DISASTER PREVENTION PAMPHLETS WITH UNIVERSAL DESIGN: A CASE STUDY FOR AIDING SENIOR CITIZENS

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ABSTRACT:

During severe natural disasters, unfortunately, the casualty rate of senior citizens is much higher than that of the general population. Therefore, this study focuses on the universal design of disaster prevention pamphlets to enhance the awareness among senior citizens. The methods for this study involved the content analysis and the behavioral observation. Based on the universal design principles, disaster prevention pamphlets include a specific plan and visual communication design (i.e., layout design) generally. In this case, the designing focus was placed on improving the latter, which included the layout of the prevention message, legibility, color usage, and pictogram designs. The results indicate that these aspects can enhance the communication efficacy, rather than lead to cognitive overload and miscommunication. Moreover, such information can be applied to mobile applications, and improved telecommunication can be useful for senior citizens in calling for help or creating post-disaster plans. The implication of these findings might be used by Taiwan's associated disaster prevention departments as a recommendation in designing the future pamphlets that including all age peoples.

Keywords: Senior citizens; Layout design

1. INTRODUCTION

1. 1. BACKGROUND

By 2030, it is expected that nearly 20% of the U.S. population, or more than 71 million people, will be 65 years of age or older (Naumann, Dellinger, Anderson, Bonomi, & Rivara, 2012). In Taiwan, according to the Council for Economic Planning and Development, the number of senior citizens will constitute 20.1% of the total population by the end of 2015, which means that one in every five persons will be a senior citizen. Many developed countries, including Taiwan, have already investigated research on the universal design of aspects that will improve the lives of their aging population (Gutman & Yon, 2014). For example, in Taiwan, research on medical care, welfare, and other societal issues have gradually increased. In addition, research on user interface, space, environment, products, and related projects, have also stimulated the market. However, investigations concerning the communication of senior citizens from the perspective of virtual communication are still in their infancy (Wang, Wang, Wang, Xu, & Qi, 2012).

Over the last several decades, due to climate change, the global annual average numbers of natural disasters have increased, from 125 in the early 1980s, to 500 in 2006. As a consequence, the number of people affected by disasters has risen by 68% from an annual average of 174 million between 1985 and 1994, to 254 million between 1995 and 2004 (Magrath, Bray, & Scriven, 2007). It is projected that by 2015, the number of people affected could grow to an annual average of over 375 million. Climate-related disasters affect all people, but especially marginalized groups such as the senior citizens, and the chronically ill, in both cases due to discrimination, financial inequality, and/or poor health (Oxfam, 2009).

The data from Hurricane Katrina, which devastated the State of Louisiana in the United States in 2005, clearly showed that the highest proportion of deaths was among senior citizens (Brunkard, Namulanda, & Ratard, 2008). Similar findings are apparent in other disaster areas, such as the 2003 European heat wave (Kosatsky, 2005); (Robine, Cheung, Roy, Oyen, & Herrmann, 2007), the 2004 Indian Ocean tsunami, and the 2011 Japan earthquake and tsunami (Sawai, 2012).

In severe disasters, such as Taiwan's 9/21earthquake (2000), and typhoon Morakot (2008), the 3/11 tsunami in Japan (2011), and the recent earthquake in Nepal (2015), the casualty rate of the elderly is unfortunately much higher. Even at a shelter, they might very well die because of less or inferior care (FIFAS, 2012). As a result, it is of maximum importance to apply disaster prevention at the earliest stages (FEMA, 2015).

In a retrospective view of 2011, weather-related disasters and emergencies had caused the loss of significant life and property damage in many countries throughout the world. In the US alone, 12 separate billion-dollar disasters and more than 1,000 weather-related deaths were reported (NOAA, 2011). Various cities have been enhancing their disaster risk management (DRM) capacity to mitigate the increasing risk of disasters (Hori & Shaw, 2012). In addition, the casualty rate of the elderly has been unfortunately higher, especially in Taiwan, where many more live in villages than in urban areas (Lin, 2010). Furthermore, those who reside in such villages, also have a lower ability to communicate with rescuers during and after disasters (Wang et al., 2012). Thus, it is necessary to educate them about the risks and preventative methods for disasters to enhance their preparedness for such tragedies. Therefore, it is crucial to make the disaster prevention pamphlets functional, simplified, and clearly identifiable.

At the beginning of this research, the authors found that there were several different layout designs of such pamphlets, and that a universal design had not, as yet, been adopted for the majority of the disaster prevention pamphlets. Furthermore, since the elderly's physical status and cognition gradually degenerates over time, a universal design of such pamphlets should be immediately improved. Therefore, through a previous case study, this research focuses on the possibility of developing a universal design of disaster prevention pamphlets to promote the awareness among the aging population.

1.2 PURPOSE

This research mainly investigated the universal design applied in disaster prevention pamphlets. The study purposes as below:

1. To understand the current design situation of a domestic disaster prevention pamphlet.

2. To investigate design problems from a universal design viewpoint.

3. To generate the importance level of each message sign to emphasize the design.

4. To organize references with a universal design principle.

5. To provide the research results to the government, placement agency, and design field, including school's administrators.

1.3 FIELD AND LIMITATION OF THE RESEARCH

This study investigated the plan of universal design applications. To probe more deeply into the topic, the authors narrowed down the research fields as fellows: 1. Focus on home safety like falling down or natural disasters. 2. Investigate the virtual design only in pamphlets; however, the disaster's definition and content accuracy are not involved. For manpower and time concerns, the paper pamphlet and electronic files were collected from the government organizations and official websites.

2. LITERATURE REVIEW

The definition of disaster according to the Disaster Prevention and Protection Acts means typhoons, floods, earthquakes, blizzards, mudslides, and natural disasters. In addition, floods, explosions, public gas usage, fuel pipelines, power transmission failures, mining disasters, air crashes, shipwrecks, land traffic accidents, forest fires, and toxic chemical materials disasters. Mentioned that a disaster is an event that causes a large number of lives and property loss because of the dangerous environment (Nasreen, 2004). The authors can simply summarize the definition above that disaster is a natural or man-made hazard resulting in an event causing significant physical damage, destruction, and loss of life.

The purpose of this study was to investigate the universal design principle by applying graphical virtualization elements into the disaster prevention pamphlet to make it easy to understand. The references were mainly analyzed through the disaster management, origins of universal design, human visual system (HVS), and the basic principle of layout design.

2.1. DISASTER MANAGEMENT

In 2000, Taiwan's Executive Yuan published the Disaster Prevention and Protect Acts, as shown in Figure 1, that includes mitigation, preparedness, response and recovery (Executive Yuan, Disaster Prevention and Response Office, 2010). Disaster management can be divided into four steps: mitigation and preparedness in advance, response, and recovery after disaster. It depends on educating and advocating the disaster prevention to promote disaster management.
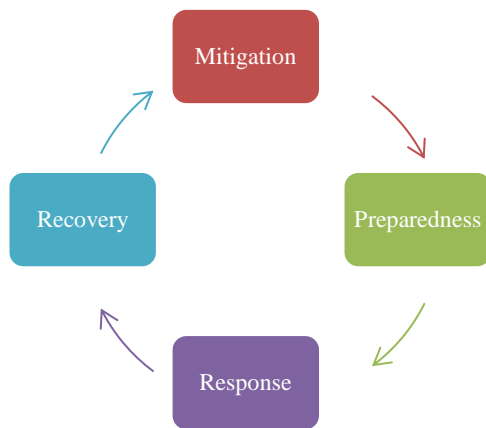
Figure 1: Relationship of disaster management from disaster prevention and response office of executive Yuan (2010), and disaster prevention policy in 2011

This basic concept of disaster prevention is to educate the senior citizens to attend prevention acts instead of controlling disasters (Greenberg, 2014). To carry out the core concept of preparation and participation, the pamphlet should be integrated with related disaster management information. In addition, appropriate art designs, as well as universal designs in seven principles, are as an auxiliary method to be applied into public publications for all ages. To reach the goal mentioned above, the authors investigated common disaster prevention advertising matters and layout design concepts as the basis of the study.

2.2 COMMON DISASTER PREVENTION ADVERTISING MATTERS

A pamphlet relies on advertising matters to promote disaster prevention education. The medium includes pamphlets, learning websites, direct mail, discs, animation, and games. Even though there are a large number of disaster prevention books and reports, however, the contents are either complicated and/or uninteresting for most people to understand or be concerned about. There is still room to improve the design and practicability.

2.3 ORIGINS AND DEVELOPMENT OF UNIVERSAL DESIGN

Ron Mace, (1970), originally proposed the word "Universal Design"(Mace, 1997). The concept of universal design was developed from both accessible design and adaptable design. The main purpose was to solve the physical problems of the senior citizens and the disabled. Accessible design mainly focuses on the concept of equitable application. Distinct subjects and fields could differentiate the definition of universal design. The most common use of the seven principles were edited by 10 provokers and published on December 7th, 1995(NC State University, 1997).

1. Equitable use: The design is useful and marketable to people with diverse abilities.

2. Flexibility in use: The design accommodates a wide range of individual preferences and abilities.

3. Simple and intuitive use: Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

4. Perceptible information: The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

5. Tolerance for error: The design minimizes hazards and the adverse consequences of accidental or unintended actions.

6. Low physical effort: The design can be used efficiently and comfortably and with a minimum of fatigue.

7. Size and space for approach and use: Appropriate size and space is provided for approach, reach, manipulation, and use, regardless of the user's body size, posture, or mobility.

2.4. VISUAL PHYSIOLOGY CHARACTERISTICS OF THE SENIOR CITIZENS

It is essential to understand the feelings and awareness of the senior citizens in order to reach their goal – universal design. Visual sense is the basis of reading and judging ages. The sensibility of vision is one of the body-aging indicators. The visual sense degenerates from 40 years of age; moreover, the illumination level the senior citizens need is 3-fold higher than the young need. The reaction time of the information process for senior citizens becomes slower as they grow older (Lee & Tzeng, 2000).

2.5. RESEARCH OF COLOR AND WORD ANALYSIS

According to the study of the TOPPAN PRINT Co., Ltd, senior citizens have a reduction of color sensibility. Furthermore, the awareness of color becomes one tone. The plain color becomes vivid while the chromatic color becomes plain. The three leading legibility elements for the senior citizens are word size, space, and font.

Besides, the minimum readable distance test showed that senior citizens (between 60 to 70 years old) could recognize font size 25 points in a poorly lighted environment; however, the young could read a 2.5 times smaller font size than the senior citizens. To sum up, it is quite essential to emphasize the font size for senior citizens' reading.

2.6. ISO GUIDE 71

Depending on the ISO Guide 71 (Guidelines for standards developers to address the needs of older persons and persons with disabilities, 2014) sensory abilities, the effects of aging are loss of near distance vision, hearing, and sensitivity; moreover, failing memory and autism are classified as to the cognitive abilities (ISO/IEC Guide 71, 2014).

When comparing the location and layout of information and controls, the main design points are color, font size, contract effect, and shape in the sensory abilities. Using proper pictogram will help the senior citizens understand what the messages mean in cognitive abilities. On the other hand, clear message symbols and proper material usage are the keys of design as well.

2.7. LAYOUT VISUAL COMMUNICATION DESIGN

Layout design, defined as surface graphical design, is to colorize and arrange graphics and characters. Layout design usually concludes three types: concrete, semi-concrete, and abstract graph (Konyalioglu, Konyalioglu, Ipek, & Isik, 2005). The main visual design factors for editing a pamphlet are symbols, graphic language, layout structure, and color, which are imperative to communicate the corporate image, brands, contents, purposes, and specified uses to consumers (Landa, 2010).

3. METHODS

The authors investigated the universal design of disaster prevention pamphlets based on the content analysis and the observation of their layouts. Each sample was objectively analyzed with a visual design program and then accessed with further subjective comments and suggestions. As illustrated in Fig. 2, the design process consists of theme setting, frame plan, content plan, and layout design.

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│     Collection of related references           │
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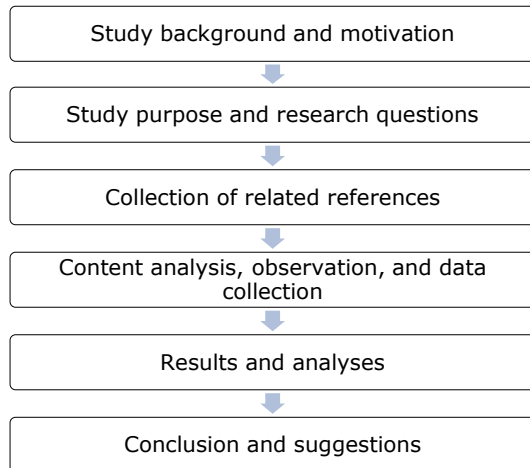
Figure 2: Design process of this study.

The purpose of the pamphlet is to augment the public's awareness of disaster prevention and maximize the adaptability towards impending catastrophes. Apart from the instructions for disaster prevention plans and standard operating procedures, it is also significant to express the closest refuge routes when disaster strikes. Thus, the main contents of the pamphlet should consist of an emergency package, action plan, disaster simulation, and an evacuation map with the directed routes.

4. RESULTS

4.1. ANALYSIS OF CURRENT DISASTER PREVENTION PAMPHLETS

From January to July, 2014, the authors collected a sample of disaster prevention pamphlets issued by the Taiwan government. They comprised of, six citizens' disaster prevention pamphlets, two guidance for free access disposals, one of safety instructions for the elderly, and one safety instructions for children.

As indicated in Tables 1 and 2, Gothic typeface was widely used for the title of the disaster prevention pamphlets. The minimum character size was 12-point (Disaster Prevention Guidelines for Family published by the National Fire Agency, Ministry of the Interior, Taiwan), while the maximum size was 24-point (Universal Design Guidelines for Housing Development in Taipei published by the Department of Urban Development, Taipei City Government, Taiwan). All of the characters were written horizontally.

The fonts included round, Gothic, and ming, ranging in size from 9-point to 14-point. The layout designs were customized based on the paper size. With regard to the color contrast, most of the

pamphlets' contents were printed either with graphs and/or white texts on colored backgrounds. In addition, the use of comic characters were prevalent to captivate the readers.

The Universal Design Guidelines for Housing Development in Taipei by the Department of Urban Development contains vivid drawings. However, the drawings only indicate routes instead of the application of disaster evacuation. According to the ISO Guide 71, a graph aids senior citizens to receive informations more than actual descriptions (Lee & Tzeng, 2000). Apparently, there is now scope to enhance the graphs on disaster prevention pamphlets as well as home safety messages.

Finally, warning notices and disaster prevention information, including the classification of disasters and warning tips, are commonly shown in high chromaticity contrast. Messages regarding evacuation kits, safety checklists, evacuation routes, and maps, are always presented in graphs and checklist formats. In summary, the visual design issues that did not comply with the existing universal design manual are listed as follows:

1. Poor legibility

The legibility is low due to mass omissions and small-sized texts. In addition, the sentences are too long and the spaces are too narrow. Furthermore, the poor color contrasts of the graphs makes them difficult to understand.

2. Poor effect from warning tips

The layout design of the pamphlet does not effectively bring out the importance of the message guidelines and warning tips.

3. Poor pictogram usage

The proper use of graphs can facilitate the ease of understanding. However, it is better to use simple texts and more appropriate graphs in the layout design, especially when space is limited.

4. Poor disaster information

This study found that the majority of the disaster prevention pamphlets were disorganized. A well-organized layout, such as the publishing of legal messages and emphasizing information by importance, will improve the overall legibility of disaster-related information.

Table 1: Analysis of the disaster prevention pamphlets issued by the Taiwan government.
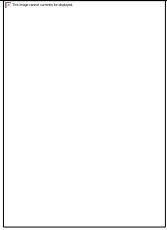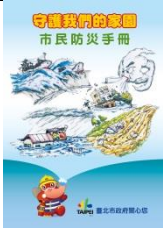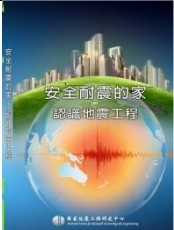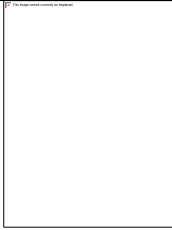
	Disaster prevention pamphlet for families	Disaster prevention pamphlet for citizens	Home safety pamphlet for the elderly with dysphasia	Pamphlet for creating barrier-free facilities	Universal design guidelines for housing developments in Taipei
Text					
Title	Gothic letter 12-point	Gothic letter 12-point	Round letter 16-point	Round letter 20-point	Gothic letter 24-point
Contents	Round letter 9-point	Round letter 9-point	Round letter 14-point	Round letter 9-point	Gothic letter 12-point
Direction	Horizontal	Horizontal	Horizontal	Horizontal	Horizontal
Color contrast	Black text on white background	Black text on color background	Brown text on white background	Black text on white background	Black text on white background
Graph					
Pictogram	No	No	No	Yes	No
Graph	Photographs and comic characters	Comic characters	Photographs and comic characters	Photographs	Photographs and comic characters
Warning					
Disaster classification	4	6	7	No	No
Warning tips	Not specific, Gothic letter 25-point	No	Yes, 14-point Red text on white background	No	No
Evacuation bag	No	No	No	No	No
Check list	3	1	3	No	5
Evacuation route	2 (draw it yourself)	1 (draw it yourself)	No	No	1 (draw it yourself)
Evacuation map	No	Yes	No	No	No
Specifications					
Size	21 cm x 15 cm	21 cm x 15 cm	21 cm x 15 cm	21 cm x 15 cm	21 cm x 15 cm
Pages	70	64	86	114	88

Table 1: Analysis of the disaster prevention pamphlets issued by the Taiwan government (Cont'd).

	Disaster prevention pamphlet for citizens	Earthquakes and the engineering of buildings	Disaster prevention pamphlet for citizens	Home safety pamphlet	Home safety for children pamphlet
Text					
Title	Gothic letter 16-point	Gothic letter 14-point	Gothic letter 14-point	Gothic letter 14-point	Round letter 20-point
Contents	Round letter 9-point	Gothic letter 12-point	Round letter 10-point	Ming letter 11-point	Ming letter 14-point
Direction	Horizontal	Horizontal	Horizontal	Horizontal	Horizontal
Color contrast	Black text on color background	Black text on white background	Black text on white background	Black text on white background	Black text on white background
Graph					
Pictogram	No	No	No	No	No
Graph	Comic characters	Photographs, comic characters	Comic characters	Comic characters	Comic characters
Warning					
Disaster classification	6	1	4	8	4
Warning tips	No	No	Yes, 14-point orange or red text on white background	No	No
Evacuation bag	No	1	1	1	No
Check list	1	1	No	2	8
Evacuation route	1	2	No	2	No
Evacuation map	No	No	15	1	No
Specifications					
Size	21 cm x 15 cm	21 cm x 15 cm	21 cm x 15 cm	21 cm x 15 cm	21 cm x 15 cm
Pages	48	258	30	112	70

4.2. UNIVERSAL DESIGN PRINCIPLES FOR DISASTER PREVENTION PAMPHLETS

Referring to the seven principles of universal design (see Table 3) and the ISO Guide 71, investigators have generated a list of principles for disaster prevention pamphlets (Null & Cherry, 1996).

Table 2: Principles of disaster prevention pamphlet creation in conformance with universal design.

Seven principles	Disaster prevention pamphlet
1. Equitable use	None.
2. Flexibility in use	None.
3. Simple and intuitive use	Process design principle: The principle should classify the contents according to disaster types, frequency of occurrence, and importance so that readers can easily peruse and memorize the information.
4. Perceptible information	Visual communication design principle: (1) Layout of disaster prevention message Disaster information with high importance should be placed on the front page of the pamphlet. Auxiliary aspects include high contrasts, vivid colors, and proper graphic symbols. (2) Text legibility Enlarging the text size, enhancing the contrast of the graphs and text, setting proper space, avoiding reverse type text, dividing paragraphs properly, and using vivid colors to emphasize the title are the methods for increasing text legibility. (3) Color usage Strong and high contrasting colors should be used for warnings and tips. (4) Graphs and symbols design The graphs and symbols used should be easy to understand from the outset.
5. Tolerance for error	There is no direct solution for the layout design of a disaster prevention pamphlet.
6. Low physical effort	None.
7. Size and space for approach and use	The pamphlet is compiled in hard copy as well as in files for computers and mobile phones so that it is easy for readers to download, operate, deliver, store, and peruse.

Principles in terms of fault tolerance and low physical effort: There are no direct correspondence issues on designing a disaster prevention manual, and thus, it will not be discussed in this study. The disaster prevention pamphlet with a universal design concept will eliminate the barriers in communication and avoid lapses in the implementation of prevention principles. The use of visual communication design principles in this research can greatly upgrade the influence of the disaster prevention information.

In addition, such improvements in universal design can ultimately achieve a more direct awareness and alleviate cognitive overload and miscommunication. Due to the frequent occurrence of natural disasters over the past decade, there has been significant consideration towards disaster management, prevention, and education.

5. DISCUSSION

This study has focused on establishing the basic awareness of natural disasters among senior citizens and thereby planning appropriate responses to such disasters. Based on the authors' analysis, the following four conclusions can be made regarding the universal design of disaster prevention pamphlets: (1) confirm the specific response group; (2) analyze the response plans; (3) investigate unregistered organizations and their locations, and indicate their potential risks to the public; and (4) create a database and message delivery operation, including the organization of evacuation assistance plans and related messages. It is necessary to analyze the communication methods for all types of disasters, such as mudslides, typhoons, floods, earthquakes, and combinations of said disasters. Moreover, basic needs including multiple languages, sounds, colors, and texts, are also essential.

This study investigated the efficiency of applying a universal design principle to a disaster prevention pamphlet, especially with regard to the safety of senior citizens. The process was then divided into three parts. First, the current status of disaster prevention pamphlets were analyzed and then compared to the design defects with the universal design principles. Second, the methods to promote the overall design of such pamphlets were organized. Finally, the design principle of the disaster prevention pamphlets were analyzed and summarized by using both the universal design principles and common principles. The authors concluded that a disaster prevention pamphlet based on the universal design principle must include a disaster prevention plan and an appropriate visual communication design (i.e., layout design).

This study primarily focused on a visual communication design as the ultimate goal, and the following four points were found to be the most essential in such a design:

1. Layout of disaster prevention messages: All messages should be organized and listed according to importance. Highly significant messages should be placed on the cover and at the bottom of the page and highlighted in bright and vivid colors. Moreover, the correct graphical characters and iconic symbols are essential. Graphical symbols should be based on the most common and easily recognizable ones to eliminate any obstructions during its usage.

2. Legibility: The font size should be as large as possible, and the size of the graphs should be enhanced. Highlighted texts should be applied in the titles and headlines instead of being included in the illustrations.

3. Color usage: The communication effect is more pronounced with the appropriate use of colors and icons. For warnings and tips, high-contrast colors are more suitable, as it was observed that there was no direct connection between colors and disaster types. In addition, the present status is associated with colors and graphs.

4. Graphs and symbols design: The graphs and symbols used should be easy to understand from the outset.

6. CONCLUSIONS

Through inductive reasoning and demonstration, the aforementioned design principles do enhance the communication efficacy in disaster prevention information. Moreover, these design principles not only achieve intuitive awareness, but also reduce cognitive overload and miscommunication, as well as requiring perceptible information of design principles. However, future research should focus on layout designs and disaster prevention designs that exceed the limit of current visual communication designs. In this case, a disaster prevention pamphlet based on a universal design would be much more effective.

Finally, it has been observed that cell/mobile phones are used by the majority of the population, suggesting that they have become ubiquitous in everyday life. In addition, simplified cell phones that include an easy interface as well as specific functions (i.e., emergency keys, healthcare reminders) to meet the senior citizens' needs.

Therefore, the authors suggest that the disaster prevention pamphlet should be digitalized and connected with smartphone applications, which can be especially helpful for senior citizens at the time of a disaster, and also during the post-disaster recovery phase. In brief, Taiwan's general population is aging fast and thus, it is time to promote a universally designed disaster prevention pamphlet, which will be for everyone who is in need of help and guidance during such adversities.

ACKNOWLEDGMENTS

REFERENCES:

Brunkard, J., Namulanda, G., & Ratard, R. (2008). Hurricane Katrina deaths, Louisiana, 2005. Disaster Med Public Health Prep, 2(4), pp. 215-223. doi: 10.1097/DMP.0b013e31818aaf55

NC State University, The Center for Universal Design (1997). The Principles of universal design.

FEMA. 2015, (05/01/2015). Ready-prepare, plan, stay informed,. from http://www.ready.gov/translations/chinese/index.html

FIFAS. 2012. Older Americans 2012: Key Indicators of Well-Being.: Federal Interagency Forum on Aging-related Statistics. Retrieved from http://www.agingstats.gov

Greenberg, M. R. 2014. Protecting seniors against environmental disasters: from hazards and vulnerability to prevention and resilience: Routledge.

Gutman, G. M., & Yon, Y. 2014. Elder abuse and neglect in disasters: Types, prevalence and research gaps. International Journal of Disaster Risk Reduction, 10, pp. 38-47. doi: 10.1016/j.ijdrr.2014.06.002

Hori, T., & Shaw, R. 2012. Global Climate Change Perception, Local Risk Awareness, and Community Disaster Risk Reduction: A Case Study of Cartago City, Costa Rica. Risk, Hazards & Crisis in Public Policy, 3(4), pp. 77-104. doi: 10.1002/rhc3.19

ISO/IEC Guide 71. 2014. Guidelines for Standards Developers to Address the Needs of Older Persons and Persons with Disabilities (2 ed.): International Organization for Standardization Geneva.

Konyalioglu, S., Konyalioglu, A. C., Ipek, A. S., & Isik, A. 2005. The Role of Visualization Approach on Student's Conceptual Learning. International Journal for Mathematics Teaching and Learning, 47.

Kosatsky, T. 2005. THE 2003 EUROPEAN HEAT WAVES. 10(7). http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=552

Landa, R. 2010. Graphic design solutions: Cengage Learning.

Lee, C. F., & Tzeng, S. Y. 2000. A Study on the universal design study of elderly people in GUI design.: Ministry of Science and Technology, Taiwan.

Lin, C. H. 2010. When disaster came how to do? Disaster response SOP.: Cit'e media holding group, Taipei, Taiwan.

Mace, R. 1997. What is universal design. The Center for Universal Design at North Carolina State University. Retrieved Retrieved November, 19, 2004.

Magrath, J., Bray, I., & Scriven, K. 2007. From weather alert to climate alarm.   Retrieved from http://www.oxfam.org/sites/www.oxfam.org/files/climate%20alarm.pdf

Nasreen, M. 2004. Disaster research: exploring sociological approach to disaster in Bangladesh. Bangladesh e-journal of Sociology, 1(2), pp. 21-28.

Naumann, R. B., Dellinger, A. M., Anderson, M. L., Bonomi, A. E., & Rivara, F. P. 2012. Healthcare utilization and costs among older adult female drivers and former drivers. J Safety Res, 43(2), pp. 141-144. doi: 10.1016/j.jsr.2012.01.001

NOAA. 2011. NOAA: 2011 a year of climate extremes in the United States. Retrieved from http://www.noaanews.noaa.gov/stories2012/20120119_global_stats.html

Null, R. L., & Cherry, K. F. 1996. Universal Design-Creative Solutions for ADA Compliance. Professional Publications, Inc., California, USA.

Oxfam. 2009. The Right to Survive. The humanitarian challenge for the twenty-first century   Retrieved from http://www.oxfam.org/sites/www.oxfam.org/files/right-to-survive-summary-eng.pdf

Robine, J., Cheung, S., Roy, S. L., Oyen, H. V., & Herrmann, F. R. 2007. Report on excess mortality in Europe during summer 2003: Health & Consumer Protection Directorate General.

Sawai, M. 2012. Who is vulnerable during tsunamis? Experiences from the Great East Japan Earthquake 2011 and the Indian Ocean Tsunami 2004. Paper presented at the United Nations Economic and Social Commission for Asia and the Pacific. http://www.unescap.org/sites/default/files/IDD-DRS-who-is-vulnerable-during-tsunamis.pdf

Wang, X. J., Wang, Y. G., Wang, F. X., Xu, Q. Y., & Qi, P. F. 2012. Government's policy response to the problem of aging approach to explore-innovative service model of health care industry. T & D Free Net.