether and how beliefs impact intentions to adopt riparian zone management. Their study revealed that strong intenders had a stronger belief that riparian management was associated with environmental benefits and such people paid less attention to the cost relative to weak intenders. These studies suggest that beliefs are influential in conservation practice. However, they fail to provide deeper insights into how socio-demographic factors (e.g., gender) interacts with cultural aspects. This kind of understanding requires the application of multivariate techniques that reveal the mechanisms through which variables transmit their effects onto others, as well as the conditions under which such relationships operate (Hayes, 2013). This much more advanced understanding of the (potential) role of beliefs in conservation practices could enhance the design and implementation of water management policies. Accordingly, using survey data from four communities in the Wenchi Municipality in Ghana, this study pursues two

key objectives: 1) establish whether beliefs affect pro-environmental behaviour in relation to water resources management; 2) establish potential conditions under which beliefs affect pro-environmental behaviour.

2. THEORETICAL FRAMEWORK: HEALTH BELIEF MODEL

The Health Belief Model (HBM), regarded as one of the oldest social cognition theories, was developed to predict people's involvement in health-related examinations (Rosenstock, 1974; Mullen et al., 1987; Norman and Conner, 1996). The HBM seeks to predict whether people would engage in healthy behaviours to control or reduce the chances of contracting a disease and/or premature deaths. The HBM posits that two main typologies of beliefs drive people's intent and readiness to adopt preventive measures: beliefs regarding willingness to take action and beliefs that are related to factors that might facilitate or constrain an action. It is argued that perceived susceptibility and severity of a condition are key drivers of people's willingness to engage in healthy behaviours. Similarly, the benefits and costs associated with an action may be regarded as drivers of behaviours (Sheeran and Abraham, 1996; Rosenstock et al., 1974).

The inherent flexibility in the application of the model makes it much more appropriate for application in predicting a myriad of human behaviours (Norman and Conner, 1996). Some empirical studies have provided evidence to support the belief-behaviour link. These studies suggest that people are more likely to engage in positive environmental behaviours when they hold the belief that they have the capacity to help address environmental problems through their actions (e.g., Axelrod and Lenman, 1993; Grob, 1995; Huebner, 1981; Kiatkawsin and Han, 2017). Also, beliefs about whether environmental circumstances will either improve to the benefit of all or threaten a larger segment of the population influence people's decisions to act pro-environmentally or otherwise (Kiatkawsin and Han, 2017; Stern, 2000; Stern et al., 1999). Individuals holding stronger beliefs and ideals that are critical to conserving the environment are more likely to develop obligations to preserve the environment (Kiatkawsin and Han, 2017; Davari and Strutton, 2014; Tanner and Wolfing Kast, 2003) due to perceptions regarding the consequences of their behaviours on the environment.

What existing studies fail to unpack is the complex ways in which gender, age, religion, and other socio-cultural variables interact with beliefs to determine behaviours. Some studies (e.g., Hunt, 1997; Dawson, 1995; White, 1999; Chatterjee and Lundquist, 2002) have found that gender differences influence beliefs to engage in ethical and/or unethical behaviours within various communities and among different segments of society. In the viewpoint of Peterson et al., (2001), age is an instrumental predictor of beliefs, which in turn leads to behaviours. They indicate further that relatively older people have higher ethical beliefs that drive them to take up positive behaviours. However, the complexities surrounding how these factors interact with beliefs to determine behaviours remains unresolved in

conventional literature. Following this gap, the present study attempts to model these variables with the intent of dwelling on beliefs to predict behaviours. We believe that exploring the complex ways in which beliefs interact with socio-demographic variables could advance our understanding of the (potential) role of beliefs in relation to pro-environmental behaviour, and how different social groups may respond to environmental policies.

3. MATERIALS AND METHODS

3.1 Study Area

The research focused on four communities namely, Awisa, Subinso, Suhum and Atuna which fall under the jurisdiction of the Wenchi Municipal Assembly in the Brong-Ahafo Region of Ghana. Geographically, the municipality shares boundary to the south with Sunyani Municipality, the north with Kintampo South District, the west with Tain District and the east with the Techiman Municipality. Figure 1 shows the location of the municipality in the context of the Brong-Ahafo Region of Ghana (now the Bono Region). It is situated within latitudes 7^{o} 30' South and 7^{o} 15' North and longitudes 2^{o} 17' West and 1^{o} 55' East. The Municipality covers a total land area of 1,296.6 km^{2}.

Major rivers such as Tekyerebete, Tain, Subin, Yoyo and Atwene flows through the Municipality. A significant proportion of the rural dwellers depend on these natural water resources to undertake domestic, agricultural, and industrial activities (Wenchi Municipal Assembly, 2014). Consequently, there is a strong link between water resources and humans. This strong interaction has contributed positively to the Municipality's progress but at the same time, some anthropogenic factors contribute to the pollution of the water resources (Wenchi Municipal Assembly, 2014; Okumah et al., 2020). The Wenchi Municipal Assembly (2014) reports that major water bodies in the Municipality have undergone significant deterioration in terms of their quality owing to certain human-induced factors. It is therefore important to explore the drivers of behaviours in relation to water resource access and use, and whether cultural beliefs play a key role. These reasons, together, justify our selection of the Wenchi Municipality and the four rural communities for the research.

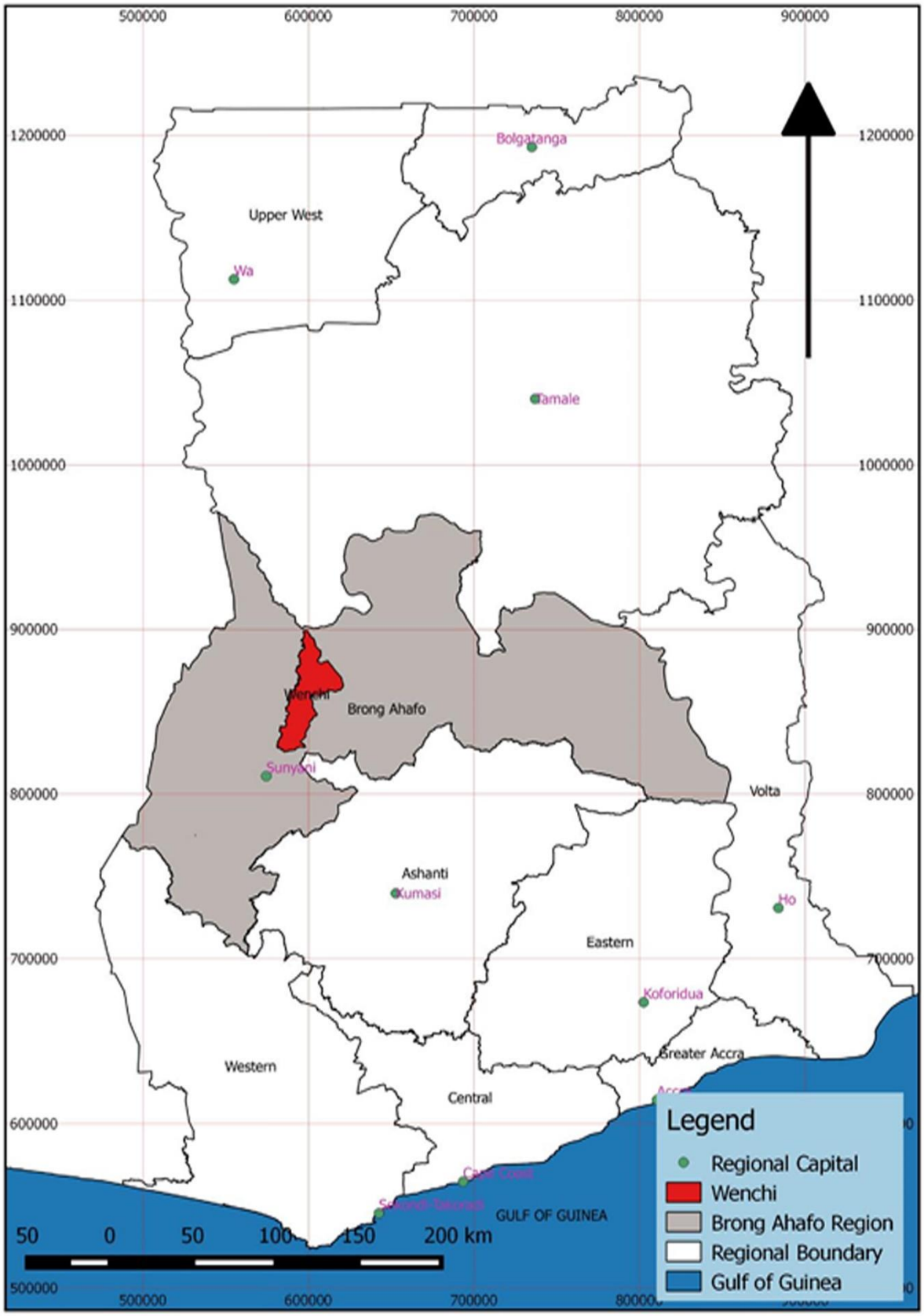

Figure 1: Map of the Wenchi Municipality
Source: Wenchi Municipal Assembly, 2014.

3.2 Data Collection

A survey instrument was developed for this research. Following the preparation of the first draft of the survey instrument, we pretested it among eight inhabitants of the community for two reasons: first, to ensure that the instrument was appropriate for our study area, and second, to address potential issues associated with acquiesces bias. A survey was conducted in the four rural communities between November 2018 and January 2019. We recruited interview participants through convenience sampling, where we contacted individuals on the streets, pubs, riverside, churches and other places and asked if they were willing to participate in the survey. We focused on residents of the study communities (and excluded strangers, travellers and visitors in the community at the time of the study) because their practices contribute to river pollution and also have a role to play in the design of water policies at the local level (Okumah and Yeboah, 2019; Wenchi Municipal Assembly, 2014). For instance, some residents of the community are authorities at the Municipal Assembly and may be involved in the regulation of practices that affect water resources. Also, some residents of the Municipality undertake agricultural and industrial activities, which constitutes economic activities that could potentially deteriorate the quality of water resources in the Municipality (Okumah and Yeboah, 2019; Wenchi Municipal Assembly, 2014). Moreover, as reported by the Municipal authority, some residents of the Municipality may have made it a habit of disposing of their solid and liquid waste and industrial effluents into the water resources, thus, contributing to water pollution.

We observed that 24 people did not want to take part because they had other commitments at the time of our fieldwork. Additional eight people did not want to participate because they felt unconfident enough to respond to our questions. Seven women wanted their husbands' permission (due to cultural norms) but their husbands we not available at the time they were contacted. We found six others not suitable. Overall, a total of 322 responses were obtained. The median age of the respondents was 33 years with 34.8, 10.8 and 47 as the mean, standard deviation and range respectively. Additionally, 52.8% of the survey participants were males whilst 47.2% of the participants were females.

We recognise that the convenience sampling technique we adopted might be prone to biases arising from self-selection (Hedt and Pagano, 2011). For example, we only surveyed individuals who had visited any of the water resources (rivers) in our research sites within the past 12 months. Respondents were asked if they had done the following (during any of their visits) in the past 12 months: 1) Dropped litter (e.g., cigarettes, condoms, cotton swabs, diapers, medication/drugs, needles, paper towels and/or wipes) around the riverbank or into the river, and 2) Washed bicycle, tricycle, car, lorry or clothes (using chemical soap) around the riverbank or in the river. The response was either "YES" = 0 or "NO" = 1. Selecting "NO" implied that the respondent had acted pro-environmentally (coded as 1) while selecting "YES" suggests that their act was not in support of the goals of water resource protection (coded as 0). Next, respondents were asked whether they believed any of those practices had effects on water quality,

or why they would not engage in such practices. This was framed as: "If people stop washing and/or littering around the riverbank or into the river, it will…" See Table 1 for the belief statements. Responses here were also "YES" or "NO".

Table 1: Belief Statements

CODE	BELIEF STATEMENT	RESPONSE	
BEL_1	Reduce water or river pollution.		
BEL_2	Save living organisms in the river.		
BEL_3	Improve the recreational value of the river.		
BEL_4	Reduce illnesses and diseases associated with water pollution (for example, Diarrhoea, Cholera, Intestinal worms).		
BEL_5	Be a sign of respect to my ancestors and river gods.	Yes	No
BEL_6	Stop the river gods from cursing me, my family and/or future generations.	(1)	(0)
BEL_7	Will keep the water clean for spiritual purposes (For example, baptism, ablution/Wuḍū, traditional rituals).		
BEL_8	Help me avoid punishment from the chief and other traditional leaders.		
BEL_9	Help me avoid punishment from the government authorities.		

3.3 Analytical Methods

We applied the conditional process modelling technique to analyse the survey data. The technique is suitable for this study because it enables the exploration of complex links such as the mechanisms (i.e., how) through which variables transmit their effects onto other variables and as well as the conditions (i.e., when) under which this happens (Hayes, 2013; 2012). Additionally, conditional process modelling allows for the inclusion of several variables in a single interaction analysis, helping to account for confounding and epiphenomenal links, and help improve the validity and reliability of model parameter estimates (Hayes, 2012, 2013; Lomax and Schumacker, 2012). Since our key objectives were to identify links and the conditions under which these happen, i.e., potential moderators, the conditional process modelling suits our study.

In our model, the nine belief statements are the independent variables while the two behavioural statements are the dependent variables. We included age and gender categories in the model as moderators, through sub-group analysis. A moderator represents a variable which contingently influences the statistical significance, direction and/or strength of a relationship between two or more other variables (Hayes, 2013). Again, applying sub-group analysis has advantages because it focuses on differences between multiple clusters, as opposed to effects in each sub-group separately, thus increasing the statistical power of the analysis (Thompson and Higgins, 2002). We included age and gender as moderators because these variables have been identified in the literature as factors that influence environmental attitudes and pro-environmental behaviour (e.g., Okumah and Ankomah-Hackman., 2020; Mensah, 2012; Cobbinah, 2015) and thus could influence the link between belief and behaviour. However, we note that these studies include those variables in first-generation statistical procedures which often fail to unpack the complex interactions between psychosocial variables (e.g.,

belief), demographic factors (e.g., age and gender) and pro-environmental behaviour (Bagozzi and Yi, 2012; Hayes, 2013; Okumah et al., 2019). Our study, therefore, adds a layer of complexity to the analysis of such relationships by employing conditional process modelling and including age and gender as moderators.

The data for the variable "age" was continuous or scale. For procedural reasons, the data for age were clustered into two main groups: young and old, with young representing participants whose age was below the median[1] age (33 years), while the older group represented participants aged 33 upwards. Applying the median as a binary marker for dividing respondents into two groups is arbitrary and thus not applicable to other populations. This is because the median was derived from the ages of survey respondents, making it subjective. The results of the present study therefore apply to populations with similar characteristics. Results should, therefore, be interpreted with caution as we are unable to extrapolate findings to all communities in Ghana and beyond. However, the results may be useful in facilitating thinking about how fairly young and old people in rural communities (in Ghana) perceive some cultural issues and whether and how these beliefs influence their behaviours.

We ran the conditional process modelling, a combination of SPSS IBM version 24 and the lavaan package within RStudio (0.5-23.1097) (Rosseel, 2017). The diagonally weighted least squares (DWLS) was applied as the model estimation method, as evidence shows that this method works well under situations such as ours, where there are small sample sizes and categorical data with non-normal (e.g., Rhemtulla et al., 2012). To evaluate the fit of the models and the data used, we relied on a range of incremental and absolute indices that are recommended in the SEM literature. The inclusion of incremental and absolute indices was based on the argument that different indices reflect diverse aspects of model fit (Hu and Bentler, 1999; Brown 2006; Hooper et al., 2008).

3. RESULTS

3.1 Overview of Responses

In Figure 2, we present a summary of the survey participants' responses to the questions on behaviours and beliefs. The majority of participants (63.7%) stated that they had washed bicycle, tricycle, car, lorry or clothes (using chemical soap) around the riverbank or in the river within the past 12 months. However, less than half (34.5%) of participants indicated that they had dropped litter (e.g., cigarettes, condoms, cotton swabs, diapers, medicine/drugs, needles, paper towels and/or wipes) around the riverbank or into the river within the same period. Regarding beliefs, while results varied slightly across

[1] We relied on the median because the data was not normally distributed: Kolmogorov-Smirnov statistic = .105; degree of freedom = 322; p-value = 0.00), making the median reliable than the mean (34.8).

different belief statements, the majority indicated that they believed in the statements asked, with the lowest being 61.5% ("*be a sign of respect to my ancestors and river gods*") and the highest, 94.7% ("*Improve the recreational value of the river*"). These results might suggest that the beliefs captured in this study are still widely held among the populace.

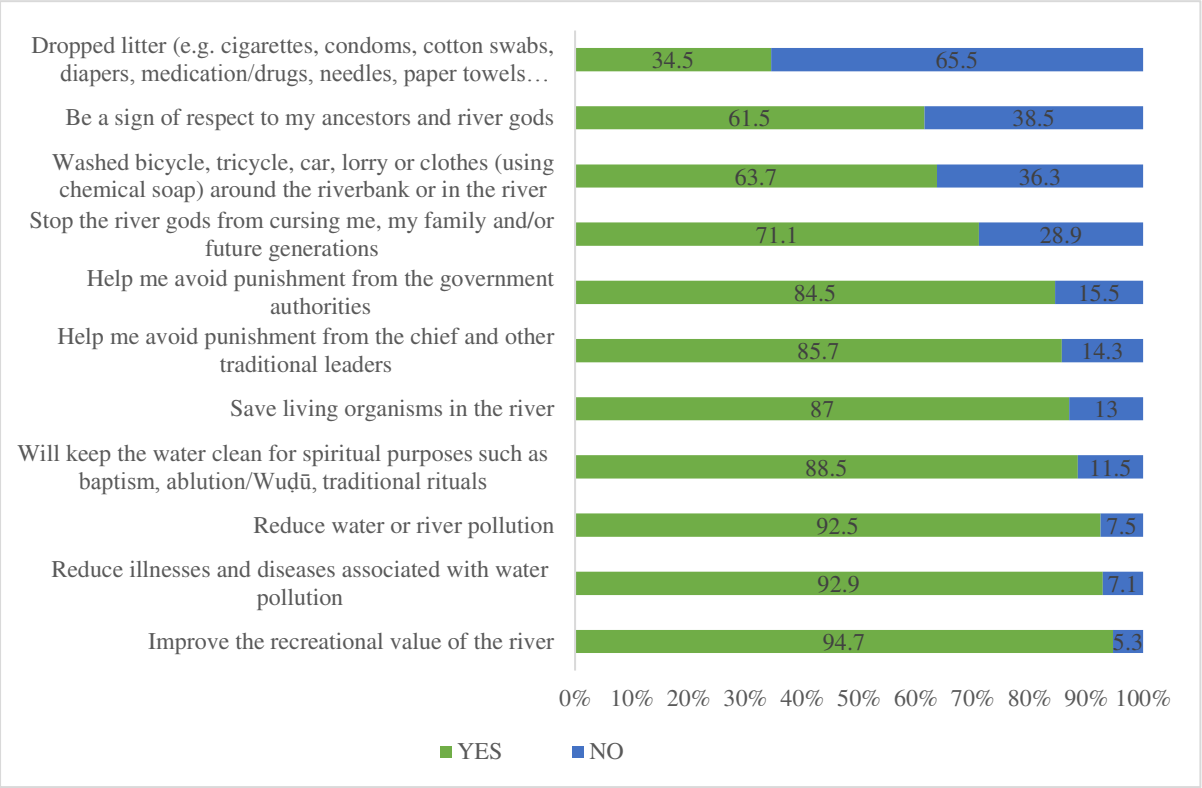

Figure 2: Survey Reponses to Behaviour and Belief Statements

3.2 Influence of Beliefs on Behaviour

In this section, we explore whether or not the nine beliefs affect the two measures of pro-environmental behaviour and the conditions under which these relationships operate.

3.2.1. Relationship between beliefs and litter dropping (Behaviour 1)

Here, we test whether the belief factors influenced individuals' behaviour (dropping litter e.g., cigarettes, condoms, cotton swabs, diapers, medicine/drugs, needles, paper towels or wipes around the riverbank or into the river). To assess the fit of the model, we relied on a range of incremental and absolute indices given that different indices reflect diverse aspects of model fit (Hu and Bentler, 1999; Brown 2006; Hooper et al., 2008). Results indicate a satisfactory fit: $\chi 2$ (n = 322) = 50.3, $p<0.05$; comparative fit index (CFI) = 1; Non Normed Fit Index (NNFI) = 1; Root mean square error of approximation (RMSEA) =0.000; Standardized Root Mean Square Residual (SRMR) = 0.000. From

Table 2, results show that there was no evidence of a relationship between belief and pro-environmental behaviour ($p>0.1$).

There is evidence, however, to suggest that gender and age moderate the relationship between belief and pro-environmental behaviour (Table 2). For instance, among the male group, people who believed that engaging in the recommended practices will help them avoid punishment from government authorities were more likely to have acted pro-environmentally ($p<0.1$), i.e., they were more likely not to have dropped litter indiscriminately in the past 12 months. However, this relationship was non-existent among the female population ($p>0.1$). Further, younger people (below 33 years) who had a belief that acting pro-environmentally in relation to water resources management will reduce illnesses and diseases associated with water pollution were more likely to have acted pro-environmentally ($p<0.1$). However, we do not find evidence to support the relationship between belief and pro-environmental behaviour among the older group ($p>0.1$).

3.2.2. Relationship between beliefs and washing bicycle, tricycle, car, lorry or clothes in the river (Behaviour 2)

In this section, we explore whether the belief factors influenced individuals' tendency to wash bicycle, tricycle, car/lorry or clothes (using chemical soap) around the riverbank or in the river. Results indicate a fair fit: $\chi 2$ ($n = 322$) = 6.94, $p>0.05$; CFI = 1; NNFI = 1.231; RMSEA =0.000; Standardized Root Mean Square Residual (SRMR) = 0.000. Results in Table 3 show that some belief factors influence pro-environmental behaviour ($p<0.1$). The results suggest that people who believe that engaging in the recommended pro-environmental behaviours will reduce river pollution (BEL_1), save living organisms in the river (BEL_2) and improve the recreational value of the river were more likely **not** to have washed bicycle, tricycle, car, and lorry or clothes (using chemical soap) around the riverbank or in the river within the last 12 months. However, there was no evidence supporting the hypothesized link between behaviour and other beliefs (Table 3).

Results of a subgroup analysis (Table 3) show that among the females group, individuals who believe that practising the recommended pro-environmental behaviours will stop the river gods from cursing them, their family and/or future generations (BEL_6) and help them avoid punishment from government authorities (BEL_9) were more likely to have acted pro-environmentally ($p<0.1$) but this relationship was non-existent among the male group. Also, for the older group, people who believed that practicing the recommended pro-environmental behaviours will be a sign of respect to their ancestors and river gods were more likely to have acted positively ($p<0.1$; $R^2 = 16.1\%$), but this belief–behaviour link was non-existent among younger people.

Overall, the belief factors could be summarised under three main categories based on the results: those for which the evidence suggests a non-statistically significant relationship, those that were significant irrespective of the role of age and gender, and the last group, those whose relationship with behaviour depended on age and gender (see also Table 4).

Table 2: Effects of beliefs on Litter Dropping

CODE	BELIEF STATEMENT	ESTIMATE	STD. ERR	P-VALUE
	OVERALL SAMPLE			
BEL_1	Reduce water or river pollution.	0.274	0.041	0.772
BEL_2	Save living organisms in the river.	0.222	0.046	0.891
BEL_3	Improve the recreational value of the river.	0.352	0.043	0.396
BEL_4	Reduce illnesses and diseases associated with water pollution.	0.301	0.080	0.490
BEL_5	Be a sign of respect to my ancestors and river gods.	0.166	0.027	0.717
BEL_6	Stop the river gods from cursing me, my family and/or future generations.	0.182	0.018	0.951
BEL_7	Will keep the water clean for spiritual purposes (for example, baptism).	0.242	0.018	0.766
BEL_8	Help me avoid punishment from the chief and other traditional leaders.	0.220	0.127	0.465
BEL_9	Help me avoid punishment from the government authorities.	0.206	0.497	0.131
	SUBGROUP ANALYSIS			
	FEMALES			
BEL_1	Reduce water or river pollution.	0.005	0.370	0.961
BEL_2	Save living organisms in the river.	0.079	0.297	0.446
BEL_3	Improve the recreational value of the river.	0.087	0.515	0.464
BEL_4	Reduce illnesses and diseases associated with water pollution.	0.033	0.595	0.789
BEL_5	Be a sign of respect to my ancestors and river gods.	0.015	0.245	0.898
BEL_6	Stop the river gods from cursing me, my family and/or future generations.	0.033	0.251	0.777
BEL_7	Will keep the water clean for spiritual purposes (for example, baptism).	0.014	0.365	0.898
BEL_8	Help me avoid punishment from the chief and other traditional leaders.	0.169	0.361	0.167
BEL_9	Help me avoid punishment from the government authorities.	0.080	0.318	0.488
	MALES			
BEL_1	Reduce water or river pollution.	0.057	0.425	0.558
BEL_2	Save living organisms in the river.	0.062	0.363	0.578
BEL_3	Improve the recreational value of the river.	0.018	0.570	0.879
BEL_4	Reduce illnesses and diseases associated with water pollution.	0.060	0.382	0.580
BEL_5	Be a sign of respect to my ancestors and river gods.	0.084	0.237	0.448
BEL_6	Stop the river gods from cursing me, my family and/or future generations.	0.055	0.276	0.632
BEL_7	Will keep the water clean for spiritual purposes (for example, baptism).	0.092	0.332	0.384
BEL_8	Help me avoid punishment from the chief and other traditional leaders.	0.073	0.314	0.498
BEL_9	Help me avoid punishment from the government authorities.	0.185	0.287	*
	YOUNG			
BEL_1	Reduce water or river pollution.	0.019	0.376	0.778
BEL_2	Save living organisms in the river.	0.044	0.391	0.538
BEL_3	Improve the recreational value of the river.	0.030	0.519	0.702
BEL_4	Reduce illnesses and diseases associated with water pollution.	0.770	0.717	***
BEL_5	Be a sign of respect to my ancestors and river gods.	0.005	0.270	0.949
BEL_6	Stop the river gods from cursing me, my family and/or future generations.	0.003	0.315	0.974
BEL_7	Will keep the water clean for spiritual purposes (for example, baptism).	0.014	0.338	0.853
BEL_8	Help me avoid punishment from the chief and other traditional leaders.	0.083	0.374	0.316
BEL_9	Help me avoid punishment from the government authorities.	0.082	0.282	0.248
	OLD			
BEL_1	Reduce water or river pollution.	0.091	0.439	0.369
BEL_2	Save living organisms in the river.	0.051	0.282	0.611
BEL_3	Improve the recreational value of the river.	0.044	0.533	0.670

BEL_4	Reduce illnesses and diseases associated with water pollution.	0.045	0.364	0.655
BEL_5	Be a sign of respect to my ancestors and river gods.	0.057	0.230	0.601
BEL_6	Stop the river gods from cursing me, my family and/or future generations.	0.044	0.238	0.675
BEL_7	Will keep the water clean for spiritual purposes (for example, baptism).	0.014	0.391	0.890
BEL_8	Help me avoid punishment from the chief and other traditional leaders.	0.043	0.304	0.670
BEL_9	Help me avoid punishment from the government authorities.	0.145	0.333	0.139

Notes: ***p-value < 0.001, * *p-value < 0.01, *p-value < 0.1.

Table 3: Effects of beliefs on washing items in the river

CODE	BELIEF STATEMENT	ESTIMATE	STD. ERR	P-VALUE
	OVERALL SAMPLE			
BEL_1	Reduce water or river pollution.	0.125	0.271	*
BEL_2	Save living organisms in the river.	0.145	0.261	*
BEL_3	Improve the recreational value of the river.	0.196	0.330	**
BEL_4	Reduce illnesses and diseases associated with water pollution.	0.007	0.303	0.929
BEL_5	Be a sign of respect to my ancestors and river gods.	0.048	0.165	0.524
BEL_6	Stop the river gods from cursing me, my family and/or future generations.	0.094	0.181	0.224
BEL_7	Will keep the water clean for spiritual purposes (for example, baptism).	0.000	0.235	0.996
BEL_8	Help me avoid punishment from the chief and other traditional leaders.	0.001	0.228	0.989
BEL_9	Help me avoid punishment from the government authorities.	0.118	0.219	0.117
	SUBGROUP ANALYSIS			
	FEMALES			
BEL_1	Reduce water or river pollution.	0.137	0.377	0.145
BEL_2	Save living organisms in the river.	0.214	0.428	0.106
BEL_3	Improve the recreational value of the river.	0.160	0.457	*
BEL_4	Reduce illnesses and diseases associated with water pollution.	0.140	0.555	0.164
BEL_5	Be a sign of respect to my ancestors and river gods.	0.083	0.277	0.480
BEL_6	Stop the river gods from cursing me, my family and/or future generations.	0.266	0.278	*
BEL_7	Will keep the water clean for spiritual purposes (for example, baptism).	0.094	0.415	0.393
BEL_8	Help me avoid punishment from the chief and other traditional leaders.	0.051	0.397	0.666
BEL_9	Help me avoid punishment from the government authorities.	0.239	0.391	*
	MALES			
BEL_1	Reduce water or river pollution.	0.123	0.416	0.191
BEL_2	Save living organisms in the river.	0.080	0.369	0.473
BEL_3	Improve the recreational value of the river.	0.225	0.605	*
BEL_4	Reduce illnesses and diseases associated with water pollution.	0.017	0.380	0.877
BEL_5	Be a sign of respect to my ancestors and river gods.	0.021	0.224	0.837
BEL_6	Stop the river gods from cursing me, my family and/or future generations.	0.081	0.267	0.462
BEL_7	Will keep the water clean for spiritual purposes (for example, baptism).	0.057	0.330	0.586
BEL_8	Help me avoid punishment from the chief and other traditional leaders.	0.003	0.311	0.977
BEL_9	Help me avoid punishment from the government authorities.	0.055	0.296	0.584
	YOUNG			
BEL_1	Reduce water or river pollution.	0.102	0.382	0.295
BEL_2	Save living organisms in the river.	0.304	1.076	0.282
BEL_3	Improve the recreational value of the river.	0.160	0.478	0.125
BEL_4	Reduce illnesses and diseases associated with water pollution.	0.066	0.552	0.545
BEL_5	Be a sign of respect to my ancestors and river gods.	0.104	0.269	0.370
BEL_6	Stop the river gods from cursing me, my family and/or future generations.	0.156	0.289	0.179
BEL_7	Will keep the water clean for spiritual purposes (for example, baptism).	0.098	0.327	0.350
BEL_8	Help me avoid punishment from the chief and other traditional leaders.	0.049	0.340	0.655
BEL_9	Help me avoid punishment from the government authorities.	0.090	0.313	0.427
	OLD			
BEL_1	Reduce water or river pollution.	0.109	0.43	0.248
BEL_2	Save living organisms in the river.	0.057	0.31	0.591
BEL_3	Improve the recreational value of the river.	0.260	0.56	0.011
BEL_4	Reduce illnesses and diseases associated with water pollution.	0.039	0.40	0.710

BEL_5	Be a sign of respect to my ancestors and river gods.	0.195	0.22	*
BEL_6	Stop the river gods from cursing me, my family and/or future generations.	0.033	0.25	0.751
BEL_7	Will keep the water clean for spiritual purposes (for example, baptism).	0.133	0.42	0.199
BEL_8	Help me avoid punishment from the chief and other traditional leaders.	0.058	0.37	0.613
BEL_9	Help me avoid punishment from the government authorities.	0.104	0.37	0.308

Notes: ***p-value < 0.001, * *p-value < 0.01, *p-value < 0.1.

Table 4: Summary of Results

CODE	Belief Statement	Total Sample	Men	Women	Young	Old
BEL_1	Reduce water or river pollution.	**B2**				
BEL_2	Save living organisms in the river.	**B2**				
BEL_3	Improve the recreational value of the river.	**B2**	**B2**	**B2**		
BEL_4	Reduce illnesses and diseases associated with water pollution.				**B1**	
BEL_5	Be a sign of respect to my ancestors and river gods.			**B2**		**B2**
BEL_6	Stop the river gods from cursing me, my family and/or future generations.			**B2**		
BEL_7	Will keep the water clean for spiritual purposes (for example, baptism, ablution/Wuḍū, traditional rituals).					
BEL_8	Help me avoid punishment from the chief and other traditional leaders.					
BEL_9	Help me avoid punishment from the government authorities.		**B1**	**B2**		

Notes: The presence of **B1** or **B2** indicates a statistically significant relationship between the belief factor in question and one of the behaviours **(B1 and B2);** where **B1** = dropped litter (for example, cigarettes, condoms, cotton swabs, diapers, medication/drugs, needles, paper towels and/or wipes) around the riverbank or into the river; and **B2** = washed bicycle, tricycle, car, lorry or clothes (using chemical soap) around the riverbank or in the river.

4. DISCUSSION AND CONCLUSION

This study aims at exploring the links between beliefs and pro-environmental behaviour, as well as potential moderating factors such as age and gender, which, as discussed in the introduction, interact with beliefs to shape behaviours. To do this, we relied on conditional process modelling to analyse survey data from four rural communities in Ghana. Here, we discuss the potential limitations of the research before reflecting on our findings. First the dichotomous (i.e., yes/no) approach to eliciting responses from survey participants may be limited because it fails to reflect nuances among the responses provided. We acknowledge that although the conditional process modelling technique applied here helps to uncover some nuances, it is not adequate to fully account for the impact of cultural belief systems. Cultural beliefs are qualitative issues. Thus, understanding these beliefs and how they interact with behaviour requires complementing this study with qualitative techniques that offer deep and rich information (Sieber, 1973).

Additionally, being self-reported, the data has a tendency of suffering from acquiesce bias (Schuman and Presser, 1981); there was the possibility that some survey participants projected themselves as being environmentally responsible. This could have been caused by a combination of social desirability and memory bias, which makes some survey participants over-reporting pro-environmental behaviours (Warriner et al., 1984; Kormos and Gifford, 2014). We attempted to address aspects of this limitation

through pilot testing where we found that there was a fair distribution of responses across negative and positive practices. We further confirm that this was not a major problem in the present study as results suggest that a little over half of the respondents reported negative environmental practice such as washing items in the rivers. Therefore, while we entreat readers to note this limitation, we encourage future studies to employ observed measures of monitoring and measuring behaviours. Finally, beliefs and pro-environmental behaviours may be driven by other psychosocial variables e.g., awareness, attitudes, ascription of responsibility (Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980; Ajzen, 1991; Kollmuss and Agyeman, 2002; Blackstock et al., 2010; Okumah et al., 2018) and demographic factors such as educational status, religious affiliations, and income (Mensah, 2012; Cobbinah et al., 2015), which we miss in the present study.

Overall, we found that only three belief factors had a direct link with behaviour. This relates specifically to the second behaviour (i.e., washing a bicycle, tricycle, car, and lorry or clothes – using chemical soap – around the riverbank or in the river). The implication is that people who believed that the recommended pro-environmental behaviours will: 1) reduce water or river pollution, 2) save living organisms in the river and 3) improve the recreational value of the river were more likely **not** to have washed bicycle, tricycle, car, lorry or clothes (using chemical soap) around the riverbank or in the river within the last 12 months. Arguably, these results suggest that although culture is over time and space, the penetration of Western religious practices have practically not eroded the centuries-long belief systems that regulate rivers as "sacred sites" in our study communities. This might partially support Yeleliere's et al. (2018) thesis that customary law for the enforcement of norms on water usage in contemporary Ghanaian societies is still relevant and practiced in rural communities. However, our evidence does not support a direct link between the remaining six beliefs and behaviour. This might be due to the lack of variation in the data; for almost all belief factors, over three-quarters of respondents believed such factors were important (Figure 2).

Furthermore, the subgroup analysis unearthed additional belief factors that influenced behaviours. For instance, although there was no evidence of a link between BEL_4 (Reduce illnesses and diseases associated with water pollution) and B1 (Reduce water or river pollution), when the entire sample is considered, the subgroup analysis revealed that age moderates this link. That is, among the young people (below 33 years), individuals who believed that acting upon the recommended pro-environmental behaviours will reduce illnesses and diseases associated with water pollution (for example, Diarrhoea, Cholera, Intestinal worms) were more likely not to have littered in and/or around the river (B1). However, this relationship was non-existent among the older group (33 years and above). It is worthy to mention that environmental concern, to a large extent, depends on some socio-demographic characteristics of which age is prominent. This finding is consistent with Franzen and Vogl's (2013) revelation that young people act pro-environmentally and show enormous concern for

the environment than the older ones in part because the younger ones grew up at a time when the issue of environmental management and conservation had gained increasing attention globally in part because of the media and information technology. In Ghana, younger people are more likely to have more exposure to scientific information from the media as well as their literacy in information technology as opposed to the older generation in rural areas. Other studies relate the high awareness about environmental quality in coastal communities in Ghana, for example, to youth education and growing political engagement.

We note, however, that the finding that age plays a role in pro-environmental behaviours departs from what has been reported in similar studies in Ghana. For instance, Okumah et al. (2020) reported that there was no evidence supporting this link. The difference in the results from these studies may be attributed to the different statistical methods applied. In Okumah et al.'s study, they applied a first-generation statistical technique (i.e., ANOVA) which often fails to account for the complexity in the determinants of pro-environmental behaviour (Hayes, 2012, 2013; Okumah et al., 2019). However, in the present study, we apply conditional process modelling which helps to untangle relationships that otherwise would not have been identified, even when SEM is applied without introducing such moderating variables (Hayes, 2012, 2013). The conditional process modelling technique is, therefore, a useful technique for unpacking such complexities, providing a profound understanding of the interactions between or among a set of variables.

Additionally, the subgroup analysis (see Table 3) shows that, for the male group, those who believed that acting upon the recommended practices will help them avoid punishment from the government authorities were more likely not to have littered in and/or around the river. This belief also influenced behaviours among the female group, although this applied to a different practice (i.e., washing bicycle, tricycle, car, lorry or clothes around the riverbank or in the river). Moreover, results of the subgroup analysis show that older groups and females, compared to males, still revere rivers as sacred sites and maintain a sign of respect to an individual's ancestors and the river gods. Consequently, older community members were likely to avoid practices such as washing bicycle, tricycle, car, lorry or clothes around the riverbank or in the river. For their part, the female group believed that acting pro-environmentally would stop the river gods from cursing them, their families and/or future generations. We draw two major conclusions from this observation. The first is that the female group's pro-environmental behaviour towards water has deep cultural significance in the social history of water in Southern Ghana. In southern Ghana, water is construed as a fluid that signifies coolness, purity and equality, virtues which are deemed more feminine than masculine (Akyeampong, 1996). Our second conclusion is that females are more environmentally caring than males. This observation supports past research that women are more concerned about the environment than men, attributable to varying

socialization and social roles (see Mensah, 2012; Blocker and Eckberg, 1997; Bord and O'Connor, 1997; Davidson and Freudenburg, 1996; McCright, 2010; Zelezny et al., 2000).

In sum, gender and age moderate the link between belief and behaviour but the role of beliefs vary between groups: age was found to be influential in relation to beliefs 4 (reduce illnesses and diseases associated with water pollution) and 5 (a sign of respect to one's ancestors and river goods. Gender, on the other hand, had a significant impact in relation to beliefs 5 and 6 (stop the river gods from cursing me, my family and/or future generations. Furthermore, the relationship between belief and behaviour also depends on the behaviour in question; the link differed between different behaviours (e.g., beliefs 1, 2, 3, 5, affect the second behaviour only, while only belief 4 affect behaviour 1, with only belief 9 affecting both behaviours). Our findings highlight the complex interactions between socio-demographic characteristics, belief factors and behaviour. It also demonstrates the dynamic role of these variables in behaviours.

Understanding the role of these variables and the underlying socio-cultural dynamics could enhance our understanding of the complex link between belief systems and behaviours. People who regard water resources as symbols of protection and a major source of divinity, are likely to engage in sustainable behaviours that could contribute to the conservation of these resources (Gupta et al., 2016). For those who do not hold such cultural and spiritual beliefs, they are less likely to engage in sustainable practices (if their knowledge on scientific aspects of water pollution and associated consequences is limited). Therefore, policymakers may need to carefully integrate positive cultural beliefs with scientific knowledge to create awareness. Our study also provides a basis for developing much more targeted policies to influence the behaviours of different socio-demographic groups as different perceptions and knowledge have varying degrees of explanatory power on the actions of the different socio-demographic groups. Therefore, the design, goal and implementation of policies aimed at encouraging pro-environmental behaviour should carefully consider these complexities and know whom to target with which message. As the power of some beliefs is waning, regulations may be needed to enforce sustainable practices in relation to water resources. The combination of beliefs, regulations and improved knowledge on water pollution could contribute to sustainable water resources management.

Authors declare no conflict of interest.

5. REFERENCES

ADAMTEY, R., OCLOO, K.A. AND PEPRAH, C., 2014. Diamonds are forever: How myths can contribute to land degradation by small-scale diamond mining in Akwatia, Ghana. *Ethiopian Journal of Environmental Studies and Management*, *7*(5), pp.468-477.

AJZEN, I. 1991. The theory of planned behavior. *Organizational Behavior and Human Decision Processes,* 50**,** 179-211.

AJZEN, I. 2002. Perceived behavioral control, self- efficacy, locus of control, and the theory of planned behavior. *Journal of applied social psychology,* 32**,** 665-683.
AJZEN, I. & FISHBEIN, M. 1980. *Understanding Attitudes and Predicting Social Behaviour,* Englewood Cliffs, New Jersey Prentice-Hall Inc.
AKYEAMPONG E., 1996. *Drink, Power, and Cultural Change: A Social History of Alcohol in Ghana, c. 1800 to recent times.*
AKYEAMPONG, E. 2001. Between the sea and the lagoon: An eco-social history of the Anlo of south-eastern Ghana, c. 1850 to recent times.
ANIAH, P., AASOGLENANG, A.T. AND BONYE, S.Z., 2014. Behind the myth: Indigenous knowledge and belief systems in natural resource conservation in North East Ghana. *International Journal of Environmental Protection and Policy*, *2*(3), pp.104-112.
AWUAH-NYAMEKYE, S., SARFO-MENSAH, P., AMISAH, S. AND OWUSU-BI, A. 2014. Environmental Conservation and Preservation of Cultural Heritage. *Worldviews: Global Religions, Culture, and Ecology*. **18**(1), pp.30–53.
AXELROD, L.J. AND LEHMAN, D.R., 1993. Responding to environmental concerns: What factors guide individual action? *Journal of environmental psychology*, *13*(2), pp.149-159.
BAGOZZI, R. P., YI, Y. 2012. Specification, evaluation, and interpretation of structural equation models. Journal of the Academic of Marketing Science, 40(1), 8-34.
BLACKSTOCK, K. L., INGRAM, J., BURTON, R., BROWN, K. M. & SLEE, B. 2010. Understanding and influencing behaviour change by farmers to improve water quality. *Science of the total environment,* 408**,** 5631-5638.
BLOCKER, J.T., ECKBERG, D.L., 1997. Gender and environmentalism: results from the 1993 General Social Survey. Social Science Quarterly 78, 841–858.
BORD, R.J., O'CONNOR, R.E., 1997. The gender gap in environmental attitudes: the case of perceived vulnerability to risk. Social Science Quarterly 78, 830–840.BRAUN, L.N. 2015. Canadian Journal of African Studies / Revue canadienne des études africaines Cyber Siren: What Mami Wata reveals about the Internet and Chinese presence in Kinshasa.
BROWN, T.A., 2006. Confirmatory Factor Analysis for Applied Research. The Guildford Press, New York and London.
CHATTERJEE, A. AND LUNDQUIST, A.R., 2002. Factors Related to the Cognitive Moral Development of Business. *Journal of Business Ethics*, *35*(4), pp.255-268.
COBBINAH, P.B. 2015. "Local attitudes towards natural resources management in rural Ghana". *Management of Environmental Quality: An International Journal*, 26 (3), 423-436, https://doi.org/10.1108/MEQ-04-2014-0061
DAVARI, A. AND STRUTTON, D., 2014. Marketing mix strategies for closing the gap between green consumers' pro-environmental beliefs and behaviors. *Journal of Strategic Marketing*, *22*(7), pp.563-586.
DAVIDSON, D.J. AND FREUDENBURG, W.R., 1996. Gender and environmental risk concerns: A review and analysis of available research. *Environment and behavior*, *28*(3), pp.302-339.
DAWSON, L.M., 1995. Women and men, morality and ethics. *Business Horizons*, *38*(4), pp.61-68.
FIELDING, K.S, TERRY, D.J., MASSER, B.M., BORDIA, P., HOGG, M.A., 2005. Explaining landholders' decisions about riparian zone management: The role of behavioural, normative, and control beliefs.
FISHBEIN, M., AND AJZEN, I., 1975. Beliefs, Attitudes, Intentions and Behavior: An Introduction to Theory and Research, (Reading, Mass.: Addison-Wesley).
FRANZEN, A. AND VOGL, D., 2013. Two decades of measuring environmental attitudes: A comparative analysis of 33 countries. *Global Environmental Change*, *23*(5), pp.1001-1008.
GREENE, S. E. 2002. *Sacred sites and the colonial encounter: A history of meaning and Memory in Ghana*. Indiana University Press.
GROB, A., 1995. A structural model of environmental attitudes and behaviour. *Journal of environmental psychology*, *15*(3), pp.209-220
GUPTA, N., KANAGAVEL, A., DANDEKAR, P., DAHANUKAR, N., SIVAKUMAR, K., MATHUR, V.B. AND RAGHAVAN, R., 2016. God's fishes: religion, culture and freshwater fish conservation in India. *Oryx*, *50*(2), pp.244-249.

HAYES, A.F., 2012. PROCESS: A versatile computational tool for observed variable mediation, moderation, and conditional process modelling [White paper].
HAYES, A.F., 2013. Introduction to mediation, moderation and conditional process analysis, The Guildford Press, New York and London.
HEDT, B.L. AND PAGANO, M., 2011. Health indicators: eliminating bias from convenience sampling estimators. *Statistics in medicine*, *30*(5), pp.560-568.
HOOPER, D., COUGHLAN, J. AND MULLEN, M., 2008. Structural equation modelling: Guidelines for determining model fit. *Articles*, p.2.
HU, L.T. AND BENTLER, P.M., 1999. Cut-off criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural equation modelling: a multidisciplinary journal*, *6*(1), pp.1-55.
HUEBNER, R.B. AND LIPSEY, M.W., 1981. The relationship of three measures of locus of control to environment activism. *Basic and Applied Social Psychology*, *2*(1), pp.45-58.
HUNT, A., 1997. Are women more ethical than men? *Baylor Business Review*, *15*(1), p.7.
HUTCHINS, M.G., 2012. What impact might mitigation of diffuse nitrate pollution have on river water quality in a rural catchment? *Journal of environmental management*, *109*, pp.19-26.
KIATKAWSIN, K. AND HAN, H., 2017. Young travelers' intention to behave pro-environmentally: Merging the value-belief-norm theory and the expectancy theory. *Tourism Management*, *59*, pp.76-88.
KOLLMUSS, A. & AGYEMAN, J. 2002. Mind the Gap: why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research,* 8**,** 239-260.
KORMOS, C. & GIFFORD, R. 2014. The validity of self-report measures of proenvironmental behavior: A meta-analytic review. *Journal of Environmental Psychology,* 40**,** 359-371.
LOMAX R.G., SCHUMACKER, R.E. 2012. A beginner's guide to structural equation modelling. Routledge Academic, New York.
MACLEAN, K., HEARLE, C. AND RUWANPURA, K.N., 2020. Stigma of staining? Negotiating menstrual taboos amongst young women in Kenya. In *Women's Studies International Forum* (Vol. 78, p. 102290). Pergamon.
MCCRIGHT, A.M., 2010. The effects of gender on climate change knowledge and concern in the American public. Population and Environment 32, 66–87.
MENSAH, I. 2012. Environmental Education and Environmentally Responsible Behaviour: The Case of International Tourists in Accra Hotels, International Journal of Tourism Sciences, 12:3, 69-89, DOI:10.1080/15980634.2012.11434664
MULLEN, P.D., HERSEY, J.C. AND IVERSON, D.C., 1987. Health behaviour models compared. *Social science & medicine*, *24*(11), pp.973-981.
NORMAN, G.C., AND CONNER, M.E., 1996. The role of social cognition models in predicting health behaviours: Future directions. In M. Conner, & P. Norman (Eds.), *Predicting Health Behaviour* (pp. 197-225). Buckingham, England: Open University Press.
OECD. 2012. Water Quality and Agriculture: Meeting the Policy Challenge. OECD Studies on Water. Paris: Organisation for Economic Co-Operation and Development.
OECD. 2017. Diffuse Pollution, Degraded Waters: Emerging Policy Solutions. Paris: OECD Publishing.
OKUMAH, M. AND ANKOMAH-HACKMAN, P., 2020. Applying conditional process modelling to investigate factors influencing the adoption of water pollution mitigation behaviours. *Sustainable Water Resources Management*, *6*(2), p.17.
OKUMAH M, ANKOMAH-HACKMAN P, YEBOAH A.S. 2020. Do socio-demographic groups report different attitudes towards water resource management? Evidence from a Ghanaian Case study. GeoJournal Doi: 10.1007/s10708-020-10173-9
OKUMAH, M., MARTIN-ORTEGA, J. & NOVO, P. 2018. Effects of awareness on farmers' compliance with diffuse pollution mitigation measures: a conditional process modelling Land Use Policy, 76, 36-45.

OKUMAH, M., P. CHAPMAN, J. MARTIN-ORTEGA and P. NOVO. 2019. Mitigating Agricultural Diffuse Pollution: Uncovering the Evidence Base of the Awareness–Behaviour–Water Quality Pathway. *Water,* 11(1), p29.

OKUMAH, M. AND YEBOAH, A.S., 2019. Exploring stakeholders' perceptions of the quality and governance of water resources in the Wenchi municipality. Journal of Environmental Planning and Management, pp.1-29.

OKUMAH M, YEBOAH AS, AMPONSAH O. 2020. Stakeholders' willingness and motivations to support sustainable water resources management: Insights from a Ghanaian study. Conservation Science and Practice.

OSEI-TUTU, P., 2017. Taboos as informal institutions of local resource management in Ghana: Why they are complied with or not. *Forest policy and economics*, *85*, pp.114-123.

OWUSU, P.A., ASUMADU-SARKODIE, S. AND AMEYO, P., 2016. A review of Ghana's water resource management and the future prospect. *Cogent Engineering*, *3*(1), p.1164275.

PETERSON, D., RHOADS, A. AND VAUGHT, B.C., 2001. Ethical beliefs of business professionals: A study of gender, age and external factors. *Journal of Business Ethics*, *31*(3), pp.225-232.

RESURRECCION, B.P., JANE REAL, M. AND PANTANA, P., 2004. Officialising strategies: Participatory processes and gender in Thailand's water resources sector. *Development in Practice*, *14*(4), pp.521-532.

RHEMTULLA, M., BROSSEAU-LIARD, P. É., & SAVALEI, V. 2012. When can categorical variables be treated as continuous? A comparison of robust continuous and categorical SEM estimation methods under suboptimal conditions. *Psychological methods*, **17**, 354-373.

ROSSEEL, Y., 2017. The Lavaan Tutorial. Department of Data Analysis, Ghent University, Ghent, Belgium. Available online: http://lavaan.ugent.be/tutorial/tutorial.pdf (Accessed 23/03/2018).

ROSENSTOCK, I.M., 1974. Historical origins of the health belief model. *Health education monographs*, *2*(4), pp.328-335.

SARFO-MENSAH, P. AND ODURO, W. 2007. *Traditional Natural Resources Management Practices and Biodiversity Conservation in Ghana: A Review of Local Concepts and Issues on Change and Sustainability* [Online]. W. Wildlife and Range Management. [Accessed 29 November 2018]. Available from: http://ssrn.com/abstract=1017238http://ssrn.com/abstract=1017238http://ssrn.com/abstract=1017238HTTP://SSRN.COM/ABSTRACT=1017238.

SHEERAN, P. AND ABRAHAM, C., 1996. The health belief model. *Predicting health behaviour*, *2*, pp.29-80.

SCHUMAN, H. AND PRESSER, S., 1981. Questions and answers: Experiments on question form, wording, and context in attitude surveys. *New York: Academic*.

SIEBER, S. D. 1973. The integration of fieldwork and survey methods. *American Journal of Sociology,* 73**,** 1335-1359.

STERN, P. C., DIETZ, T., ABEL, T., GUAGNANO, G. A. & KALOF, L. 1999. A value-belief-norm theory of support for social movements: The case of environmentalism. *Human ecology review***,** 81-97.

STERN, P. C. & DIETZ, T. 1994. The value basis of environmental concern. *Journal of social issues,* 50**,** 65-84.

STERN, P. C. 2000. Toward a Coherent Theory of Environmentally Significant Behavior. *Journal of Social Issues,* 56**,** 407–424.

TANNER, C. AND WÖLFING KAST, S., 2003. Promoting sustainable consumption: Determinants of green purchases by Swiss consumers. *Psychology & Marketing*, *20*(10), pp.883-902.

THOMPSON, S. G. & HIGGINS, J. P. T. 2002. How should meta-regression analyses be undertaken and interpreted? *STATISTICS IN MEDICINE,* 21**,** 1559–1573.

THOMPSON, S. G. & HIGGINS, J. P. T. 2002. How should meta-regression analyses be undertaken and interpreted? *STATISTICS IN MEDICINE,* 21**,** 1559–1573.

WARRINER, C.K. ed., 1984. *Organizations and their environments: Essays in the sociology of organizations* (Vol. 3). Greenwich, Conn.: Jai Press.

WENCHI MUNICIPAL ASSEMBLY 2014. District Medium-Term Development Plan (2014-2017).

WHITE JR, R.D., 1999. Are women more ethical? Recent findings on the effects of gender upon moral development. *Journal of public administration research and theory*, *9*(3), pp.459-472.

WHITE, M. J., & HUNTER, L. M. 2009. Public perception of environmental issues in a developing setting: environmental concern in coastal Ghana. *Social Science Quarterly*, *90*(4), 960-982.

YEBOAH, F.K., LUPI, F., KAPLOWITZ, M.D., 2015. Agricultural landowners' willingness to participate in a filter strip program for watershed protection. Land Use Policy 49 (2015) 75–85.

YELELIERE, E., COBBINA, S.J. AND DUWIEJUAH, A.B., 2018. Review of Ghana's water resources: the quality and management with particular focus on freshwater resources. *Applied Water Science*, *8*(3), p.93.

ZELEZNY, L.C., CHUA, P., ALDRICH, C., 2000. Elaborating on gender differences in environmentalism. Journal of Social Issues 56, 443–457.