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Cultural influences on the management of environmental health risks among low-income pregnant women

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Abstract

Following environmental health disasters such as Hurricane Katrina and the Gulf Oil Spill, U.S. Gulf residents expressed concern regarding air quality. Women with children make many decisions that mitigate household air quality risks; however, research examining culture's influence in their risk perception and the influence which this has on their behaviour is limited. In this article we examine the cultural connection between low-income women with children along the U.S. Gulf concerning the local threat of air quality. We used cultural consensus analysis to examine the perceptions of low-income, first-time pregnant women. We undertook an interview survey of 112 women living in Southeast Louisiana, USA between May 2014 and March 2015. In this article we examine if there was a shared (cultural) understanding among these women on how to manage air quality threats, to evaluate what determined cultural sharing in the group, and to explore what role cultural beliefs played in their intended household strategies. We found that although air quality was rarely discussed by the women in our study, we were able to identify two multi-centric cultural models of how these women sought to make sense of air quality issues. In one model they relied on their immediate social network of family and friends while in the other model they were willing to make use of official sources of information. These two models helped explain what measures these women planned to take to address air quality issues in an around their household. Our findings show that cultural norms permeate the assessment of risk in a community and that programmes designed to improve public health need to take into account the cultural context of the population.

Keywords

risk; risk perception; culture; air quality; pregnancy; risk communication

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Introduction

In this article, we aim to develop an understanding of the role that culture plays in shaping the ways in which low-income, first-time mothers perceive and respond to air quality hazards. We will examine if there is a shared cultural understanding of air quality risks among a sample of low-income pregnant women. We will then evaluate what factors were associated with differences in cultural beliefs. Finally we will explore the association between an individual's culture and their intended behaviour.

Air pollution and risk

Impact of air pollution on low-income communities—Air pollution is considered to be a major environmental concern for low-income, women with children along the U.S. Gulf Coast (Mundorf & Lichtveld, 2016). Researchers have found that exposure to air pollution is linked to many acute and chronic diseases with fetuses and young children being especially vulnerable (Trasande & Thurston, 2005). Childhood exposure to outdoor air pollution has been linked to diseases such as asthma (Gehring et al., 2010). Exposure to a range of airborne chemical and biological contaminants inside the house may also lead to asthma and other respiratory problems (Jones, Recer, Hwang, & Lin, 2011; Kennedy & Grimes, 2013).

Exposure to these contaminants and the diagnosis of many air-related health issues disproportionately affect families in particular regions, of certain ethnic and racial minority groups and of families with lower income (Halterman, Conn, Hernandez, & Tanski, 2010). Poor housing and proximity to industrial pollution play a major role in creating these disparities; yet, housing and lifestyle factors (including smoking, cleaning strategies, cleaner usage, etc.) can also influence family exposure (Nethery et al., 2012).

Interventions seeking to encourage such measures in at-risk populations have been mixed in both changing perceptions and behaviour (Fitzpatrick, Coughlin, & Chamberlin, 1992; Wakefield et al., 2002). Families may be enacting alternative measures and actions that fail to effectively reduce household-level air pollution, or worse, unintentionally increase exposure (Cabana et al., 2004; Freidin & Timmermans, 2008). To target models of measures and actions that are shared in at-risk communities, more ecological interventions have advanced a potential cultural influence at play (Mao, Bottorff, Oliffe, Sarbit, & Kelly, 2015; Prokhorov et al., 2013).

Risk, culture, and pregnancy—The term risk is used in a variety of fields and attempts to create a unified, cross-disciplinary understanding have proved to be difficult. For the sake of clarity, we have adopted the definition proposed by Heyman and his colleagues (2010) who defined risk as:

the project of uncertain expectation, viewed in terms of randomness, about the occurrence of a negatively valued outcome category within a selected time frame (Heyman, Alaszewski, & Shaw, 2010)

Sociologists such as Beck have argued that contemporary high income countries are 'risk societies' as the identification, allocation and management of risk have become major issues of public concern (Beck, 1992). One way of researching this phenomena is to examine the

sociocultural influences on risk issues and, in particular, the ways that cultural norms shape how risks are identified and managed (Lupton & Tulloch, 2002).

Risk issues are particularly important for the parents, because they have to assess risks on behalf of their children in the situation in which there can be conflicting information both about the nature of such dangers and the best way of mitigating them. Furedi has describe the dilemmas which modern parents have to manage as paranoid parenting (Furedi, 2008).

In many households, women are still primarily responsible for protecting the health of the child through managing household activities that mitigate threats in the home environment (Alanne, Laitinen, Söderlund, & Paavilainen, 2012). From when they first become pregnant, women take on the responsibility with appraising a stream of new potential risks (such as pregnancy-related health issues), as well those established risk that threaten the foetus and new born baby (such as air pollution) (Rothman, 2014; Satterthwaite, 1996). Given their responsibility and the formative nature of pregnancy, culture may play an especially powerful role in how new mothers navigate risk (Harkness & Super, 1996). We define culture as the information needed to act appropriately in a given context (Goodenough, 1996). Parent-centred social networks are known to help new mothers learn to become parents by informing culturally-appropriate behaviour (Harkness, Super, & Keefer, 1992). Similar sociocultural processes may be affecting how new mothers appraise unfamiliar environmental risks, and how to best take action (Crighton et al., 2013).

A well-researched example of the role of mothers in risk management is the case of infant feeding. In many cultures, women's infant feeding decision influence their identity as 'moral mothers' (Lee, 2008). As a result, women often struggle with balancing their resources, their personal risk perceptions and the sociocultural model of 'doing what is healthy' (Lee, 2007). Yet, interventions incorporating the sociocultural perspective that change sources of cultural information can affect perceptions of risk and improve health behaviours (Mak, 2016).

Researchers working with new mothers have identified differences in how they understand and respond to environmental threats inside and outside the home (Crighton et al., 2013). Some researchers have found important differences in the ways in which mothers respond to risks such as air pollution that are influenced by the different ways in which they perceive risk (Cabana et al., 2004; Freidin & Timmermans, 2008). However despite the existing research on the ways in which culture shapes risk management, it is not clear how the specific threat of air pollution is perceived and managed through a cultural lens.

In this article we examine the extent to which a sociocultural approach to risk enhances our understanding of home air management strategies. We focus on the role of culture in shaping the ways in which low-income pregnant women mitigate risk in their homes. We investigate the existence of shared cultural knowledge, what factors best predict culture and what role this cultural knowledge has on actual personal behaviour. By focusing on the cultural influences of this issue, we add a new perspective on how risk is appraised and managed in household activities.

Methodology

In this article we draw on research conducted with first-time pregnant women in Southeast Louisiana, U.S.A. to help examine the cultural link between the perceived risk of air pollution, and the behaviour these women take to protect their families. To explore cultural influences of behaviour, we followed a research approach from cultural anthropology that can quantify cultural beliefs through ethnographic methods (A Kimball Romney, Batchelder, & Weller, 1987; Weller & Romney, 1988). We conducted one-on-one informant interviews with first-time pregnant women in their own homes along the Gulf coast about air pollution, and their perception of appropriate strategies to mitigate the threat. This provided us with a rich source of data that we could use to explore how culture shaped their perceptions and responses

We used surveys to collect information of the participants' personal details, their cultural beliefs related to air quality, and what they intended to do in their own homes and communities. The research was approved by Tulane University's Institutional Review Board and data was collected from May 2014 to March 2015.

Study Setting and Participants—To explore cultural influences of first-time mothers in the Gulf South, we recruited women participating in an ongoing intervention study, *Project 3: Building Community Resilience through Disaster Mobile Health*, as a part of a larger research collaborative, *Gulf Resilience on Women's Health (GROWH)*. The larger GROWH collaborative was funded due to widespread regional concerns about the safety of the environment (air, water and seafood), and health of mothers and children following the U.S. 2010 Gulf Oil Spill. As a result, an environmental health study was implemented to specifically address the safety of seafood and air quality, with an emphasis on community-based participatory research (Wickliffe et al., 2014; Wilson et al., 2015). By recruiting from this cohort, we were able to study a population that was affected by widespread environmental health concerns.

This cohort also allowed us to focus on women who were just starting to be acculturated to a new role as mothers. Women in ongoing intervention study were required to be in the first or second trimester of the pregnancy of their first child. Finally, the cohort also allowed us to focus on women who had low incomes relative to the wider population. Women in the ongoing intervention study were originally recruited women through Women, Infants and Children (WIC) clinics and therefore these were all low-income women who were eligible for the Women, Infants and Children programme ("Women, Infants and Children: WIC Eligibility Requirements," 2015). This enabled us to recruit women on low income who were more likely to be exposed to air pollution because they lived in cheap housing near sources of air pollution and had less resources with which to mitigate the effects of poor air quality. The entire study sample skewed young, non-white and relatively low income.

We recruited a sample of 112 women from the wider intervention study. From this sample we selected 20 women to take part in a scoping exercise using a freelist approach (Mundorf & Lichtveld, 2016; Weller & Romney, 1988) to identify strategies to manage indoor and outdoor air quality and sources to turn to for assistance. Stratified sampling was used to maximise a roughly equal diversity across age, residence, and race (Mundorf & Lichtveld,

2016). Given the agreement in responses, the sample size of this exercise was considered sufficient (Weller & Romney, 1988). The most salient freelist responses were then used as topics in a separate questionnaire. This questionnaire was given to the full sample of 112 women to rate their agreement. Given the group's level of agreement with each other, the sample size far surpassed the minimum recommended for the cultural analysis (Weller, 2007).

Our sample population all resided in Southeast Louisiana, an area affected by 2010 Gulf Oil Spill (Figure 1). This area has long been associated with poor air quality from high industrial activity, with the state of Louisiana being ranked fourth in the country for total onsite air releases of chemicals and pollutants (United States Environmental Protection Agency, 2013). Recent disasters have also played a role in air quality and air quality perceptions. For example in the aftermath of Hurricane Katrina, the overwhelming presence of mould as an asthma allergen led to concerns of indoor air quality in New Orleans (Rabito, Iqbal, Kiernan, Holt, & Chew, 2008), and in 2010 oil the spill sparked community concerns regarding outdoor air quality (Goldstein, Osofsky, & Lichtveld, 2011; Middlebrook et al., 2012).

The interviews—We started the development of the cultural survey by conducting a freelisting exercise. Community health workers were trained in conducting this ethnographic method, and met one-on-one with each of the women (n=20). The community health workers asked the women the following freelisting prompt questions:

- *Threats in the environment:* 'What are the things in the environment that threaten mothers and children in your community?'
- *Ways to manage threats:* 'For each of these things in the environment, what are ways that mothers prepare or respond?'
- *Sources of support:* 'For each of the things in the environment, who do other mothers typically turn to for information and support?' (Mundorf & Lichtveld, 2016)

Responses were pooled, standardised and coded. The cultural importance of each item was measured by either the average rank on each participant's list or the frequency mentioned across all participants' lists (Weller & Romney, 1988). Relative importance is also measured by a combination of both rank and frequency through the Smith's index rank salience (Smith & Borgatti, 1997).

The most salient actions and sources related to air quality were then used to create a pool of culturally-relevant risk-management sources and strategies. The pool was used to design a questionnaire that listed all the actions which mothers could take to mitigate the risk of poor air quality. We invited a larger group of recruited women (n=112) to complete this questionnaire. The women were asked to respond not from a personal perspective and were asked to rank the importance of the different possible actions on a 6-point scale rating actions from 'Not important' to 'Extremely Important' and the likelihood of using different sources of information from 'Extremely Unlikely' to 'Extremely Likely'.

Several months later, all 112 women were recruited to take part in a follow-up modified questionnaire (102 of the women agreed to participate). It included questions about the same actions and sources of information as the initial questionnaire. However, the women were asked to express their personal opinion on a 4-point scale from 'Not important' to 'Very important' if they had to deal an air quality hazard. We also asked some additional questions about perceptions of the risk perception of indoor and outdoor air pollution. We invited the participants to comment on their experience managing the threat, their responsibility within their household about making decisions about air management and how frequently they talked to other mothers in the community about air management. We conducted this questionnaire to better understand their personal beliefs. It was implemented separately from the cultural survey to avoid having the participant's perceptions (elicited in the personal survey) to influence their cultural perceptions.

Data Analysis—We analysed the cultural survey ratings using cultural consensus analysis. This approach focuses on the way a topic is culturally shared amongst respondents, what sort of cultural knowledge they have, and their shared cultural beliefs. This approach enabled us to assess whether individual responses were sufficiently similar to indicate that there was an underpinning shared group response. We used factor analysis output to identify such fits between individual and group responses. We judged that if the ratio of the highest eigenvalue of the factor analysis to the second highest was greater than or equal to 3:1 we could take it as evidence of a shared group response. We then would be able to use the factor scores of the output to construct weighted responses to the survey questions based on the sample's agreement with each other (A.K. Romney, Weller, & Batchelder, 1986).

The consensus analysis was then used to produce two factor loadings for each respondent, which then enabled us to examine cultural variability. The first factor loading for each respondent indicated how well her responses fit with the group model, while the second one identified how much of the individuals response was unexplained by the model. We used these two factor loadings to assess subcultural differences in the population (Dressler, Balieiro, & Dos Santos, 2015).

We assessed subcultural differences by plotting the first and second factor loadings on an x/y axis, and used a visual, subjective inspection of the scatterplot (combined with a hierarchical cluster analysis) to determine whether the participants were better grouped as multiple subcultures, rather than a single cultural group (Handwerker, 2001). We examined segmented samples separately in cultural consensus analysis, and qualitatively evaluated the responses of the identified the cultural groups. We used a logistic regression to identify significant predictors of cultural belief and group membership. Predictors were included in the model if there was a significant relationship (chi-square test of independence, $p < 0.05$). Cultural data were analysed using the software Anthrapac (Borgatti, 1992). All other data were analysed using the software SPSS (SPSS, 2006).

Findings

We started our analysis by evaluating the cultural survey responses of the entire sample. The results produced a model with a poor fit (its eigenvalue ratio was 3.13:1, and several

negative first factor loadings, that is individuals whose responses did not fit with the group response). We reexamined the data and identified three clusters of responses representing three subcultures (see Figure 2). Group 1 was made up of respondents who all had relatively high first factor loadings and large positive second factor loading scores, that is the conformed to the group response and this response accounted for most of their responses. Group 2 was made up of respondents with high first factor loadings and negative second factor loading, so they conformed to the group response but it did not account for all their responses. Group 3 participants had both low first factor loading scores and second factor loading scores around zero. Since women in Group 3 did not share any cultural understanding of appropriate air quality strategies, so we were not able to use their answers as cultural responses. As a result, we focused the cultural analysis only on women in Groups 1 and 2.

Table 1 shows the socio-demographic makeup of the study population across the three cultural groups. Few of the mothers in our study agreed with the statement that indoor air was a risk to their family (27%) or that it was as a feared threat (26%), and a substantial minority agreed they had ‘small’ or no choice in managing indoor air risks (48%). Nearly half the women in the study indicated that outdoor air pollution was a risk to their family (41%), and was a feared risk (44%). However most women in the study indicated that had little choice in managing the risk (82%). The three groups we identified had similar perceptions of the threat of indoor air and outdoor air but the groups differed in their past experience with air pollution, and how often they talked with other mothers about the risk. Women in Group 1 were much more likely have experience and to talk with other mothers. (see Table 1)

Table 2 shows the different weighted responses for specific risk behaviours, and Table 3 shows the responses to the sources of support and information for women in Groups 1 and 2. The women shared near identical responses to most of the risk behaviours, with differences being ones of degree, for example agreeing an activity was ‘extremely important’ rather than ‘very important’. The behaviour that differentiated responders in Groups 1 and 2 most was the use of air fresheners as a way of addressing indoor air problems. There was great difference between the two groups in of support and information: participants in Group 1 tended to highly valued family and friends as appropriate sources to turn for air quality advice and support, while Group 2 were more responsive to official sources (government services, and local leaders).

We ran a multinomial logistic regression to identify the factors most closely associated with the membership of each group (Table 4). We found that Group 3 women were differentiated from Group 1 women (in a moderately predictive model, Nagelkerke $R^2 = 0.29$) by their agreement that managing indoor air in the home was not their ‘complete’ responsibility in their family (Odds ratio 4.97 (0.95–25.98)). We found that Group 2 were differentiated from Group 1 women by two factors, they agreed that they never talked to other mothers about outdoor air pollution (Odds ratio 3.89 (1.36–11.19)) and that they had little experience in managing outdoor air pollution (Odds ratio 6.16 (1.82–20.81)).

We also examined possible group differences in how the women reported intended behaviours in their own life and whether there was any association between cultural group membership and response (Table 5). Women in Group 1 were much more likely than women in the other groups to agree that they ‘Avoid parts of house where there is a problem’ (OR 2.50 (1.08–5.80)), ‘Call a professional to clean/fix’ (2.93 (1.20–7.15)), and ‘Keep house extra clean’ (4.05 (1.49–11.01)) in the event of an indoor air quality issue. These women were also more likely to ‘Keep windows closed as much as possible’ (2.61 (1.13–6.03)) if confronted with an outdoor air quality issue. The only actions that women in Group 1 were less likely (although not statistically significantly) to report were to ‘Paint over mold [mould] spots’ (0.90 (0.38–2.11)) and ‘Keep windows open as much as possible’ (0.95 (0.41–2.20)) in the event of an indoor air quality issue.

In terms of support in and information about air pollution risk (see Table 6), women in Group 1 were more likely to use the internet for help to manage outdoor air threats (3.05 (1.28–7.29)). However, they were not differentiated from respondents in the other groups in terms of increased likelihood of relying on friends and family for air quality help, despite agreeing to the statement that friends and family were appropriate sources of help and information. In contrast women in Group 2 were no more likely to intend to rely on official sources, such as ‘Local government leaders’, ‘Government services’, despite their stated preference for these sources of help. In fact, only 28.89% of women in Group 2 intended to use local leaders for advice and support with indoor air concerns (compared with 42.11% of women in Group 1).

Because women in Group 1 were much more likely to say they would enact several different air management strategies - keeping the house clean, avoiding any problem area and calling a professional - we undertook a logistic regression to see if group membership was predictive of each type of response, when controlling for other relevant covariates. We created a moderately strong model (Nagelkerke $R^2 = 0.23$) to predict if the respondent would agree it was ‘very important’ to avoid problem areas in the house. Group membership did act as a significant predictor when considered with other predictors such as education and household responsibility. Tables 7 and 8 show results of models predicting if a respondent would agree it ‘very important’ to call a professional (Table 7) and keep their house clean (Table 8). Moderately predictive models were created for both behaviours, and even when controlling for other factors, cultural group membership was predictive of their intended behaviour.

Discussion

In this article we have shown that while the women in our study did not discuss air quality much or view it as a particular risk, many of them shared an understanding of how air quality risks should be managed. We identified three distinctive groups of women. One group (Group 3) of women lacked a shared understanding and mostly responded idiosyncratically about how air pollution should be managed. The other two groups mostly had a shared view of the threat of air pollution but differed mainly in their views of how they should deal with it, with Group 1 relying on family and friends rather official sources to help

and information whereas women in Group 2, valued of official sources as much as family and friends.

We found three personal characteristics that tended to be associated group alignments. Based on the multinomial regression, it appears a major reason why some (Group 3) lacked a shared idea of air quality management may be due to their perceived lack of responsibility in making those decisions in their home. Meanwhile, a key factor in differentiating women in Groups 1 and 2 were their past experience with air quality issues and engagement with other mothers on this topic.

The ways in which women aligned themselves with different values and beliefs was statistically correlated with their intended behaviour in relationship to managing the risks of air pollution. Women in Group 1 were much more likely than other women to keep their house clean, stay away from the parts of the house where there was a problem, and to call a professional. Even when adjusting for other factors, the women's grouping remained predictive of whether a woman intended to call a professional and keep her house clean.

There were some inconstancies between women's values and intended behaviour. For example women in Group 1 placed more emphasis on friends and family than the government and local leaders whereas for Group 2 women it was the reverse yet there were no significant differences between the women in the two groups in their intentions to make use of these two sources of help. This could be a reflection of some values being more important than others. There's also a possibility that this reflects some unobserved group barrier for these women, such as time, money, self-efficacy, that are more important and shape their choices. In other studies using cultural consensus, that gap in approximation, termed 'cultural consonance', has been shown to be robust predictor of worse health outcomes (Dressler, 2012).

More broadly, there were no discernible differences in socio-demographic characteristics between the groups of women. This fits with the finding of previous research, which showed that no demographic information to be associated with taking environmental action (Cabana et al., 2004). However, there was also no discernible difference in the women's risk perception of air quality. This differs from other research in the risk literature that found a link between risk perception and action (Mak, 2016).

Risk, Experience, and Trust in the Government

Our findings indicate that the sociocultural process influences the risk perceptions and behaviours of low-income pregnant women. The specific association between past experience with air quality as a hazard and membership to a culture that shares a relatively negative perception of government sources was notable. This could indicate a cultural-level dissatisfaction with how official sources have acted in the past. Living through such a high-profile environmental disaster like the Gulf Oil Spill may have affected how some women perceived the government's competence in helping ensure a clean environment. Similar large-scale environmental disasters have negatively affected a population's trust in the government and amplified their perception of environmental risks (Nicholls & Picou, 2013; Safford, Ulrich, & Hamilton, 2012). The risk literature also provides evidence that concerns

about the competence of public institutions may affect personal perception of risk, and a perception of personal responsibility in mitigating that risk (Bickerstaff, 2004; Bickerstaff & Walker, 1999) A recent risk study with mothers found a similar dynamic between environmental concern/awareness and higher levels of protective action (Laferriere et al., 2014).

Our findings are consistent with existing theories of risk in the sociocultural literature and show a shared model of lay risk management strategies (Hammer & Inglin, 2014). While most actions which women indicated they intended to take were congruent with public health recommendations, there were some strategies which are not, and might lead to increased risk in and around the home. For example, household that ignore or avoid air quality issues in the house could increase exposure over time. Similarly women who believe they are taking corrective action by painting over mould spots (rather than properly cleaning them), or heavily using chemical cleaners in the home (in combination with keeping the windows closed) may be unintentionally worsen their household air quality. Contrary to previous studies, there are clear distinctions in behaviour between the risk management of indoor and outdoor environment (Crighton et al., 2013). This may be indicative of unique sociocultural processes in the study area that lead to similar perceptions of air quality inside and outside the home. Additional research will further explore this dynamic among this study sample by analysing cultural perceptions of environmental control and risk, and their association with risk strategies.

The major division between participants in our study was the information seeking intentions, women in Group 1 – who was more likely to have previous experience of air pollution risk – shared an active model of information seeking as family, friends, doctors, internet, and TV news were seen as appropriate sources to turn to. Women in Group 2 – who was less likely to have experience- had no clear, culturally-appropriate source of information regarding indoor air issues. This may demonstrate how past experience may be related to contrasting cultural beliefs. If this is true, it is interesting that lessons from the experience are manifesting as an alternative model of information seeking, rather than altered risk-reduction strategies.

Conclusion

In this article we have examined how low-income pregnant women's understanding of how to manage air risks, the factors were associated with differences in their beliefs and the relationship between beliefs and intended actions. Our findings indicate that a diverse group of low-income, first-time mothers in Southeast Louisiana generally agreed about the ways to manage the risk in the air. However, our findings also identified disagreements and different intentions about information seeking.

We found that three factors interact to affect the risk of a vulnerable population. Environmental exposures exist in the region through a burden of environmental disasters and chronic environmental contamination. This interacts with the policy that is unique to an area. As demonstrated by the cultural data, the experiences produced through services and policies may be impacting how risks are perceived, communicated and managed. Culture

influence where and how people contact environmental media. These three factors all work together to determine the risk of a population in that place, and emphasise the sociocultural relationship between health, risk, and society.

We believe our findings demonstrate the utility of cultural analysis methodology of risk. A more sophisticated incorporation of culture can enhance a profile of community risks and inform effective strategies for intervention. Specifically for the study area, more culturally-informed risk communication strategies can be designed to address the lower-rated behaviours among the specific sub-populations noted.

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Figure 1. Study area with assigned regional categories by parish. Note: Map of Louisiana with study area highlighted with selected regions highlighted in different shades.

Figure 2. Segmented cultural groups. Note: Scatterplot of each participant's two factor loadings with superimposed boundaries signifying how participants were segmented into 3 separate groups.

Table 1.**Socio-Demographic Membership and Risk Perception by Cultural Group**

Category Total Sample % (n)	Group 1 % (n)	Group 2 % (n)	Group 3 % (n)
Age- Under 24 44.64 (50)	43.90 (18)	44.00 (22)	47.62 (10)
Region - Suburban 50.00 (56)	39.02 (16) *	60.00 (30) *	47.62 (10) *
Race/Ethnicity - White 24.11 (27)	26.83 (11)	20.00 (10)	28.57 (6)
High School Degree- No 16.96 (19)	17.07 (7)	18.00 (9)	14.29 (3)
Housing Type – Own Residence 14.41 (16)	12.20 (5)	12.00 (6)	23.81 (5)
Household Income – Less than \$10,000 55.77 (58)	60.53 (23)	50.00 (23)	60.00 (12)
Air Pollution is a 'Moderate' or 'Extreme' Risk Indoor- 27.18 (28) Outdoor- 40.78 (42)	23.68 (9) 44.74 (17)	24.44 (11) 33.33 (15)	40.00 (8) 50.00 (10)
Have 'Small choice' or 'No Choice' in controlling exposure to air pollution Indoor- 52.43 (49) Outdoor- 81.55 (84)	55.26 (21) 84.21 (32)	51.11 (23) 80.00 (36)	50.00 (10) 80.00 (16)
Have 'Moderate' or 'A Great Deal' of experience in managing air pollution Indoor- 29.13 (30) Outdoor- 33.00 (34)	23.68 (9) 52.63 (20) *	33.33 (15) 13.33 (6) *	30.00 (6) 40.00 (8) *
Have 'Complete' responsibility at home to make decisions to manage family's exposure to air pollution Indoor- 29.13 (30) Outdoor- 11.65 (12)	44.74 (17) * 13.16 (5)	26.67 (12) * 13.33 (6)	5.00 (1) * 5.00 (1)
'Never' talk about air quality concerns with other mothers in community Indoor- 42.72 (44) Outdoor- 38.83 (40)	42.11 (16) 21.05 (8) *	51.11 (23) 55.56 (25) *	25.00 (5) 35.00 (7) *

* Significant associations (p<0.05) between groups using Chi-Square

Table 2.**Participant Group-Specific Weighted Responses – Risk Behaviours**

“According to other mothers in your community, how important is it to do the following activity to manage air pollution.”			
Behaviour	Weighted Average of Consensus Rating Group 1 *	Weighted Average of Consensus Rating Group 2 *	Collapsed Response Group 1/ Group 2 **
Avoid parts of the house where there is a problem (e.g., mould, smell)	5.62	5.01	Extremely important / Very important
Call a professional to fix/clean (e.g., mould, smell)	5.51	4.85	Extremely important / Very important
Keep house extra clean	5.75	5.33	Extremely important / Very important
Keep windows open as much as possible (indoor air)	4.72	4.52	Very important
Paint over mould spots	3.79	4.09	Moderately important
Use devices like humidifiers and air fresheners	5.08	3.92	Very important / Moderately important
Ask authorities to do something (outdoor air)	5.32	5.3	Very important
Don't add to the pollution (outdoor air)	5.44	5.16	Very important
Keep windows closed as much as possible (outdoor air)	4.84	4.37	Very important / Moderately important
Move to a cleaner community	4.46	4.5	Moderately important
Stay indoors as much as possible (outdoor air)	3.78	3.71	Moderately important

* Items were rated on a 1–6 scale interval. Averages are weighted by the cultural competencies of the group members

** Answers are collapsed from scale interval: (1.00 to 1.5), ‘Low importance’ (1.51 to 2.5); ‘Slight importance’ (2.51 to 3.5); ‘Moderately important’ (3.51 to 4.5); ‘Very important’ (4.51 to 5.5); ‘Extremely important’ (5.51 to 6.0)

Table 3.**Participant Group-Specific Weighted Responses – Sources of Support and Information**

“How likely would other mothers in your community use the following source for support and information when faced with the threat of air pollution?”			
Sources	Weighted Average of Consensus Rating Group 1 *	Weighted Average of Consensus Rating Group 2 *	Collapsed Response Group 1 / Group 2
Doctor (indoor air)	3.77	3.44	Somewhat likely / Somewhat unlikely
Family (indoor air)	4.65	2.51	Likely / Unlikely
Friends (indoor air)	3.84	1.78	Somewhat likely / Unlikely
Government services (indoor air)	2.67	3.49	Somewhat unlikely
Internet (indoor air)	3.48	3.13	Somewhat unlikely
Local leaders (indoor air)	2.54	3.45	Somewhat unlikely
People at church (indoor air)	2.1	1.97	Unlikely
Police (indoor air)	2.13	2.2	Unlikely
TV news (indoor air)	3.59	2.87	Somewhat likely / Somewhat unlikely
Doctor (outdoor air)	4.07	3.06	Somewhat likely / Somewhat unlikely
Family (outdoor air)	3.89	1.94	Somewhat likely / Unlikely
Friends (outdoor air)	3.39	1.8	Somewhat unlikely / Unlikely
Government services (outdoor air)	2.44	4.58	Unlikely / Likely
Internet (outdoor air)	3.76	4.04	Somewhat likely
Local leaders (outdoor air)	3.16	5.06	Somewhat unlikely / Likely
People at church (outdoor air)	2.23	1.93	Unlikely
Police (outdoor air)	2.75	3.18	Somewhat unlikely
TV news (outdoor air)	4.25	4.26	Somewhat likely

* Items were rated on a 1–6 scale interval. Averages are weighted by the cultural competencies of the group members.

*** Weighted responses were collapsed from interval key: ‘Extremely unlikely’ (1.00 to 1.5); ‘Unlikely’ (1.51 to 2.5); ‘Somewhat unlikely’ (2.51 to 3.5); ‘Somewhat likely’ (3.51 to 4.5); ‘Likely’ (4.51 to 5.5); ‘Extremely likely’ (5.51 to 6.0)

Table 4.**Multinomial Logistic Regression Results of Predictors of Group Membership**

Predictor		Group 2		Group 3	
		Odds Ratio (Ex(B))	(95% CI)	Odds Ratio (Ex(B))	(95% CI)
Ever talk about outdoor air issues with other moms	No	3.89	(1.36–11.19)	1.91	(0.54–6.78)
	Yes				
Have at least moderate experience with outdoor air issues	No	6.16	(1.82–20.81)	1.06	(0.32–3.51)
	Yes				
Complete responsibility in her home to manage indoor air quality	No	1.24	(0.38–4.06)	4.97	(0.95–25.98)
	Yes				

Note: Model is a multinomial logistic regression with cultural group categories as dependent variables; experience, frequency of discussion and household responsibility are included in the table, with region included as a covariate. Group 1 was used as the reference category/Model characteristics: $R^2 = 0.252$ (Cox and Snell) 0.287 (Nagelkerke); Model $\chi^2 = 29.60$

Table 5.

Air Quality Actions Across Cultural Group

Action Text	Percentage answered ('Very Important')			Odds Ratio of those in Group 1 (95% Confidence Interval)
	Group 1	Group 2	Group 3	
Avoid parts of the house where there is a problem (e.g., mould, smell)	68.42	44.44	45.00	2.50 (1.08–5.80)
Call a professional to fix/clean (e.g., mould, smell)	76.32	55.65	40.00	2.93 (1.20–7.15)
Keep house extra clean	84.21	57.78	50.00	4.05 (1.49–11.01)
Keep windows open as much as possible (indoor air)	36.84	28.89	50.00	0.95 (0.41–2.20)
Paint over mould spots	31.58	42.22	20.00	0.90 (0.38–2.11)
Use devices like humidifiers and air fresheners	52.63	44.44	45.00	1.27 (0.57–2.84)
Ask authorities to do something (outdoor air)	47.37	37.78	30.00	1.49 (0.66–3.37)
Don't add to the pollution (outdoor air)	57.89	46.67	40.00	1.58 (0.70–3.54)
Keep windows closed as much as possible (outdoor air)	52.63	24.44	35.00	2.61 (1.13–6.03)
Move to a cleaner community	39.47	35.56	25.00	1.22 (0.53–2.82)
Stay indoors as much as possible (outdoor air)	42.11	20.00	25.00	2.32 (0.97–5.55)

Table 6.

Air Quality Source of Support and Information Across Cultural Group

Action Text	Percentage answered ('Likely' or 'Very likely')			Odds Ratio of those in Group 1 (95% Confidence Interval)
	Group 1	Group 2	Group 3	
Doctor -outdoor air Indoor air	47.37 60.53	44.44 55.56	50.00 45.00	0.96 (0.43–2.15) 1.30 (0.58–2.94)
Family -outdoor air Indoor air	44.74 71.05	44.44 60.00	60.00 65.00	0.76 (0.34–1.71) 1.44 (0.61–3.42)
Friends -outdoor air Indoor air	36.84 44.74	51.11 62.22	50.00 50.00	0.51 (0.22–1.17) 0.53 (0.23–1.19)
Govt. Services -outdoor air Indoor air	52.63 36.84	57.78 42.22	50.00 50.00	0.84 (0.37–1.86) 0.65 (0.28–1.49)
Internet -outdoor air Indoor air	65.79 73.68	51.11 51.11	40.00 35.00	1.96 (0.86–4.50) 3.05 (1.28–7.29)
Local Leaders -outdoor air Indoor air	44.74 42.11	51.11 28.89	60.00 50.00	0.64 (0.28–1.43) 1.19 (0.52–2.73)
Church Leaders -outdoor air Indoor air	28.95 28.95	26.67 20.00	30.00 25.00	1.13 (0.46–2.75) 1.57 (0.63–3.94)
Police -outdoor air Indoor air	15.79 7.89	24.44 13.33	30.00 20.00	0.56 (0.20–1.57) 0.49 (0.13–1.92)
Television News -outdoor air Indoor air	71.05 44.74	80.00 51.11	60.00 60.00	0.82 (0.34–2.01) 0.64 (0.28–1.43)

Table 7-

Multiple Logistic Regression Predicting If Participant Would Call a Professional to Address Indoor Air Quality Concern

Predictor		Odds Ratio (Ex(B))	(95% CI)
High School Graduate	No		
	Yes	5.42	(1.52–19.24)
Income over \$10,000	No		
	Yes	3.13	(1.19–8.25)
Cultural Group 1	No		
	Yes	4.84	(1.60–14.61)

Note: Model is a logistic regression with whether the participant responded that it would be ‘very important’ for them to ‘Call a professional to clean/fix (e.g. mould, smell) a potential indoor air issue’

Model characteristics: $R^2 = 0.199$ (Cox and Snell) 0.271 (Nagelkerke); Model $\chi^2 = 21.25$

Table 8-

Multiple Logistic Regression Predicting Whether Participant Would Keep House Clean to Address Indoor Air Quality Concern

Predictor		Odds Ratio (Ex(B))	(95% CI)
Level of choice about being exposed to indoor air pollution	Moderate/Complete		
	Small/None	4.21	(1.59–11.15)
Level of risk that indoor air pollution poses to family	Moderate/Extreme		
	Small/None	2.93	(0.91–9.38)
Cultural Group 1	No		
	Yes	5.39	(1.83–15.84)

Note: Model is a logistic regression with whether the participant responded that it would be ‘very important’ for them to ‘Keep house extra clean (e.g., vacuum, wash sheets)’ in response to indoor air concerns

Model characteristics: $R^2 = 0.210$ (Cox and Snell) 0.290 (Nagelkerke); Model $\chi^2 = 24.258$