Final Report

HUMAN CITIES EXPO

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Contents

I. Introduction

It has been years since Beijing residents have had their last sunny winter. As Beijing experiences rapid economic development, an undesirable side effect - air pollution- has appeared and has rapidly become a major health and environmental challenge. With more than 200 million residents, Beijing ranks one of the most highly populous urban areas. Such a high density makes Beijing vulnerable to many environmental and health issues including the 2003 SARS epidemic and the floods in 2013. Therefore, campaigns are needed to spread awareness about air pollution and to educate people about how to protect themselves effectively. Clean Air Asia (CAA) is a leading international non-governmental organization that leads the mission for better air quality and healthier, more livable cities in Asia. CAA is planning to launch a public health education campaign to protect the health of senior citizens, a particularly vulnerable group, against the effects of urban air pollution in Beijing. As a group of students from Stanford University and Tsinghua University with a variety of backgrounds and skills in engineering and the social sciences, we are advising CAA on ways to effectively communicate with senior citizens to empower them to take steps to protect their health. We produced a comprehensive literature review and conducted fieldwork to inform our prototypes of materials that CAA can use to educate senior citizens.

II. Context

We searched scientific and psychological publications from online databases and organized this information to provide multiple perspectives on the issue of the health impacts of air pollution on the elderly in Beijing.

The scientific literature review focuses on how the major air pollutants affect human health, especially for the elderly in a variety of geographical contexts. The psychological literature review focuses on important considerations when communicating with the elderly. We also reviewed relevant previous campaigns in China, Japan, and the US and evaluated their impacts. We conducted interviews with experts at Stanford University and Tsinghua University to complement our literature review. These experts provided us with useful ideas about how the scientific basis of air pollution and effective ways to reduce the exposure level of senior citizens.

We conducted field research in Beijing and the San Francisco Bay Area to develop and test materials that could be used in Clean Air Asia's public health campaign to seniors. Some of our group members conducted interviews in Beijing last summer, and we extended our investigation to include a cohort in Bay Area. We used the findings from our interviews to design prototypes of flyers and educational activities. We then tested and refined these flyers to evaluate the most effective strategies to communicate health information to senior citizens. Using this information, we developed a lecture that we delivered on-site with Clean Air Asia to seniors in Beijing. During the activity, we introduced the health impact of air pollutants and suggested proper protection method by showing our posters and videos.

We will conclude this report with a reflection on the design process and the findings from our research. We will suggest future work and summarize our recommendations for Clean Air Asia.

III. Literature Review

Through our literature review, we explored three questions:

1. What are some major health concerns associated with exposure to air pollution that are particularly relevant to senior citizens living in urban areas?
2. What are important psychological considerations when providing educational outreach to senior citizens particularly in Beijing?
3. What are effective campaigns that have been launched in other contexts, and how can these inform our campaign?

1. What are the health concerns associated with exposure to air pollution that are particularly relevant to senior citizens living in urban areas?

Health Effects of Air Pollution on Senior Citizens

Airborne particles affect human health and wellbeing in several ways. PM 2.5 pollution is particularly damaging for the respiratory health of vulnerable populations. A study published by the Journal of Occupational and Environmental Medicine concludes that daily exposure to PM pollution indoors and outdoors may result in adverse effects on cardiovascular function and blood mediators that modulate vascular system in seniors (Liu, 2009).

This is particularly problematic for seniors living in areas with heavy traffic pollution. When exposed to traffic related air pollution, elderly subjects with coronary artery disease experience significant rises in systolic and diastolic blood pressure and increased risk of heart attack. This was particularly pronounced in overweight individuals (Delfino, 2010). Specifically in Beijing, elevated levels of ambient air pollutants were associated with the increase in hospital emergency room visits for cardiovascular disease in Beijing, China. According to the data, the associations for 10 μg/m3 increases in levels of $PM_{2.5}$, SO_2, or NO2 and hospital ER visits for cardiovascular diseases were statistically significant. This effect was especially acute for senior citizens (Guo, 2009). According to the results of a study of Beijing citizens exposed to high levels of pollution, ambient concentration is not always a good indicator of personal exposure concentration. Outdoor activities (commute mode, exposure to heating, workday or weekend travel) influenced personal exposure concentrations significantly, but the magnitude of the influence from indoor activities (exposure to cooking) was masked by the high ambient concentrations (Du, 2010). In the Chaoyang District of Beijing, daily cardiovascular and respiratory death rates are significantly associated with the concentration air pollutants, especially deaths related to cardiovascular disease. The current movements of PM_{10} and NO_2 during the day were higher than that of single lags (distributed lags) and moving average lags for respiratory disease mortality (Zhang, 2007). This shows the relative importance of air pollution on cardiovascular and respiratory mortality.

The health impacts of air pollution are better defined by geographic rather than socioeconomic factors. In one study of health status and air pollution in urban China, elderly residents living in richer cities are affected more by air pollution than their counterparts in poorer cities. This study suggests that in areas with a higher GDP, senior citizens may be more susceptible to the ill effects of air pollution. The air pollution index included criteria such as self-rated health, and cognitive function (Sun, 2008). However, it is clear that an unequal distribution of air pollution contributes to health disparities .The gap in life expectancy between areas with good air quality and moderately heavily polluted areas was 3.78 years for women of age 65 and 0.93 years for men. The gap in health expectancy at age 65 was 5.20 years for women and 1.47 years for men in China (Wen, 2012).

Interventions for Personal Protection

There is controversy about the effectiveness of personal protective equipment. A study by the Centre for Cardiovascular Sciences in Edinburgh University suggests that reducing personal exposure level of PMs will have a small but consistent improvement to the patient's' health. Although it is difficult to reduce average pollution level, facemasks could be a good choice for whoever needed (Langrish 2012). Another study shows that personal exposure to particulate air pollution is reduced by the use of a simple facemask (Langrish 2009). However, because the small sample sizes were used, it is likely that more research must be conducted to understand the effectiveness of facial masks particularly in urban Beijing.

We conducted a review of effective air purifiers based on recommendations from air quality experts in Tsinghua University. Table 1 summarizes important considerations when choosing an air purifier. Air purifier selection should be based on the concentration of pollution indoors, the size of the home, and cost.

Table 1: Recommendations for Air Filters

Indoor Pollution Level	**Size of House**	**Cost**	**Recommendation**	**Model**
Heavy	Any	2600RMB($400) - 3400RMB($530) 2600RMB($400)	HEPA and Active Carbon Purifiers	Blueair 303, Philips AC4076
Moderate		1000RMB($160) - 2500RMB($390)	Plasma Air Cleaner	SHARP KC-Z380SW, Panasonic F-PDF35C

Moderate	Small ($15m^2$)	2700RMB($420) - 3000RMB($470)	HEPA Filters	SAMSUNG AX022
Moderate	Large		HEPA Filters	YADU KJF2903E

Other actions and lifestyle choices can improve the resilience of senior citizens against the effects of air pollution. Table 2 shows Some of the Do's and Don'ts of personal protection.

Table 2: Recommendations for Personal Protection Lifestyle Best Practices

Do's	Don'ts
Wearing medical sanitary masks is an effective means of protection.	Wearing professional masks like N95 or 3M masks will make it difficult for the elderly to breathe.
Moving green plants outside the house in the evening if possible is advisable because plants will produce CO_2 at night instead of absorb it.	Keeping green plants in the house as much as possible during the whole day can increase carbon dioxide concentrations indoors.
Washing the nose one to two times a day helps keep the nose clean.	Avoid washing the face or nose in winter for it is cold outside or washing the nose too many times in a day can hurt the mucous coat in the nose.
Do exercise daily or several times a week strengthens immunity. Choose some exercises which will not cause acute breathing if the air quality is not that bad.	Avoid doing exercise if the air quality is somewhat bad. Actually, being exposed to bad air for about one to two hours can just do a harm to the health of seniors.
Maintaining a balanced diet to keep fit	Eating too much so called "healthy food" that is advocated by traditional Chinese medical science can be detrimental.

2. What are important psychological considerations when providing educational outreach to senior citizens particularly in Beijing?

In studying how we might effectively communicate with the elderly of China, it becomes necessary to understand how to optimize potential communication methods based on their psychology. This motivates a literature review of relevant psychological studies while also acknowledging gaps in relevant knowledge for the purposes of our project.

Upon reviewing literature, we separated our findings based on relevant age-dependent variables that should be strongly considered when developing communication materials with elderly adults.

Positive Affect

Positive affect refers to the experience of positive emotions. While it has been observed that overall happiness tends to decline with age after a peak of happiness between the ages of 50 and 60 (Dodds & Danforth, 2010), the frequency and magnitude of positive affect tends to increase with age (Mroczek & Kolarz, 1998). A popular explanation is that elderly people experience more positive affect because they tend to focus on spending time with family and old friends, and avoid people and experiences that cause negative emotionality and negative affect (Carstensen, Isaacowitz, & Charles, 1999).

As was mentioned, many sources of positive affect for elderly adults are aspects of their lifestyle with which they are already intimately familiar. For this reason, many elderly adults may prefer maintaining their current lifestyle instead of manipulating any of their behaviors. This is supported by the openness aspect of personality—or openness to new experiences—slightly declining in older age (Costa et al., 1986). Additionally, older adults report the highest levels of life satisfaction (Reker, Peacock, & Wong, 1987).

Stereotype Threat & The Pygmalion Effect

Among the most significant stereotypes that elderly people face are related to being emotionally unstable, highly dependent, experiencing cognitive decline, and being frail. Many of these stereotypes are false and are certainly not generalizable to an entire age population. Regardless, many elderly adults may adopt some of these stereotypical characteristics due to instances of experiencing stereotype threat and the Pygmalion Effect.

Stereotype threat is frequently experienced when an external stimulus triggers a subconscious cue to conform to a stereotype relevant to both the situation and any demographic or social group the receiver of stereotype threat belongs to. For example, if a young person is addressing an elderly adult in a raised voice, saying words emphatically and slowly as one would to a child, an elderly person might be reminded of the stereotypes that they are frail and cognitively declining, which may lead to more subconscious realization of these behaviors on the part of the elderly adult experiencing stereotype threat. Among characteristics involved in stereotype threats of the elderly, dependency on others was one of the most salient (Ryan, Hummert, & Boich, 1995).

Similarly, expected behaviors can also be imposed on elderly adults through the Pygmalion Effect. Figure 1 demonstrates how behavior can become malleable in social situations. A study of the behavior of professional care providers towards elderly adults demonstrated that elderly adults who were exposed to more behavior that implied dependence to the care giver, such as being fed when the elderly adult is capable of feeding themselves, the elderly adult started showing more dependency characteristics later on than the elderly adult who was told to eat themselves (Baltes & Wahl, 1996).

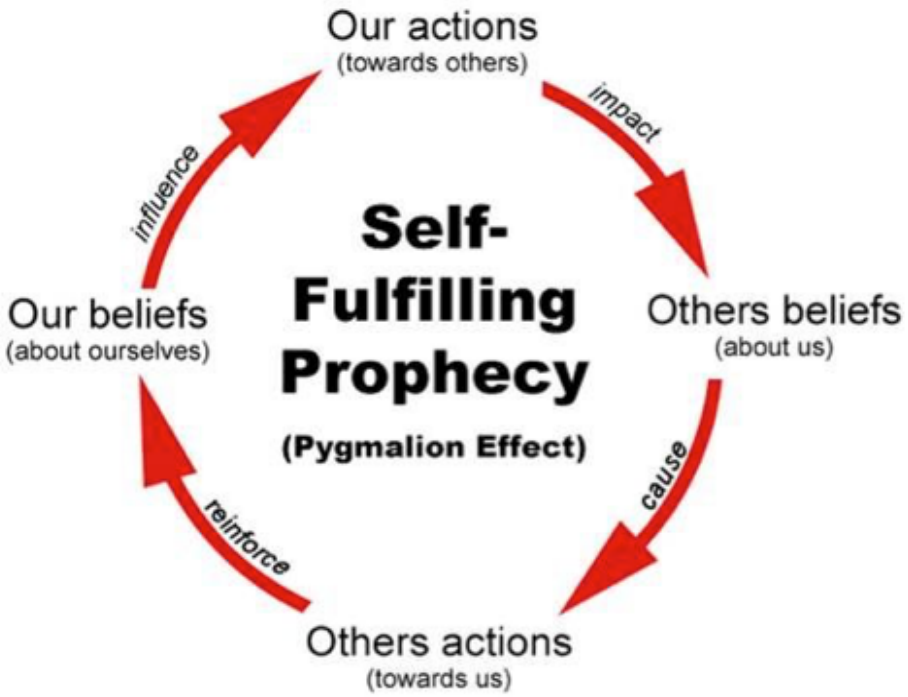

Figure 1. The Pygmalion Effect.

Figure 2 shows an alternative model for communicating with the elderly that is mindful of both stereotype threat and the Pygmalion Effect and structures communication to be need-specific to individual elderly adults (Ryan, Meredith, MacLean, & Orange, 1995).

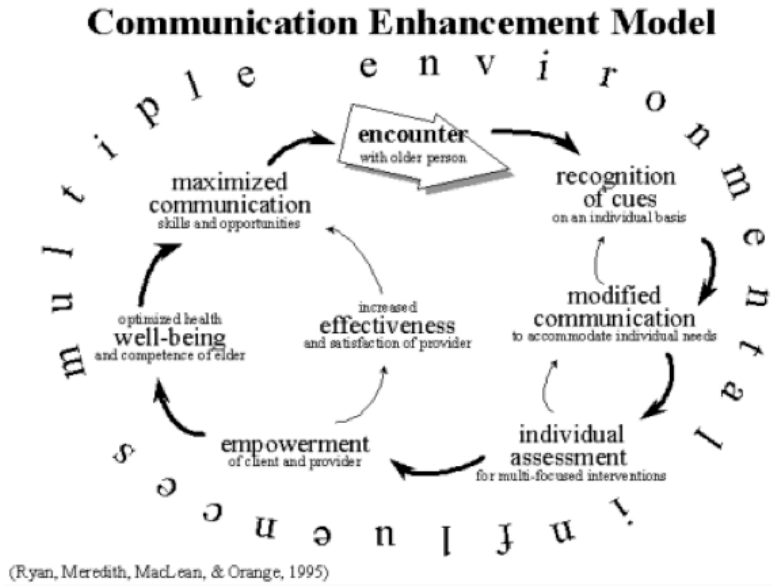

Figure 2. The Communication Enhancement Model. (Ryan, Meredith, MacLean, & Orange, 1995)

Cultural Differences

One of the significant gaps of this psychological literature review is that many of these findings come from studies that were largely conducted in western cultures. Literature focused on communication patterns of the elderly of China and eastern cultures is limited.

3. **What are effective campaigns that have been launched in other contexts, and how can these inform our campaign?**

The United States of America, Japan and China have all taken measures against air pollution over the past few decades. Various actors such as the central government, local government, and civic groups are involved in introducing policy and taking action.

In the United States, air pollution became an especially pressing issue in the 1960s. Historically, Los Angeles provides a good case study in air pollution policy because the city has implemented policies that transformed the city from one of the most polluted cities in the 1960s to a relatively safe and livable city. The population of Los Angeles was less than one million in 1920s, but it reached more than 6 millions in 1958. As the traffic and population increased, the air pollution became serious. In June 10, 1947, California Governor Earl Warren signed the Air Pollution Control Act, authorizing the creation of an Air Pollution Control District in every county of the state. In 1955, Federal Air Pollution Control Act was enacted fund research and technical assistance and to authorize the Secretary of Health, Education and Welfare to work towards a better understanding of the causes and effects of air pollution. In 2012, the National Oceanic and Atmospheric Administration announced that in Los Angeles Basin, levels of some vehicle-related air pollutants have decreased by about 98 percent since the 1960s as a result of these policies. (Air Resources Board of California Environmental Protection Agency, n.d.)

Currently, there are many clean air policies and initiatives that improve air quality in Los Angeles. The Clean Air Campaign, a non-profit organization at national level, helps companies to reduce air pollution and educate kids about the health and environmental impacts of air pollution. In detail, The Clean Air Campaign provides three major services (Clean Air Campaign, n.d.). (1) Employer Partnership Program, which create a program in order to promote carpool, telework and work as compressed flexible schedules. (2) Distribute sample of Telework tool, which includes teleworker agreement, policy and assignment. (3) Idling Reduction Program, which provides “No-Idle Zone” signage and distribute educational and training materials. Another example is Group Against Smog and Pollution, which is a non-profit citizens' group in Pittsburgh. Group Against Smog and Pollution are doing two unique actions to citizens (Group Against Smog and Pollution, n.d.). (1) Bicycle Monitoring campaign, which lent a device to bikers and bikers monitor air pollution. People can see data on the Google map. (2) EPA School Flag Program, in which students forecast air quality each morning and raise a flag with a color that corresponds to the forecasted level of air pollution for that day.

In Japan, high economic growth caused air pollutions in many cities. Some laws, which restrict emitting harmful chemical substances, were enacted in the 1970s and 1980s. The government enacted a law in 2003 that promotes education for protecting natural environment and sustainable development. Based on this law, local governments teach elderly people about protecting their natural environments. Specifically, elderly people learn about using public transportation and saving energy and electricity. (Ministry of Environment, 2006) Recently, the Japanese government put force to reduce idling. For example, Japan Trucking Association subsidizes drivers to buy a heater that works without running an engine in order to stop idling. Thanks to this policy and other policies, the concentration of NO2 and Suspended Particulate Matter (SPM) has decreased gradually since 2000 (Environmental Restoration and Conservation Agency, n.d.).

In addition to these policies conducted by the central government, local governments and citizen groups are implementing an interesting education program for elderly people. In Tokyo, there are several old public housing complexes, in which a lot of elderly people live. A social welfare organization opened a salon, which is located in the 1st floor of a housing complex, and the local government supports operation of this salon. Elderly people gather at this salon and talk together. Since this salon is equipped with posters, booklets and books related to health, elderly people learn how to improve their health even if they come to this salon just for talking. Elderly people can consult with an expert about their health (Kangaroo, 2014). Actually, in a year, about 660 people asked for advice (Japan Health Enterprise Foundation, 2012).

Similarly, in China, many policies have been implemented to counteract the negative impacts of air pollution. The central government published "The 12th Five Year Plan on Energy Conservation and Emission Reduction" in 2012, which aims to restrict emissions in heavy industry, agriculture, and urban use. Another important piece of legislation is the "Action Plan for Prevention of Air Pollution" which was published in 2013. This policy encourages heavy industry firms to use new fuels and technology and provides financial compensation for drivers to discard old vehicles. In Beijing, Beijing Traffic Management Bureau introduced Travel Restrictions by Tail Number, which restricts driving by odd and even tail numbers during rush hour.

In analyzing cases of past campaigns, both regulations imposed by the central government and educational initiatives by non-profit organizations and local agencies are important. Regulation can reduce the emissions of harmful chemical substances while education can make elderly people realize importance of protecting their health and change their behavior. Based on the success of similar efforts in the past, a campaign by Clean Air Asia at community space or salon will be effective because elderly people gather these places regularly to talk daily events. These would be good opportunities to display posters and booklets.

IV. Fieldwork - Beijing Phase 1 (September 2015)

Introduction and Methods

In the summer session, both Tsinghua and Stanford students took part in the fieldwork in Beijing as a start of our team research. The main goal was to understand seniors' existing perception and awareness of air pollution issues. The fieldwork was composed of several days of surveys, which took place in communities, parks, and kindergartens around Tsinghua University. We together talked with 60 seniors, ranged from age 55 to 85, with an average age of 68.

Results

We tried to find out how much the elderly know about air pollution by asking them what is the most significant cause of air pollutants in Beijing. We showed them pictures of 5 pollutants-causing agents, which include car emissions, factory emissions, burning coals/coal emission, pollution from surrounding regions and dust.

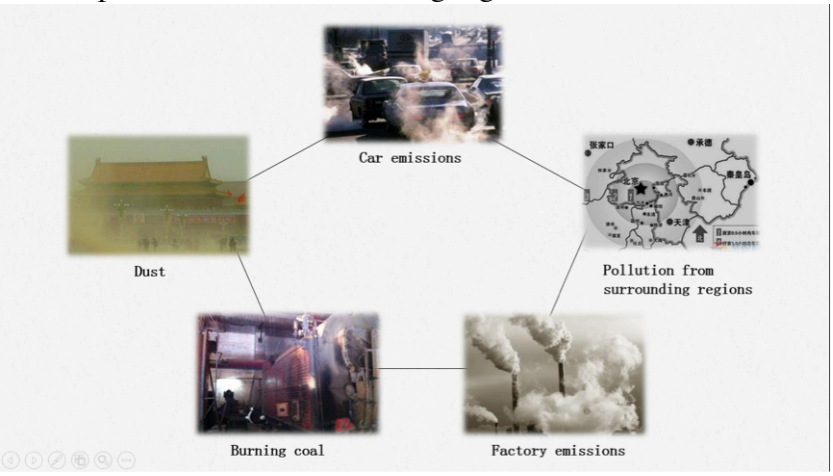

Figure 3. Diagram Used to Test Understanding about Air Pollution

1. 64% respondents think that car emission is the major source of air pollution in Beijing, which is the correct answer. From this result, we think that most elderly know a little about air pollution in the city. However, they may not have a deep knowledge of it because few people mentioned some common keywords about air pollution when they had a dialogue with us. Only 10% of them mentioned PM2.5, and even those who mentioned it didn't really know the specific details. Only 20%-30% people mentioned the word "雾霾"(smog), which is a serious problem in Beijing.
2. 30% seniors mentioned that they do not check air pollution levels at all. For the rest of the respondents, a majority mentioned that they pay attention to Weather Forecasts on TV and most of them watch it every day. Half of them mentioned looking up the sky to presume the air quality. A small number of them mentioned newspaper, radio, Internet sites and apps on phones to check air quality. And a common response is that they will only do so when air visibility is particularly bad.
3. When we asked about the methods of protection against air pollution, 1/3 of the seniors mentioned that they would not go outside when the air is particularly bad, and they may not take other measures to protect themselves.
4. As we all know, wearing a mask is a common way for protection when the air is bad. Yet for the elderly we interviewed, only 2 of them wear masks. Others may wear a mask occasionally or totally refuse it. The elderly don't like masks because wearing a mask is uncomfortable and they think maybe useless. And people around them are not wearing masks. Some people think the masks are useful but

too expensive, so 10 of the seniors said that when the air is bad, they often put on masks for their children and grandchildren instead of themselves.
5. Another kind of protection they mentioned is putting an air purifier at home. 5 of them have air purifiers at home and 3 mentioned cost problems related to air purifiers.
6. And we also found very common sentiments during the interview that 80-90% of the seniors said something like 'oh, we can do nothing about the air. This is not our problem. It is the government that should do more to protect us from the pollution, not us…'

Based on these findings, we surveyed 50 more citizens from the communities around Tsinghua University to learn more about their habits and lifestyles. We found that:

1. Many elderly interviewees' daily activities involve: strolling, taking care of grandkids, and square dances. Usually they didn't go far away from home.
2. Lots of senior people enjoy watching TV. Around half of the seniors would watch yang-sheng shows (yang-sheng means keeping in good health in English) through which they learned some information about air pollution and protecting methods.
3. Most seniors would take half to an hour's walk or some form of dance exercise every day. The results may be biased because all the interviewees were interviewed outdoor. Usually they wouldn't check air pollution level before they go out to exercise unless serious air pollution was encountered.

Recommendations for the Next Phase of Fieldwork

We also asked the seniors what would make them more willing to protect themselves from air pollution. The result is: the elderly would be more willing to protect themselves from air pollution when their children or grandchildren ask them to put on a mask or when they can get access to high-quality and less expensive masks. We realized that this should be an area of focus for our next round of fieldwork.

V. Fieldwork - Bay Area (Early November 2015)

Introduction and Justification

Following our fieldwork in Beijing, we realized the need to further explore the motivation and knowledge of seniors about air pollution. While the population and environmental conditions in the San Francisco Bay Area are different than in Beijing, we aimed to test the ideas that we learned through our first round of fieldwork and literature review through a comparative perspective. The focus of the Bay Area fieldwork was on discovering ways to better communicate with senior citizens of Asian descent and convey health related information.

Methods

Round 1 of Interviews: San Francisco, October 31, 2015

We conducted our first round of interviews on October 31, 2015 in San Francisco's Chinatown. The Chinatown in San Francisco is one of the oldest Chinese communities within the United States of America. We selected this location to conduct interviews because many people still are very connected to the traditional Cantonese way of life and there is a large concentration of senior citizens. Many of our interviewees work in small retail shops for living. We chose to conduct interviews on a Saturday morning because we

hoped to speak with elderly shoppers as they bought vegetables and other groceries. However, we spent 3 hours and only found a few interviewees that were willing to cooperate. We decided to modify our focus from understanding what senior citizens knew about air pollution to understanding how seniors preferred to receive health information.

Round 2 of Interviews: Mountain View, November 14, 2015

In order to get more information from Mandarin speakers, we did a supplementary interview Saturday afternoon in Mountain View. We modified our strategy by creating a brief survey and an extended questionnaire. We received responses from 20 people in Ranch 99, a Chinese supermarket and Nijiya, a Japanese supermarket. Because we came prepared with our questions listed on paper, people understood our interview was brief and non-political, which improved our response rates and people's willingness to participate in our study.

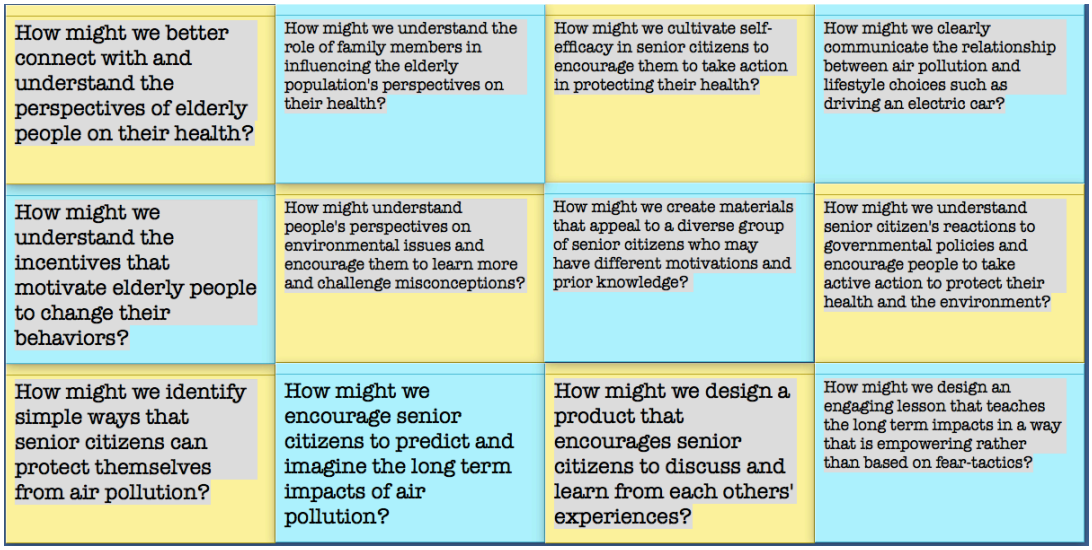

Figure 4. Based on the feedback from the first round of interviews, we brainstormed these questions to focus our research and empathize with our interviewees

Our principal driving questions were:

1. How might we better connect to and understand the perspectives of elderly people on their health?
2. How might we better create materials that appeal to a diverse group of senior citizens who may have different motivations and prior knowledge?

In order to answer these questions, we presented 4 rather different posters in order to observe reactions and ask people to describe what they liked or disliked about each model. We decided to focus more on understanding the way that seniors receive and communicate health related information. This was a useful complement to the interviews being conducted by the Tsinghua students and this built off of the interviews conducted over the summer. We tested the following 4 prototypes with elderly shoppers in the two supermarkets.

Figure 5.(Prototype 1) We used a dramatic photo which shows seriousness of air pollution with large text about the seriousness of air pollution

Figure 6.(Prototype 2) We used contrasting photos of healthy elderly people to show what times of day are better to exercise and pictures of masks that were effective

Prototype 3: Using Cartoons to Demonstrate Happy and Healthy Seniors

Figure 7.(Prototype 3) We used a cartoon with written health information. This is characteristic of many public health posters currently used throughout Asia.

Figure 8.(Prototype 4) We used an interesting statistic and pie chart with a simple message to test the effectiveness of using statistics.

We approached 20 Japanese, Mandarin, and English speaking people to better understand the way they access information about health. We conducted short surveys as well as short conversation to better empathize with our users and put our prototypes into context. We asked several seniors to interact with and give feedback on our four prototypes. These were the questions that we asked for each prototype:

1. What are your impressions of this poster?
2. How did looking at this poster make you feel?
3. If you saw this poster in a newspaper or in a public place, would you be likely to notice it?
4. How likely do you think it is that you would share it with a friend?
5. After reading the poster, would you act or think any differently about this health issue?
6. What do you like about this poster? What do you think could be better?

While it did feel a little bit intrusive to ask people who were busy shopping, we found that a small number of people were genuinely interested in our project, and many gave us helpful insights into which posters they found the most effective. We found that many people had similar reactions to the posters, and we could immediately tell which of the four posters were more effective than others based on these reactions.

Results from Surveys

Through prototype testing, we asked for feedback on our four designs and observed people's reactions to our posters. We found through this process that:

1. Elderly people found that the poster (Prototype 1) which uses a photo that shows seriousness of air pollution clear and felt that it made them realize the importance of air pollution.
2. Elderly people preferred the prototypes, which offered clear and easily implementable strategies to protect against air pollution. Providing the pictures of effective and ineffective masks was particularly well received.
3. Many of the elderly people we interviewed were confused by the statistics, and did not know how to read the pie chart. We found that pictures were more effective that statistics in conveying information to our target population.
4. We received feedback that the cartoon was not very clear or effective. Currently, the Chinese government creates many public health cartoons, which do not capture the interest nor clearly convey health information. We decided that our final prototype should not rely on colorful yet vague drawings.
5. The prototypes with fewer words (Prototypes 1 and 2) received more positive feedback. In their campaign materials, the number of words should be limited to ensure that only the most important information is included.

Next Iteration of Prototypes

Based on the above findings, we decided not to update a poster using cartoon and a poster using a pie chart because elderly people did not prefer these posters. We created the following prototypes:

Figure 9. We decreased number of words and made the words bigger. We added brighter colors to make the poster more visually attractive and easy to read. In addition, we changed the message and wrote a more concrete message. Our main objective is to make people realize impact of air pollution.

Figure 10. We decreased the amount of content and made images and words bigger in order to make our message clear and concise.

Figure 11. We created a poster displaying when to go outdoors and stay indoors since people want to know concrete actions to take. This is informed by our interviews with experts. Our main objective is to persuade people not to go outdoors when air pollution is serious.

We also learned that many elderly people trust the medical advice of doctors and friends and 75% of seniors talk about their health at least once a week.

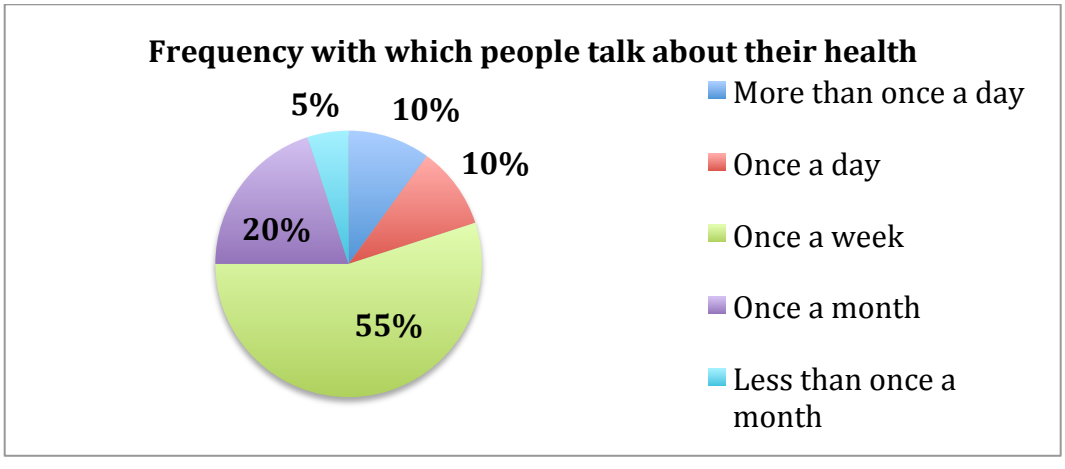

Figure 12. We found from our surveys that health was a topic that most seniors talked about regularly. This was helpful information in re-designing our prototypes

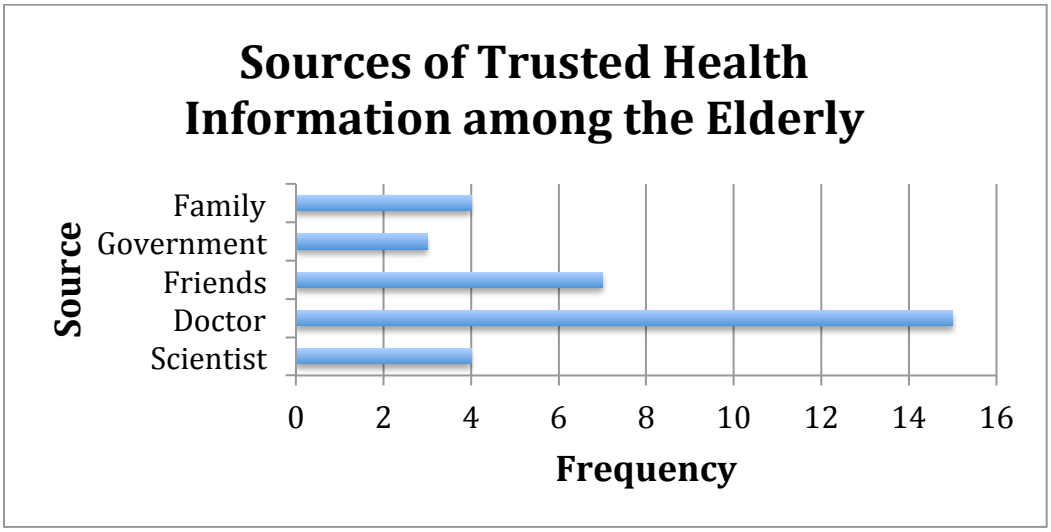

Figure 13. We found from our surveys that more people trusted information from their doctors and friends than from the government.

Recommendations for the Next Phase of Fieldwork

Our next step is to identify our sizes of posters and locations where we should post our posters. According to interviews, elderly people get information related to health through internet, talking with family, friends and doctors. Hence, one idea is that posters, of which sizes are enough to see, are posted in hospitals. Another idea is that since results of interview show that elderly people talk about health with their spouses almost every day, posters should be posted in supermarkets, where old men and women often visit.

We found that presenting the information directly was more effective than showing abstract images or data. In our interview in Bay Area, people got informed about the importance of air problem as well as the effectiveness of different masks. However, we observed a lower level of interest for Bay Area citizens than for Beijing citizens where the problem is more immediate. During the next phase of testing in Beijing, our posters will be sent out to local senior people in Beijing, and hopefully they can benefit from the work.

VI. Fieldwork - Beijing Phase 2 (Late November 2015)

Introduction and Justification

Based on the work done in the Bay area, we further developed materials to be tested as part of the campaign with Clean Air Asia (CAA). We included the flyers, booklets and an informative video that we showed to the elderly. We used these materials to organize the campaign, the overall plan, activities, games, and interpersonal communications. For this part, we worked with CAA and studied past campaigns to create our own plan.

Together with the officer of Clean Air Asia, we went to a community called Zhenwu Jiayuan in the West City District in Beijing on November 27, 2015 to test our prototype, where there are many senior citizens. Because it is quite cold in Beijing, we expected there

might not be a lot of senior citizens going outside. So two stands were arranged, one of which is outside and the other is indoors.

Methods
What is beyond our expectation is that quite a few old people aging from 50 to 80 came to the stands. To stimulate their awareness of the protection for air pollution, we first showed a short video about the air pollution to them. After they got to know what is air pollution, we delivered instruction on how to protect themselves and when they should take a mask. Afterwards, we delivered a post-test to assess the effectiveness of the lesson and asked for feedback. Finally, each participant was given a 3M-mask and two medical masks as the souvenirs, and they were also educated on how to use these masks properly.

Results
We examined and improved our prototype through our campaign by observation of respondents' behaviors and gathering feedback from the audience by interviewing and analyzing questionnaires after the activity.

Here are some of our findings some:
1. Activities and games that require interaction and immediate feedback are helpful
2. Handing out real examples of materials is helpful for understanding
3. Gifts and handouts make the campaign more attractive and the listeners will be more attentive
4. Constantly gathering feedback is helpful for the elderly to retain the information learned
5. Handing out reading materials after the lecture/games is important to retain the attention of the audience

Future work
According to the feedback of the senior citizens, the followings are what we need to improve the prototype and the campaign:
1. The air cleaner recommendation part of the booklet should be revised in order not to let the senior citizens treat it as the advertisement.
2. The booklets need bigger words to learn the knowledge.
3. More encouragements such as Q&A with gifts should be put into the campaign.
4. The campaign should be launched in warmer season and last longer to make impact on the senior citizens.

VII. Recommendations for Clean Air Asia

Effective means of communication with the elderly

1. **"The simpler, the better," this was one important thing we learned from the test.** The simpler a prototype is, the better the idea will be conveyed. This idea is not hard to understand, but we did not really think this way when we initially developed the prototypes. We wanted to convey the important ideas as many as possible, and we wanted to make it abstract and cool. But we were not creating prototype for scientists or artists, and we realized that simpler was better. It was

very interesting and helpful to listen to people's different opinions about the prototypes, especially when they have some ideas that we have not thought about. First of all, we were thinking that the prototype introducing different types of facemasks was very helpful and understandable. It contained a lot of health-related suggestions, including what type of mask to wear, and what time of day to exercise. But to our surprise, each time we tested it on a participant, we were asked to explain the picture clearly. It was good to find that people were interested in this prototype, but it should be noticed that this prototype is not clearly enough in explaining what type of mask should people use. So we asked people whether they liked it, and whether they could understand. Many people responded that they really liked it because it was instructive, but they also mentioned that it was a little confusing and complicated. This was why we decided to divide this prototype into two parts, one of them introducing the best time of day for exercising, and the other introducing the type of mask suitable for elderly people.

2. **Senior citizens respond better to illustrative pictures and limited words rather than statistics or data.** In Clean Air Asia's campaign materials, the number of words should be limited to ensure that only the most important information is included. We made one prototype that included some data showing the severe problem of air pollution, because we thought people would be shocked by the data and might become interested in having a look at the problem. But we were wrong. Although the young people we interviewed liked this prototype, the middle-aged and elderly people were not very interested in the data. Since our prototype was developed for elderly people, we should focus more on their ideas. "I do not like this one because it is complicated to me. Maybe you should make simpler flyer so that people can easy to understand directly." This is one typical answer we got that could represent many elderly people. Finally we decided to give up this prototype and focus on the ones with picture and simple words on them.
3. **Constantly gathering feedback is helpful for the elderly to retain the information learned.** Many people interviewed after the lecture in Beijing said they knew more about air pollution after our campaign and the tips given in our booklet are quite useful, such as exercise after 9am and put plants outdoor at night. And most of them would like to wear masks when air pollution occurs, but air purifier remains not as popular. An elderly people would like to know more about how air pollution came into being in rural areas; another would like to know whether termly maintenance is needed for an air purifier, how and the cost. An elderly lady also gave us advice on the mask design, and she suggested that the lace should be made a little bit longer and mask should be made stronger.
4. **Gifts and handouts make the campaign more attractive and the listeners will be more attentive.** Some community staff also gave us some suggestions about our campaign. One suggested to us that we should involve people more in our campaign by adding activities like award answer-question. Another person told us that the elderly would be less willing to participate campaign than when it's warmer while air pollution is more frequent during winter.

Effective locations and methods to publicize the campaign

1. **When we are trying to persuade the elderly protect themselves from poor air, it may be useful to appeal to the advice their children and grandchildren.** This is consistent with the Positive Effect described in the literature review section.
2. **Making high-quality and less expensive masks more widely available with the cooperation between the government and the enterprises also helps.** This is consistent with the information on different interventions presented in the scientific portion of the literature review.
3. **As expected, elderly people get information mostly from the traditional forms of media, such as TV and newspaper.** When we are trying to promote the awareness of air pollution among the elderly people, posters or handbooks around the park and squares may be a good idea. And we can also use PSA (public service advertising) during their favorite TV shows.
4. **Distributing our flyer through WeChat might also be an additional way to popularize our campaign.** Some seniors said they also used the Internet quite a lot, and some even got lots of information from WeChat.

Effective psychological considerations for campaign outreach to the elderly

1. **Reference an aspect of the lives of the elderly that generally brings them positive emotionality, to motivate attention of the elderly to the topic of air pollution.** From the psychological review, we know that senior citizens tend to seek positive emotionality while avoiding negative emotionality.
2. **Ensure that the routine familiar to the elderly will not be drastically manipulated by any behavioral changes suggested by campaign materials.** Senior citizens prefer what is familiar to novel experiences, since openness declines in older age.
3. **Make the elderly feel empowered to change their future by heeding the advice of the campaign materials by using an empowering tone rather than one that will instill fear into them.** Senior citizens are highly susceptible to behavioral changes based on treatment from others per the Pygmalion Effect.

The common motive behind each of these guiding principles for the campaign is to align the campaign goals of protecting the elderly fro air pollution with the goals of the elderly. Knowledge of elder psychology helps align these goals by relaying the advice and knowledge of the campaign in a way that will appeal to the elderly. Additionally, we want to convince the elderly to take action to protect their health from air pollution in a responsible and psychologically healthy manner, which means avoiding any use of scare tactics or anything that might otherwise coerce the elderly into experiencing the damages of stereotype threat.

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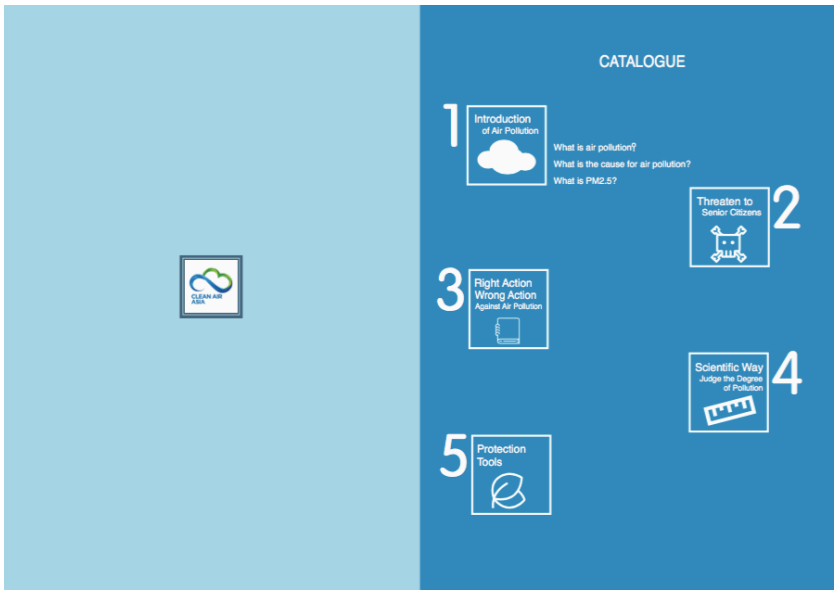
X. Appendix A: Booklet with Information for Senior Citizens

Material list (Booklet)



➢ General introduction of air pollution

How is the air in Beijing?

Air quality in Beijing is ranked the third worst out of 113 cities, according to China's Ministry of Environmental Protection. Beijing has been hit by smog for many times in recent years and the PM2.5 index has been very high. Reaching the national standard in Beijing will take at least 18 to 20 years.

What is air pollution?

A physical, biological or chemical alteration to the air in the atmosphere can be termed as pollution. It occurs when any harmful gases, dust, smoke enters into the atmosphere and makes it difficult for plants, animals and humans to survive as the air becomes dirty.

What is the cause for air pollution?

1. Burning of Fossil Fuels: Sulfur dioxide emitted from the combustion of fossil fuels like coal, petroleum and other factory combustibles is one the major cause of air pollution. Pollution emitting from vehicles including trucks, jeeps, cars, trains, airplanes cause immense amount of pollution. We rely on them to fulfill our daily basic needs of transportation. But, their overuse is killing our environment as dangerous gases are polluting the environment. Carbon Monooxide caused by improper or incomplete combustion and generally emitted from vehicles is another major pollutant along with Nitrogen Oxides, which is produced from both natural and man made processes.
2. Agricultural activities: Ammonia is a very common by product from agriculture related activities and is one of the most hazardous gases in the atmosphere. Use of insecticides, pesticides and fertilizers in agricultural activities has grown quite a lot. They emit harmful chemicals into the air and can also cause water pollution.
3. Exhaust from factories and industries: Manufacturing industries release large amount of carbon monoxide, hydrocarbons, organic compounds, and chemicals into the air thereby depleting the quality of air. Manufacturing industries can be found at every corner of the earth and there is no area that has not been affected by it. Petroleum refineries also release hydrocarbons and various other chemicals that pollute the air and also cause land pollution.
4. Mining operations: Mining is a process wherein minerals below the earth are extracted using large equipment. During the process dust and chemicals are released in the air causing massive air pollution. This is one of the reasons that are responsible for the deteriorating health conditions of workers and nearby residents.
5. Indoor air pollution: Household cleaning products, painting supplies emit toxic chemicals in the air and cause air pollution. Have you ever noticed that once you paint walls of your house, it creates some sort of smell that makes it literally impossible for you to breathe?

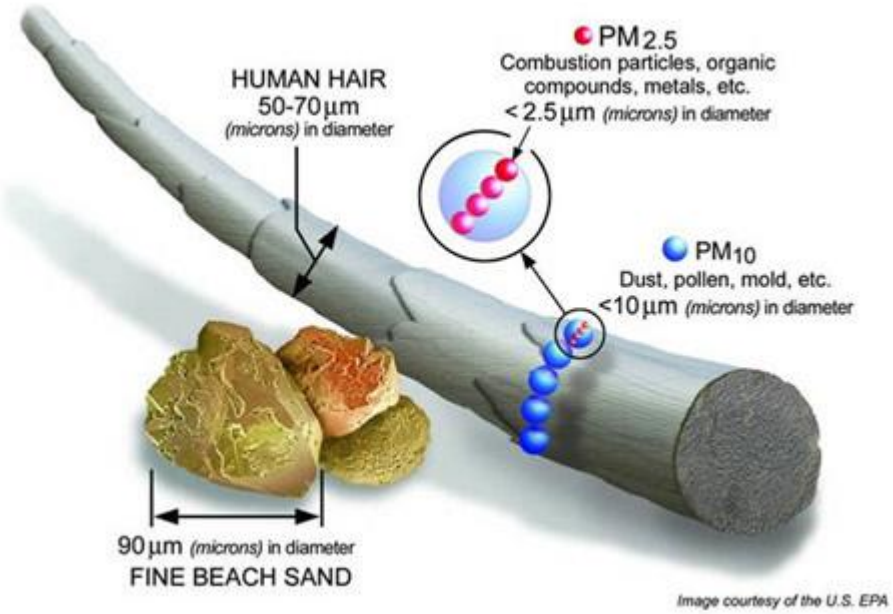
What is PM2.5?

We can all appreciation what pollution is and specifically pollution that´s in the air

refered to as particle pollution. Particle pollution is also known as "Particulate Matter" or simply PM. While the term PM is simple, PM itself is a relatively complex mixture with extremly small particles and liquid droplets that float around in the air.

There are two kinds of particle pollution, fine particles and inhalable coarse particles. Fine particles are called PM2.5, because their size is 2.5 micrometers in diameter and smaller.

Inhalable coarse particles are called PM10, because their seize ranges from 10 micrometers down to larger than 2.5 micrometers.



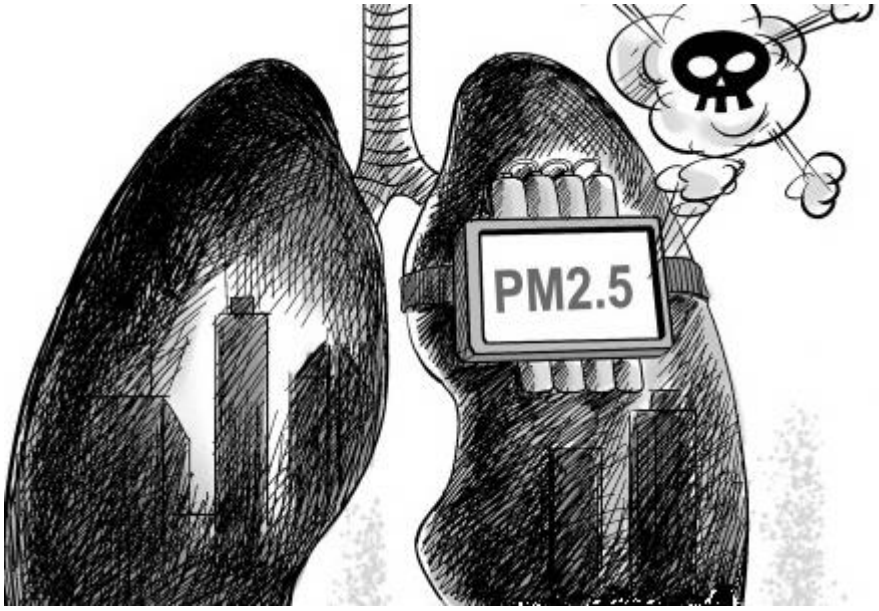
Because fine particles(PM2.5) is much smaller than inhalable coarse particles(PM10), its negative effects on human health is more severe.

Where does PM 2.5 come from?

PM2.5 comes from both natural sources and manmade sources. Natural sources include dust, volcanic ash, forest fire, sea salt, etc. manmade sources include primary particles and secondary particles. Primary particles come from coal burning, industrial dust, vehicle exhaust, construction and road dust, while secondary particles, which is the main cause of PM2.5, are generated by complex chemical reactions among sulfur oxide, nitric oxide, ammonia, and volatile organic compound in the atmosphere.

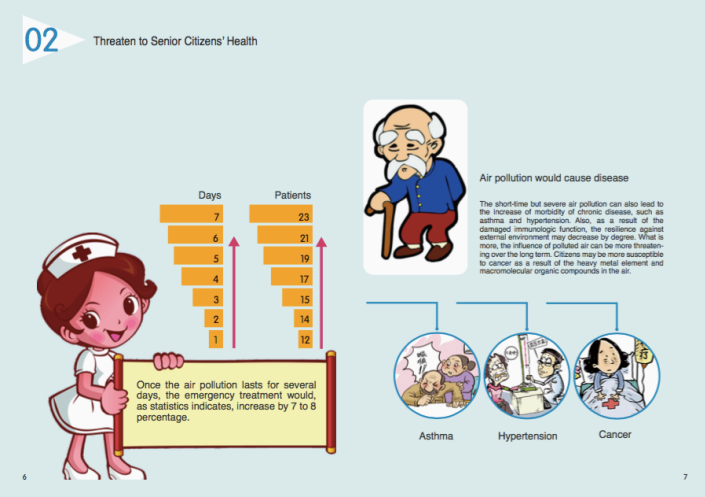
What is the harm of PM2.5?

When we breathe, the fine particles can reach the deepest regions of our lungs. And exposure to particles is linked to variety of significant health problems, ranging from aggravated asthma and one in this scale to pre-mature death in people with hard disease on the other. PM2.5 is worthy the name of "Invisible Killer".



➢ Threaten to senior citizens' health

Once the air pollution lasts for several days, the emergency treatment would, as statistics indicates, increase by 7 to 8 percentage. The short-time but severe air pollution can also lead to the increase of morbidity of chronic disease, such as asthma and hypertension. Also, as a result of the damaged immunologic function, the resilience against external environment may decrease by degree. What is more, the influence of polluted air can be more threatening over the long term. Citizens may be more susceptible to cancer as a result of the heavy metal element and macromolecular organic compounds in the air.



➢ Right action VS wrong action against air pollution

Right Action	Wrong Action
Wearing medical sanitary masks is an effective means of protection.	Wearing professional masks like N95 or 3M masks will make it difficult for the elderly to breathe.
Moving green plants outside the house	Keeping green plants in the house as

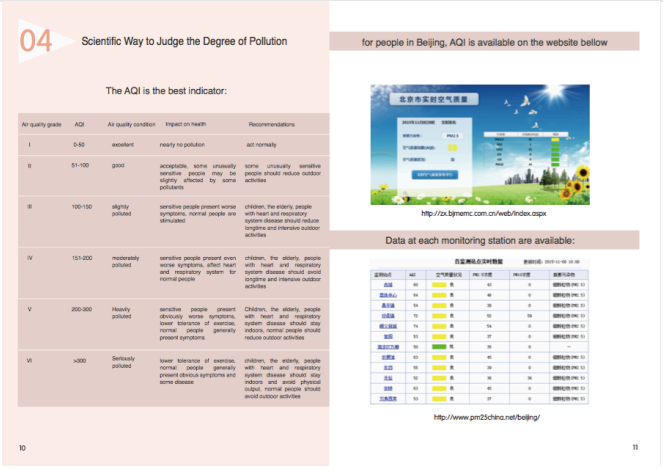
in the evening if possible is advisable because plants will produce CO_2 at night instead of absorb it.	much as possible during the whole day can increase carbon dioxide concentrations indoors.
Washing the nose one to two times a day helps keep the nose clean.	Avoid washing the face or nose in winter for it is cold outside or washing the nose too many times in a day can hurt the mucous coat in the nose.
Do exercise daily or several times a week strengthens immunity. Choose some exercises which will not cause acute breathing if the air quality is not that bad.	Avoid doing exercise if the air quality is somewhat bad. Actually, being exposed to bad air for about one to two hours can just do a harm to the health of seniors.
Maintaining a balanced diet to keep fit	Eating too much so called "healthy food" that is advocated by traditional Chinese medical science can be detrimental.

➢ Scientific way to judge the degree of pollution

The AQI is the best indicator:

Air quality grade	AQI	**Air quality condition**	**Impact on health**	**Recommendations**
I	0-50	excellent	Nearly no pollution	Act normally
II	51-100	good	acceptable, some unusually sensitive people may be slightly affected by some pollutants	some unusually sensitive people should reduce outdoor activities
III	100-	slightly	sensitive people present	Children, the elderly,

	150	polluted	worse symptoms, normal people are stimulated	people with heart and respiratory system disease should reduce longtime and intensive outdoor activities
IV	151-200	Moderately polluted	sensitive people present even worse symptoms, affect heart and respiratory system for normal people	Children, the elderly, people with heart and respiratory system disease should avoid longtime and intensive outdoor activities
V	200-300	Heavily polluted	sensitive people present obviously worse symptoms, lower tolerance of exercise, normal people generally present symptoms	Children, the elderly, people with heart and respiratory system disease should stay indoors, normal people should reduce outdoor activities
VI	>300	Seriously polluted	lower tolerance of exercise, normal people generally present obvious symptoms and some disease	Children, the elderly, people with heart and respiratory system disease should stay indoors and avoid physical output, normal people should avoid outdoor activities



for people in Beijing, AQI is available on the website bellow:
http://zx.bjmemc.com.cn/web/index.aspx

Data at each monitoring station are available:
http://www.pm25china.net/beijing/

各监测站点实时数据 更新时间：2015-11-08 10:00

监测站点	AQI	空气质量状况	PM2.5浓度	PM10浓度	首要污染物
古城	60	良	43	0	细颗粒物(PM2.5)
奥体中心	64	良	46	0	细颗粒物(PM2.5)
昌平镇	54	良	38	0	细颗粒物(PM2.5)
怀柔镇	72	良	52	59	细颗粒物(PM2.5)
顺义新城	74	良	54	0	细颗粒物(PM2.5)
官园	53	良	37	0	细颗粒物(PM2.5)
海淀区万柳	50	优	35	0	—
农展馆	63	良	45	0	细颗粒物(PM2.5)
东四	55	良	39	0	细颗粒物(PM2.5)
天坛	52	良	36	36	细颗粒物(PM2.5)
定陵	63	良	45	0	细颗粒物(PM2.5)
万寿西宫	53	良	37	0	细颗粒物(PM2.5)

➢ Introduction of some recommended masks, air purifier and other protection tools, and their average prices.

The following is what should be considered when we buy the air cleaner:

If the smog in the house is heavy, it's better to select filtering air cleaner, consisting of such materials as HEPA and active carbon. HEPA is used to filter the microscopic particle， and the active carbon can be used to purify poisonous air.

Recommended air cleaner: Blueair 303, Philips AC4076

If the smog is not quite heavy, you can choose plasma air cleaner, which is convenient and effective to sterilize the air. But it is a little expensive.

Recommended air cleaner: SHARP KC-Z380SW, Panasonic F-PDF35C

The choice of the air cleaner is also determined by the size of the house. For example, the air cleaner of 120m3 per hour is a good choice for the house of 15 square meters. The larger the house, the more air should be blown per hour.

Recommended air cleaner: SAMSUNG AX022 for small house, YADU KJF2903E

As a whole, the air cleaner for the elderly should be easy to control. And it should also be energy-saving, because the senior citizens tend to save more energy.

As for the mask, according to the recommendation of the doctor, the hospital-used mask is good enough.

Appendix B: Questionnaires used for Bay Area Fieldwork

Open ended questions

1. Tell us about a time when you saw an advertisement that you found very memorable?
2. How do you get information? Do you watch TV, read newspapers?
3. How do you get information specifically about health?
4. How often do you interact with family members or friends? Do they ever talk to you about your health?
5. If you were trying to teach someone else about a health-related topic how would you do this?
6. Do you feel like you are in control of your health related decisions?
7. If you were to convince someone to stop smoking how would you try?

Survey Questions:

1. How often do you talk about your health?
    a. More than once a day
    b. Once a day
    c. Once a week
    d. Once a month
    e. Less than once a month
2. Who would you trust more about receiving information related to health?
    a. A doctor

   b. A scientist
   c. A child or other family member
   d. A friend
   e. A celebrity
   f. A religious leader
   g. A politician
   h. A government campaign
3. Please indicate true or false and explain
   a. I would rather do something that makes me happy today even if it may have consequences in the future.
   b. I believe my daily actions have an impact on my health.
   c. I actively try to learn about ways to improve my lifestyle and health.
4. Have you ever decided to quit smoking?
   a. Yes - I used to smoke, but I stopped.
   b. No - I am a smoker
   c. N/A - I have never been a smoker
5. If yes, which of the following factors influenced you **most** in deciding to stop smoking?
   a. Advice from family members
   b. Advice from friends
   c. Advice from a doctor or health professional
   d. A campaign on TV
   e. An article in a newspaper or book
   f. Other: _____

Questions for Testing the Prototype

- What are your impressions of this poster?

1.
2.
3.
4.

- How did looking at this poster make you feel?

1.
2.
3.
4.

- If you saw this poster in a newspaper or in a public place, would you be likely to notice it?

1.
2.
3.
4.

- How likely do you think it is that you would share it with a friend?

1.
2.
3.
4.

- After reading the poster, would you act or think any differently about this health issue?

1.
2.
3.
4.

- What do you like about this poster? What do you think could be better? (To get you to care more?)

1.
2.
3.
4.

Appendix C: Notes from Interviews with Experts

Notes from Interview with Dr. Lynn Hildemann, Professor at Stanford University, Department of Civil and Environmental Engineering

- The effect of a face mask is controversial. The effect depends on its film. A facemask also has side effects. A facemask can not protect humans from ozone.
- Beijing's air pollution comes from usage of coals for heaters and transportation. Growing population also increase the number of cars and the amount of coals burned for heaters. In addition to that, the Beijing's weather worsens its pollution. In winter, since clouds remain in Beijing, the pollutants do not move from Beijing.
- Travel Restrictions by Tail Number, which restricts driving by tail number during rush hours, was introduced in Mexico, too. But, it did not work because people bought second cars. On the other hand, Singapore puts regulations on buying a second car. As for traffic, one way is promoting public transportation.
- Reducing idling does not have much effect on preventing air pollution. But, there is a

paper that stopping drive-through is an effective way to prevent air condition.

Notes from Interview with Dr. Xiaochuan Pan, Professor at Peking University, School of Health Care

- The air pollution will result in the long-term health harm to the citizens, especially the senior citizens. However, if one is exposed to the smog only for several hours, there are almost no harms.
- Some old people like to exercise in the morning, which is not recommended because the pollutants deposit a lot in the morning. Noon is a better time.
- Some protection tools like masks and the air purifiers are needed. But the elderly had better not wear the 3M masks if they are not familiar how to use it, or they can't breathe well. And the air purifier is an important way to clean the air in the house, because the pollutants might fly into the house through the windows or doors.
- The flowers are also good protection tools to absorb the pollution, but they can't be put in house at night for they will breathe the oxygen and pollute the air by carbon dioxide.