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Implementing Attitudes Measurement to Influence Winter Air Pollution Mask Wearing by Pregnant Women in Ulaanbaatar: A Pilot Study

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Objective: The purpose of this study is to provide an evidence based foundation to implement interventions that improve the health of the population of UB, particularly pregnant women and their yet to be born children by reducing the impact of exposure to the ultra-high air pollution levels found in the city. **Methods:** This is a hospital based cross-sectional survey including 35 pregnant women, 26 doctors and 31 pregnant women participated in focus groups. All participants were selected from Family Health Centers and District Hospital in UB. **Results:** Pregnant women both lack accurate knowledge about the effects of extreme air pollution and mask wearing and desire to have more knowledge. Health practitioners scored much higher than pregnant women, in general, on knowledge about the health implications of air pollution and the benefits of wearing air masks. Pregnant women report an overall very negative perception about wearing air masks that is more negative than their report about their perceptions of other's negative attitudes toward those who wear air masks. **Conclusion:** This pilot study exposes areas that can be used in a complementary manner in the design and implementation of the more detailed full survey that will lead to the design and implementation of the planned intervention.

Key words: Air Pollution, Mask, Pregnant Women, Attitude, Mongolia

Introduction

Air pollution, a global public health emergency, continues to increase around the world. The World Health Organization identifies air pollution as the "biggest environmental risk to health" with 90% of the city dwellers around the world living in cities that fail to meet WHO air quality guidelines [1,2]. Concerns about air pollution are not new. Since the great smog of 1952 in London, there has been a growing consensus that air pollution carries markedly elevated risk of both short and longer-term

mortality and morbidity, while also increasing the risk of a wide range of systemic health conditions that are only now being associated with air pollution [3].

Ulaanbaatar, Mongolia (UB) lies in the heart of the world's air pollution public health crisis. The World Health Organization upper limit guidelines for PM2.5 are 10 ug/m^3 annual mean and 25 ug/m^3 24-hour mean. With ultra-high PM2.5 particulate counts during the Winter (January 2017) measured as high as 495 micrograms per cubic meter (μg/m^3) and a 496 Air Quality Index rating [2], UB ranks among the worst polluted cities in the worldIn the Bayanhoshuu station, located in a Ger district, monthly average PM2.5 concentrations of 1,500 μg/m^3 were reported with daily concentrations of PM2.5 in the 2,310 – 4,060 μg/m^3 range [2, 4].

The impact of severe air pollution in UB, the capital and most populated city in Mongolia, has the potential for being associated with a public health tragedy affecting the population from conception of the unborn in the womb through the elderly [5]. Currently in UB, air pollution levels are so high that they can be associated with adverse health effects across the human health spectrum, ranging from cardiovascular system chronic diseases to low birth rate, childhood obesity and metabolic syndrome [6, 7]. Concerning the risk to children, the World Health Organization states bluntly that air pollution "can stunt their cognitive development, reduce lung function, trigger asthma and set the stage for problems later in life from cardiovascular disease, stroke, chronic respiratory illnesses and cancers" [3]. Further, long term endocrine abnormalities have been associated with elevated levels of air pollution resulting in increased incidence of childhood obesity and related health concerns [8].

Conservative estimates of the health effects of air pollution in Ulaanbaatar indicate that 29% of cardiopulmonary deaths and 40% of lung cancer deaths in UB are associated with outdoor air pollution. These deaths represent 10 to 13% of mortality under various models and assumptions [9]. Aside from these estimates, when viewed at the most extreme range, fetal deaths represent the total loss of life potential among the most precious and vulnerable of the population of UB. A correlation between marked increases in spontaneous abortion and the months of highest air pollution in UB have been shown [10]. The most long - term health impacts are those that begin in the womb by imposing on the unborn increased risk for lifelong, chronic health difficulties.

The long-term negative health impact does not fall equally across populations. As Warburton states, "because >50% of the Mongolian population is under 25 years of age, the impact will disproportionately fall upon children and young women of childbearing age." [11].

Studies using the Health Belief Model have found of the five components, perceived susceptibility and perceived severity were the two most salient factors that motivate air mask wearing during periods of increased severe respiratory infection [12]. However, the first step in persuasion efforts to motivate pregnant women to wear an air mask during high periods of pollution is to determine what attitudes and knowledge impact behavior and behavioral intention to wear a mask.To accomplish this, we use the Theory of Planned Behavior as the theoretical basis for this descriptive study.

We have found no studies into attitudes that account for the non-use of air pollution masks among the population of Ulaanbaatar (UB), Mongolia, specifically including, pregnant women (PW) in UB and the health practitioners (HP) who serve them. Because there is little existing data this study is a preliminary, descriptive study to determine; what attitudes PW and HB of UB hold concerning the health effects of air pollution; the knowledge level of PW and HP of these health effects; attitudes toward wearing air pollution masks; perceptions of social and family response to a person wearing air masks; behavioral intention; what additional data need to be gathered and analyzed to initiate an intervention trial with a high probability of succeeding in motivating pregnant women in UB to wear air masks during their pregnancy; and to determine whether there are actually any benefits to be had.

Therefore, this paper will fill in gaps concerning knowledge, attitude, behavioral intention and practice among PW and HPs toward mask wearing. The study uses the Theory of Planned Behavior to provide an evidence based foundation for future interventions to promote air pollution mask wearing. The purpose is to improve the health of the population of UB, particularly pregnant women and their unborn children by reducing the impact of exposure to the ultra-high air pollution levels found in the city. Further, this study and subsequent studies and interventions may provide a guide to address air pollution in other locations, world-wide.

Materials and Methods

1. Setting

The health system in Mongolia is a single statutory system functioning according to administrative divisions with two-tiers: primary and specialized care, the latter comprising secondary and tertiary care. While primary health care services are delivered by family GPs, who are medically trained primary health care workers at the smallest administrative unit level, secondary care is delivered by district hospitals. These district hospitals have 11-16 departments representing all major clinical specialties. Tertiary care is provided through the state clinical hospitals and specialized health centers. In 2015, there were 129 family health centers, 12 government-run district hospitals, 13 central hospitals and specialized service centers. The present study was conducted in two clinical settings in Mongolia: family health centers, and district hospitals. Family health centers usually have three to six family doctors and one nurse per doctor. On average, Mongolians visit the family health center 3.2 times every year. The district hospital is defined as a health organization that provides outpatient and inpatient medical services in at least seven specializations (internal medicine, pediatrics, obstetrics and gynecology, general surgery, dental care, neurology and infectious disease. In 2010, district hospital beds accounted for 9.5% of the total hospital beds and district hospitals admitted 76,700 patients.

Pregnant women attending Family Health Clinics (FHCs) to receive a medical examination who were registered in the clinic and health practitioners who practice medicine in the clinic were approached and asked if they were willing to participate in the study. Pregnant were assigned either to a focus group or were asked to respond to a questionnaire. Health practitioners were asked to respond to a questionnaire. Focus group participants signed a consent form and survey respondents gave oral consent before responding to the questionnaire. All focus group and survey activities took place in the FHC setting. One district hospital was also included and the procedure for pregnant women and health practitioners was the same as in the FHCs.

2. Study participants and sampling

Three small independent samples were used to provide a preliminary assessment of attitudes of pregnant women and health care providers toward air pollution health concerns and mask wearing. Taken together, the results from these three samples provide complementary indications of attitudes toward and knowledge of the negative health impact of extreme air pollution on pregnant women in UB and the potential benefits to these women of mask wearing. There were 93 total participants in the three samples.

Convenience sampling was used during this pilot study. After the pilot study, the test instruments will be improved before being used in a larger and more detailed survey. Since there will be improvements/changes to the pilot study questionnaires, we are not planning to use the same questionnaires in our larger study. We envisage that our main survey will employ a simple random sampling method. Members of the three samples did not overlap, no person was in more than one sample group and did not have an opportunity to discuss any of the questions with anyone else in their sample or in the other samples.

3. Study design and participant recruitment

This is a hospital based cross-sectional study among HPs and Pregnant women. Pregnant women were approached in participating FHCs and the study was explained and they were asked if they were willing to participate by taking a survey or being in a focus group. If so, they gave oral consent.

Doctors who work in participating FHCs and gynecologists in the district hospital were asked if they were willing to participate by taking a survey. If so, they gave oral consent. Pregnant women asked to participate in focus groups gave written consent.

The same inclusion/exclusion criteria were used for all the pregnant women who participated in the study. Inclusion criteria included: Each participant agreed to participate and signed a consent to participate in the study; Each participant to be a pregnant woman in any gestational age who was in a family clinic to have her regular check-up.

Exclusion criteria included: Any woman in the clinic who was not pregnant; did not agree to participate; was not registered in the Family Health Clinic or not in clinic for a pregnancy check-up.

Pregnant women were approached in participating FHCs and the study was explained and they were asked if they were willing to participate by taking a survey or being in a focus group.

Doctors who work in participating FHCs and gynecologists in the district hospital were asked if they were willing to participate by taking a survey. This study was conducted between May and July 2017.

Sample one: Focus Groups

Sample one consists of six focus groups comprised of pregnant Mongolian women who live in various areas of UB. These focus groups were conducted at clinics in Songino-Khairkhan district 7 khoroo, Chingeltei district, Songino-Khairkhan District, 2 Khoroo, Chingeltei district, Songino Khairkhan district, 13 khoroo, Chingeltei district. There were 4 to 7 participants in each focus group and participants were previously unknown to each other. A moderator led the discussion with a note taker and an audio recording. A compilation of important comments was derived from written notes and the audio recording. There was a total of 31 participants in the focus groups.

Sample two: Health Practitioner Survey/Medical Doctor

Sample two is a hospital-based cross-sectional study, the health practitioner sample, consisting of twenty-six medical doctors who practice in hospitals or family clinics that provide antenatal care, examine pregnant women and monitor the progress of their pregnancies. Each physician was given a written health practitioner survey that was based on the main survey given to the pregnant woman sample group.

The physicians were briefly introduced to the purpose of the study and oral informed consent was taken. In the Family Health Center, doctors were recruited after their weekly group consultation and lecture to pregnant women. For the District hospital, physicians and pregnant women were selected after individual weekly clinic visits by the pregnant women. Pregnant women and doctors were asked if they were available to do the survey at each center that we visited. Further, only doctors on shift during research were enrolled.

Sample 3: Pregnant Woman survey

Thirty-Five pregnant Mongolian women living in UB were given a survey to assess attitudes toward mask wearing during pregnancy, knowledge of the negative health impact of breathing heavy air pollution on themselves and their unborn children and their perception of the attitudes of those around them to air pollution and air pollution mask usage. This survey was designed to identify pregnant women's attitudes toward air pollution as well as their perception of the attitudes of those close to them toward air pollution and air pollution mask wearing. The survey was administered to determine what attitudes pregnant women in UB hold toward air pollution and mask wearing because these views are potentially important to tailor messaging designed to persuade them to wear air pollution masks when outside during periods of high pollution.

4. Questionnaire Development and Variable Definition

Survey instruments used in this preliminary study were based on the Theory of Planned Behavior (TPB), a widely used and accepted theory used in advertising and behavioral change interventions as evidenced by the over twenty-eight hundred peer reviewed health behavior articles listed by http://www.ncbi.nim.gov/pubmed curated by the U.S. National Library of Medicine and Science [13]. We use TPB to measure attitudes, knowledge and behavioral intention toward protective mask wearing by pregnant women during periods of high pollution.

Health behavior studies have found that attitudes toward the behaviors studied can have a significant influence on behavior. Keppler, for example, found that, "young people's attitudes and beliefs regarding noise, hearing loss, and HPDs (Hearing Protection Devices) have a significant impact on their hearing status [14]. When personal dust monitors were introduced to coal miners by the U. S. National Institute for Occupational Safety and Health (NIOSH). NIOSH cited five levels of factors that influence individual behaviors that may lead to better health choices. The highest level of influence listed was individual (e.g., knowledge, attitudes, and behaviors) and the lowest level listed was Public policy (e.g., local, state, and national laws and policies) [15].

In the pregnant women survey, we have a total of 75 questions including general opinion, specific beliefs, knowledge, concerns, future plans, attitude toward air pollution mask, communication with family members on air pollution mask usage and demographic information such as the year you were born, gestational age, number of babies, marital and educational status, residential location. The survey included two types of responses. Indicating strength of answer on 10-point scales and responses to yes, no and don't know questions. The internal consistency of the 10 items' outcome was investigated with Cronbach's alpha coefficient. The alpha coefficient is 0.92 and represents high internal consistency among the items. The content validity of the questions was checked with expert panels from Department of Obstetrics and Gynecology, Department of Epidemiology and Biostatistics, School of Public Health, Mongolian National University of Medical Sciences. The questionnaire has been translated into the Mongolian language

and back translated to English and double checked with the Principal Investigator (PI). The questionnaire was also reviewed by three medical students to guarantee that it was applicable to a Mongolian setting, and the wording was adjusted.

Twenty-Six Medical doctors completed a written Health Practitioner Survey based on the pregnant women's survey using 10-point scales and yes and no questions. There is a total of 28 questions in the Health Practitioners Survey. This survey was designed to identify positive or negative attitudes among medical doctors toward mask wearing, knowledge of potential health problems caused by air pollution and potential benefits of mask wearing by pregnant women and the attitudes of the doctor toward wearing air pollution masks themselves. This survey was administered to determine if materials needed to be developed to counter negative attitudes of doctors to air pollution mask wearing because negative attitudes on the part of doctors could negatively impact the response of pregnant women in UB to doctor's recommendations to wear air pollution masks.

The survey measured knowledge about the negative health impact of extreme air pollution, attitudes (concerns) toward the negative health effects of air pollution, attitudes (perceptions) toward wearing an air mask, perceptions of the attitudes of others toward pregnant women wearing an air mask, attitudes toward the effect of wearing an air mask on pregnant women's appearance, knowledge and attitudes about the efficacy of wearing an air mask, attitudes (concerns) about the cost of air masks and the comfort of wearing an air mask.

5. Statistical analysis and Ethical Consideration

All statistical analyses were made with Statistical Package for the Social Sciences SPSS version 17.0. The statistical analyses of categorical variables were employed Chi-Square Test to examine the association of knowledge and efficiency among Physician and Pregnant Women. P-value is less than 0.05 is considered as statistically significant. A cross-check of the data with two persons was performed to reduce errors during data entering and cleaning procedure. All questions were registered and entered according to the coding book including variable name, definition and its type. Descriptive analysis was performed using number and percentage of the distribution of responses. Additional categorization was made with 5 essential areas involving air pollution mask comfort, cost, appearance, health and efficiency. All questions were sorted into each category. Perception of pregnant women was further divided into self and other's perception toward wearing an air pollution mask. Using a scale 2 through 6 the knowledge score was calculated using 2-4 as low knowledge and 5-6 as high knowledge. Further subgroup or sensitivity analysis and more advanced statistical analysis will be done in the future more detailed survey. Ethical approval has been obtained with the Mongolian National University of Medical Sciences, Research Ethics Committee # 2017/3-2017 01 and Claremont Graduate University IRB #2866. Administrative permission was obtained with the district and family health center's managers before distributing the questionnaire.

Results

1. Health Practitioner Survey

Pregnant women in UB regularly have appointments at regional hospitals and clinics. These visits to hospitals and clinics are natural intervention points to provide information and direct recommendation to pregnant women to wear air masks. These recommendations, when made by physicians who attend these women, may be highly effective either positively or negatively if there is a positive or negative bias toward mask wearing by pregnant women held by the physicians who make the recommendation. Previously we had no data indicating attitudes held by physicians toward the effects of air pollution or toward mask wearing by pregnant women.

Based on the data collected we find that attitudes of physicians in UB pregnancy clinics are positive toward mask wearing by pregnant women. Physicians are concerned about their own health and about the health of their patients and view mask wearing as an effective method to reduce health risks caused by high air pollution levels. Equal numbers of physician's report wearing an air mask. Health practitioners report high agreement that wearing a mask is comfortable. Frequency of reported wearing air mask is higher than observed in general population where mask wearing is rare.

2. Pregnant women survey

Responses by pregnant women given the pregnant women survey were categorized into the areas of health, pregnant women's attitudes toward wearing an air mask, pregnant women's perceived attitudes of others toward pregnant women wearing air masks, appearance of pregnant women wearing an air mask,

perceived efficacy of air masks, cost of air masks and comfort of air masks. Categories were defined as positive or negative responses. In areas concerning knowledge, correct answers were defined as positive and incorrect answers were defined as negative. In areas concerning attitudes or the perception of other's attitudes those responses that were most likely to indicate a willingness to wear an air mask were defined as positive and those most likely to indicate an aversion to wearing a mask were defined as negative. Thus, under appearance, responses that indicated that the woman was less attractive because of wearing a mask were defined as negative. Under health, responses that indicated that extreme air pollution is unhealthy were defined as positive as these responses would make it more likely that a woman would wear an air mask. For "yes, no, don't know" responses, "don't know" was always defined as negative while "yes, no" responses were coded positive or negative based on

Table 1. Pregnant women general opinion toward air pollution mask (N=35)

Questions	Acceptance score		Mean(SD)
	Lower score <5 N(%)	Higher score>6 N(%)	
Will be healthy	9 (25.7)	26 (74.3)	7.26(2.96)
Will live longer	13(37.1)	22 (62.9)	6.77(2.89)
Will feel satisfied	13(37.1)	22 (62.9)	6.57(3.14)
This is a right decision to wear air pollution mask	8(22.9)	27 (77.1)	7.83(2.37)
Positive impact on my health	10(28.6)	25 (71.4)	7.31(2.52)
Comfortable to wear	17(48.6)	18 (51.4)	5.89(2.58)
Support from my family	7(20.0)	28 (80.0)	7.8(2.35)
Support from my relatives	9(25.7)	26 (74.3)	6.94(2.49)
Support from my friends	8(22.9)	27 (77.1)	7.17(2.63)
On a scale 1-10			

The most prevalent negative attitude held by pregnant women in UB concerned having adequate knowledge about wearing a mask and the efficacy of air masks. (Figure 1) (Table 2) In both these areas the categorized response rate was 68% negative indicating concerns about the act of wearing an air mask and the usefulness of the mask as protection against the harmful impact of highly polluted air. Although the pregnant women sample was small, distribution of responses and demographics were typically normal. (Figure 2) (Table 3)

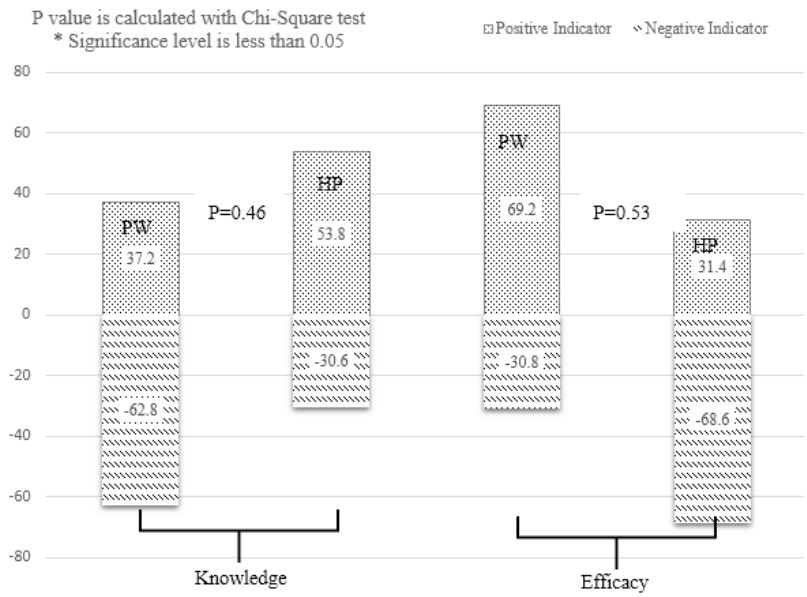

Figure 1. Knowledge & Efficiency- Air Pollution & Mask wearing Pregnant Women (PW) and Health Practitioners (HPs) Ulaanbaatar

Table 2. Chi-Square table Knowledge & Efficacy- Air Pollution & Mask wearing Pregnant women (PW) and Health Practitioners (HP) in Ulaanbaatar

Variables	Pregnant Women(%)	Health Practioners(%)	P value*
Knowledge			
Good knowledge	37.2	53.8	0.41
Less knowledge	62.8	46.2	
Efficiency			
High agreement	31.4	69.2	0.53
Low agreement	68.6	30.8	
Total	100	100	

*P-value is calculated with Chi-Square test and considered significant as <0.05

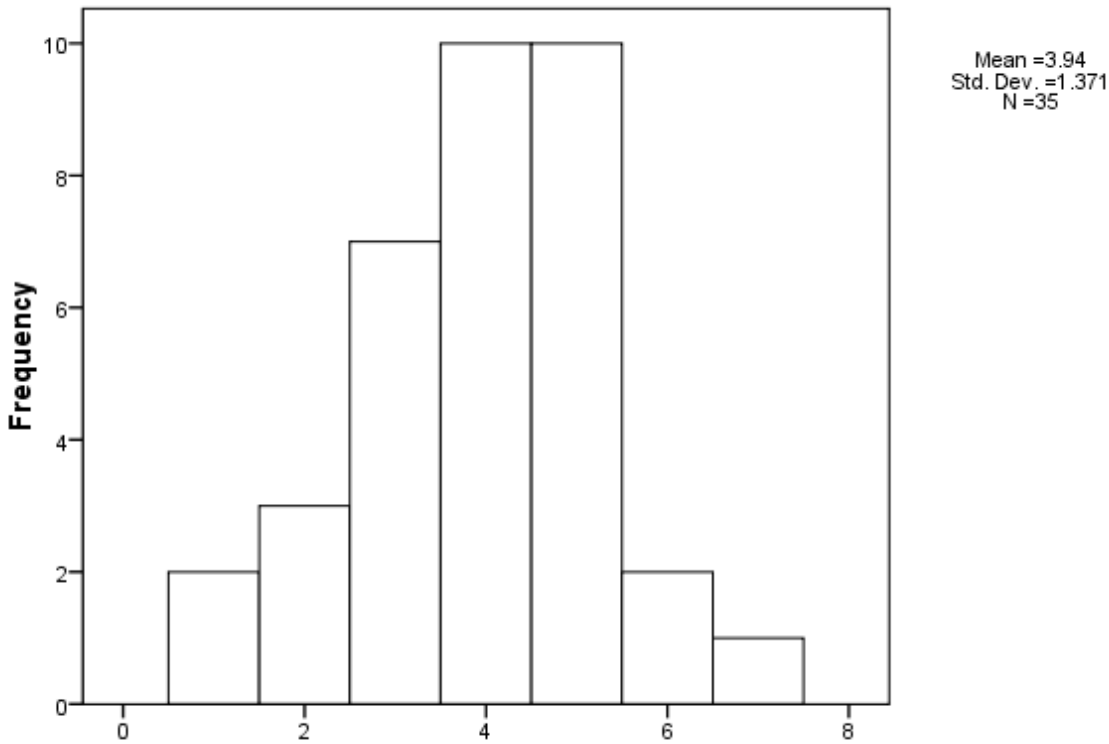

Figure 2. Pregnant women knowledge toward air pollution health effects; highest score is 7; lowest score is 1

the wording of the question.

The most prevalent positive attitude held by pregnant women in UB is their concern about health issues caused by extreme air pollution. 60% of the responses given to health-related questions were positive, with 40% being negative. Positive responses indicate those that favor wearing a mask, negative responses are those that do not favor wearing a mask. For individual responses, attitudes toward wearing a mask were generally positive (Table 1).

Focus Group Responses

Responses from the focus group participants complemented the survey responses from the health practitioner survey and the pregnant women survey in many respects. In the area of knowledge, general comments were that participants needed more knowledge but the consensus is that air pollution in the Winter is unhealthy and people need to do something about it.

Participants did not express negative impressions of those who wear air masks (Figure 3). Participants were unable to

Table 3. Pregnant women demographic indicators in the study (N=35)

Variables	N	%
Date of Birth		
<1988	9	25.7
>1989	26	74.3
Residential Location		
Chingeltei District	16	45.7
Songinokhairkhan District	19	54.3
Educational Level		
High School	7	20.0
College	6	17.1
University	3	8.6
Bachelor	18	51.4
Master	1	2.9
Marital Status		
Single	3	8.3
Married	22	62.9
Divorced/Separated	5	14.3
Living together	5	14.3
Total	35	100.0

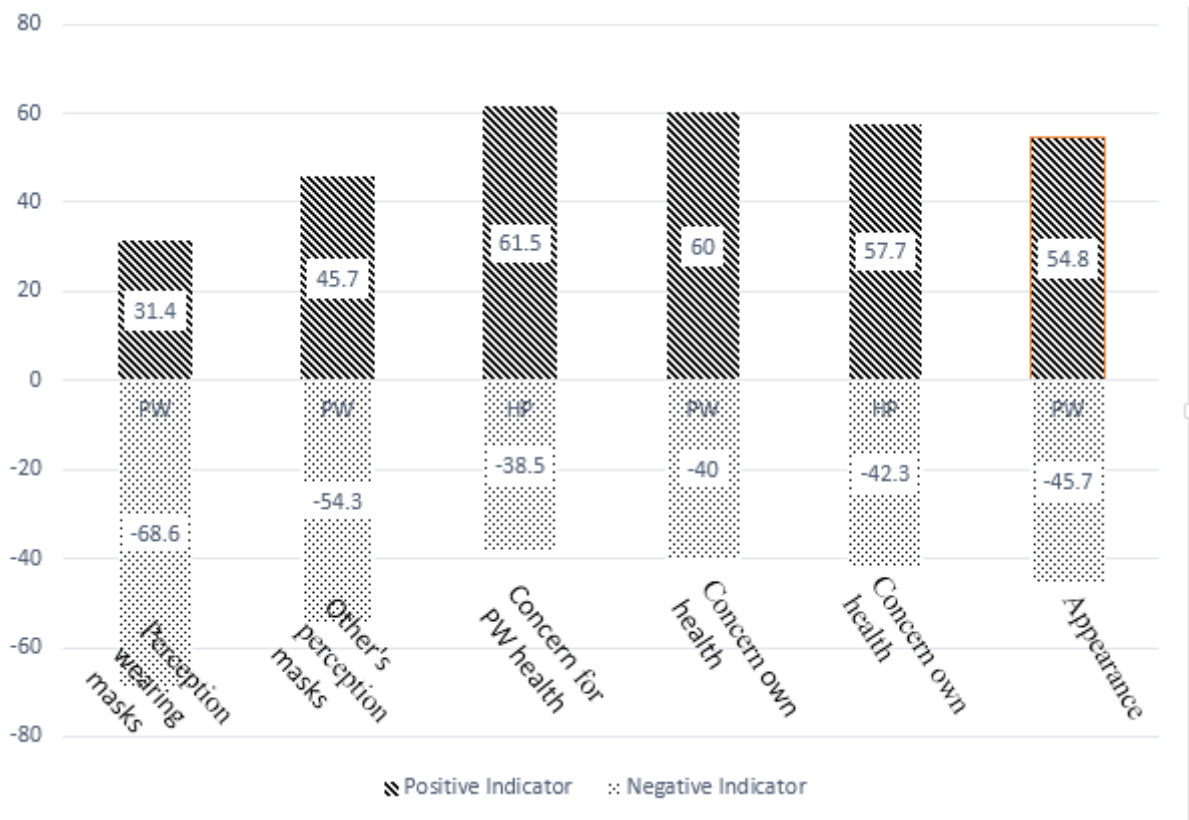

Figure 3. Perception & Appearance- Air Pollution & Mask Wearing Pregnant women (PW) and Health Practitioners (HP)

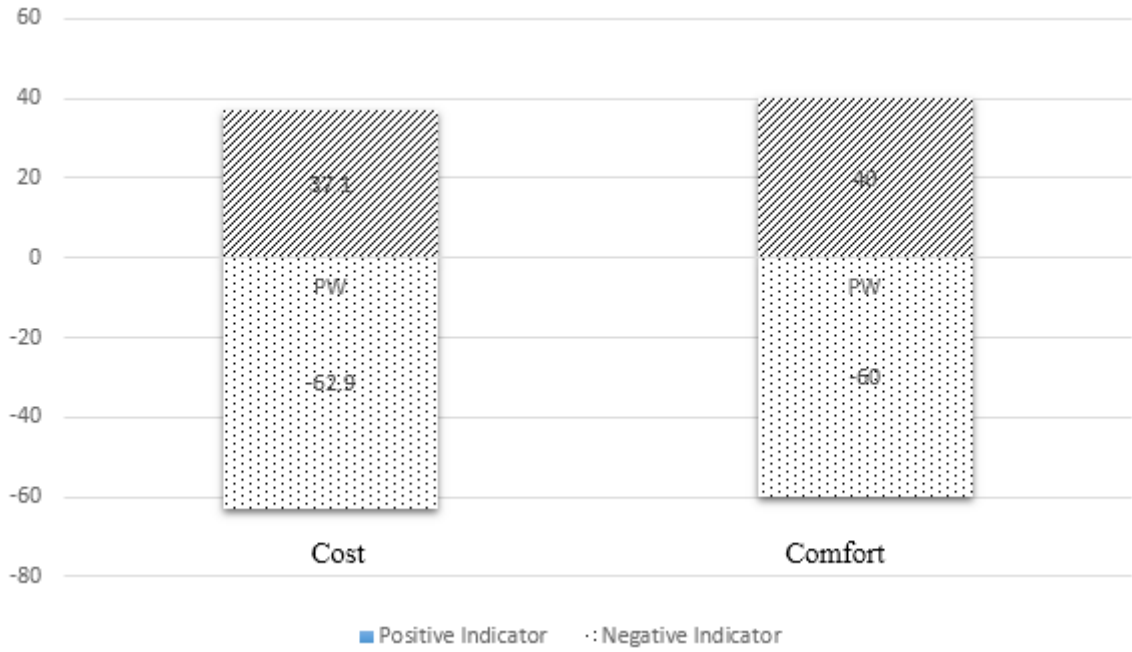

Figure 4. Cost & Comfort- Air Pollution & Mask Wearing Pregnant Women (PW) Ulaanbaatar

remember any details about persons who they may have seen on TV or the internet who were wearing air masks indicating that they did not pay more than the usual attention to those wearing masks because they considered them different in a positive or negative way. People who were seen in public wearing a mask were perceived to be taking care of their health, either from air pollution or from infectious disease, depending on the type of mask worn.

There was a strong desire expressed to have more information and encouragement to wear a mask expressed across several of the focus groups. Facebook was mentioned and communicating directly to the pregnant woman was felt to be a good way to spread the information. Pregnant women expressed concern for the health of their babies during the high pollution winter. Women did not express concern for the health of their babies connected with breathing lower pollution summer air. Medical Doctors were also specified as a credible source of information and encouragement to wear an air mask.There was concern, as in the surveys, about the cost and comfort of masks. Participants were concerned that masks would be too expensive to buy for the family and uncomfortable to wear (Figure 4).

An insight into the question of appearance emerged. There was no concern about the appearance of a person, positive or negative, who wore a mask in public, although there was concern expressed that wearing a mask could damage the makeup that a woman was wearing so the real concern about appearance was after the mask was worn and then taken off at the woman's destination.

Pregnant women in the focus groups expressed a desire to have better and more information about air pollution masks, wanted a way to protect their unborn children from the potential negative health effects of air pollution and expressed no negative attitudes toward those who wear masks. Pollution air mask wearers were perceived as being sophisticated, foreigners, loving themselves and taking care of their health.

Discussion

This is the first examination to our knowledge, using concepts embodied in the theory of planned behavior, of factors that cause women to wear or not wear an air mask. We have investigated through survey, attitudes of pregnant women toward wearing an air mask and attitudes of health practitioners, specifically medical doctors who see pregnant women during their pregnancy. Through focus groups we have both confirmed and uncovered additional attitudes toward mask wearing by

pregnant women. This pilot study exposes areas that can be used in a complementary manner in the design and implementation of the more detailed full survey that will lead to the design and implementation of the planned intervention.

Pregnant women in UB, Mongolia, breathe some of the most toxic air found in cities around the world. Respiratory disease is the nation's leading cause of morbidity [16]. In a country with the highest ratio of land space to people there is little expectation that air quality in UB will improve soon. Mask wearing during periods of high pollution is rare among the population of UB in general and is rare among pregnant women specifically. The importance of mitigating outdoor exposure to air pollution is shown by a study of carbon black, PM2.5 exposure of children in UB. The highest levels of exposure occur when the child is outside, going to school or playing, and is highest for those who are in, or closest to the Ger districts. Thus, pregnant women can expect exposure to elevated levels of black carbon, PM2.5 when they are outdoors in the highly polluted winter season [17]. Until the overall atmosphere of UB improves pregnant women have the option of wearing a mask to mitigate the amount of air pollution. Our study gathered data to that provides insights into why pregnant women do not wear masks during high pollution periods and to indicate which approaches are best to explore to help pregnant women in UB change this behavior and begin wearing masks. The stakes are enormous. Not only is each woman's own health threatened by the extreme air pollution in UB, but the development and health of the child in her womb is threatened.

Our data indicate that there are many factors to be explored to prepare an intervention to assist pregnant Mongolian women to take action and begin to wear air pollution masks during periods of Winter air pollution. Pregnant women lack accurate knowledge about the effects of extreme air pollution and mask wearing and desire to have knowledge. In the survey, pregnant women score low in knowledge about effects of air pollution and the urgency of wearing an air mask. In focus groups, this was confirmed by comments that indicate a desire to have more knowledge, and specifically, more knowledge about the efficacy of wearing an air mask, the specific benefits that could be derived from wearing air masks and how to choose which air masks to wear. There is also concern about the cost and ability to afford to wear air masks with the implication that if the pregnant woman begins to wear an air mask, then the whole family will wear masks.

Importantly, health practitioners scored much higher than pregnant women, in general, on knowledge about the health implications of air pollution and the benefits of wearing air masks. Where pregnant women showed slightly more positive concern for health impacts of extreme air pollution than they showed negative concerns, health practitioners reported a slightly higher concern for the health of pregnant women than for themselves and a slightly higher concern for the health of pregnant women than pregnant women reported for themselves. Coupled with health practitioners' much higher positive response to the efficacy of wearing an air pollution mask than pregnant women we find that health practitioners as a group favor and are positive toward recommending that pregnant women wear air pollution masks as a form of personal protection during periods of high air pollution. This is in line with Public Health recommendations published concerning health steps to be taken for protection against air pollution. Praamsma recommends, after step 1, to stay inside, that the next most important step to take is to wear an air pollution mask [18].

The responsible and enlightened position is to satisfy the need for choice for pregnant women in UB by examining alternatives to waiting and suffering. This is best accomplished using newly acquired knowledge and understanding to provide a basis for each pregnant woman to make her own informed decision backed by data and study as was done when personal dust monitors were introduced to coal miners by the U. S. National Institute for Occupational Safety and Health (NIOSH).

In that study a, decision was not made, *a priori*, that miners would not welcome and use personal dust monitors, or that the monitors would be ineffective. Monitors were produced, issued and then evaluated in the field. As noted earlier, NIOSH cited five levels of factors that influence individual behaviors that may lead to better health choices. The highest level of influence listed was individual (e.g. knowledge, attitudes, and behaviors) and the lowest level listed was Public policy (e.g., local, state, and national laws and policies) [10]. Clearly, pregnant women of UB deserve at least this level of consideration and assistance to provide them with adequate basis to make informed personal health decisions for themselves and their unborn children. Children, including infants, born and unborn, are among the most susceptible in every population to the systemically health compromising impact of extreme air pollution. The urgent

need for action is shown by such indicators as the number of spontaneous abortions increasing three-fold in the winter compared to the summer in 2011 [18].

Pregnant women, however, report an overall very negative perception about wearing air masks that is more negative than their report about their perceptions of other's negative attitudes toward those who wear air masks. In the aggregate, pregnant women's responses to questions that directly and indirectly indicate a negative attitude reveal fairly strong negative attitudes toward those wearing air masks, with the most pronounced negative attitudes being reported for themselves.

One aspect of this negative report that would not be apparent without the focus groups are the comments that were made about the concern that wearing an air mask either has, through the experience of a participant in the focus group, or could, mess up a woman's make up. This is an important consideration as the use of make-up is an integral part of many Mongolian women's routine of being properly dressed and groomed when going out and when going to work.

Pregnant women report very negative attitudes toward their perception of the efficacy of wearing an air mask during extreme winter air pollution. This is expressed as a lack of knowledge about the specifics of the dangers of highly polluted air, a lack of knowledge about what kind of air pollution masks to buy and a lack of understanding of how to know which air masks meet the requirements of filtering the harmful constituents of polluted air. Reports by pregnant Mongolian women indicate that they are very aware that their knowledge about air pollution and air masks is poor and they indicate, through their responses to the survey and in direct spontaneous comments in the focus groups, that they do not have enough knowledge and that they greatly desire to have more knowledge about the harmful effects of air pollution, the efficacy of air pollution masks and the identification of the bests masks to use.

Pregnant women report that they consider their health practitioner is an important source of information and would like to have the health practitioner's assistance in knowing which masks to use and to confirm that wearing an air pollution mask is a good thing to do. We believe from this data that this could be a very strong approach to helping pregnant women in Mongolia change their behavior from not wearing a mask to wearing a mask. Health practitioners scored the efficacy of air pollution masks much higher than pregnant women and both report that wearing a mask would be a good thing for a pregnant woman to do. Providing health practitioners with current and accurate information to pass on to pregnant women appears to have high potential as a strong persuasive action.

The cost of wearing air pollution masks is a very strong negative concern of both health practitioners and pregnant women. Health practitioners report a higher negative than pregnant women themselves. The concern of pregnant women about the cost of wearing air pollution filters includes an assumption that other members of their families will also wear air pollution masks when they begin wearing air pollution masks. This was expressed during focus group comments and in the survey with comments such as, "Not everyone can afford to buy 2000 tugrik mask, with that kind of money your children could live for 2 days." The variability of pricing was a concern as well expressed as, "a stable price on every mask, every pharmacy has different prices. Some of them so expensive that you have to choose between a mask and bread."

Pregnant women perceive that air pollution masks are uncomfortable to wear. These discomforts include difficulty breathing when wearing the mask, unpleasant odors from their own expiration being trapped in the mask, physical overheating and sweating when wearing a mask and the problems of maintaining a pleasing appearance because the mask might damage their make-up.

Across all categories health practitioners report more positive attitudes toward pregnant women wearing masks with 4 out of 5 aggregated areas of response being more positive than negative. Yet, almost 50% of health practitioner responses were negative. Thus, health practitioners need supporting materials to help them have the information that pregnant women want and need about air pollution's health dangers and the value, comfort and affordability of wearing air masks. This data indicates that health practitioners need support materials to provide information to help them have a positive attitude toward recommending that their patients wear air masks during periods of extreme winter pollution. It may be necessary for health practitioners to provide a starter supply of air pollution masks to encourage a change in behavior in their pregnant patients from not wearing an air pollution mask to wearing an air pollution mask.

Finally, we have strong indication of an absence of correspondence between attitudes and actions or a lack of

attitude-behavior consistency (ABC) [19]. Pregnant women in UB do not have a negative bias against those who wear air pollution masks nor do they report a perception of negative bias against them wearing an air pollution mask. Wearers of masks are reported by them to be "sophisticated" and caring for their health. Pregnant women in UB also express the need to protect their unborn from the potential negative health effects of ultra-high air pollution. Yet, pregnant women in UB still do not wear air pollution masks to the detriment of the babies that they carry and to themselves.

The individual pregnant woman in Mongolia has little hope of single-handedly changing the entire atmospheric environment of UB. Yet, it is indefensible to treat pregnant women of UB as powerless, ignorant and unworthy of having an awareness of all potential avenues of relief for herself and her unborn child. As when handwashing was introduced as an important health measure, there may be a measure of resistance to new avenues of behavioral change by organizations that, rightly, believe that the ultimate solution is to provide clean atmospheric conditions for all citizens of UB [20]. Our aim is to explore these additional avenues of choice and present those that have value to those who need them most, the pregnant women of UB.

During the next, more detailed and larger study and the following intervention we intend to use the attitude behavior consistency findings to test the value of strengthening attitudes toward the need to protect the unborn child and to use the perceived value of a recommendation by a physician to increase the strength of attitudes toward the need to protect the health of the baby. Additionally, we are interested eventually in physiological testing that will help establish the potential health benefits of mask wearing.

Our samples were small and this is a pilot study. We had a total of 93 participants in three independent samples, each of which were investigated separately and distinctly. We intend to follow up with a more focused and comprehensive survey for pregnant women and health practitioners to refine our understanding of specific approaches to implement an effective intervention to change pregnant women's behavior to mask wearing. There are areas that need clarification, particularly in areas of attitudes concerning the perception of those who wear an air pollution mask. We intend to design specific portions of the next study to address these needs.

Conflict of Interest

The authors state no conflict of interest.

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