Farming Profile and Damages Caused by Super Typhoon "Rolly" in Selected Coastal Areas in Sorsogon City, Philippines

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ABSTRACT

The impact of a typhoon disaster depends on the intensity and strength of the typhoon which can be linked with the precautionary measures and knowledge of local residents. This descriptive-correlational research design gathered data on the farming profile and damages caused by super typhoon *Rolly* in the selected coastal areas in Sorsogon City, Philippines through surveys, field visits, and interviews. Out of the purposively chosen 1000 respondents, 834 of them reported damages in their housing. Most of the farmer respondents have more than 20 years of engagement in the mono-cropping system, tilling below the one-hectare size of land near their residency as a tenant. Moreover, the majority of the farmers were newly engaged ($\leq$ 5 years) in livestock production in their backyard. The multiple regression reveals that the barangay location (β =-9.866), water resources (β =5.197), households who experienced flooding (β =6.067), and household head age (β =0.135) were statistically significant predictors of typhoon damages. The farmers who used mono-cropping in any of the rice, corn, cassava, coconut, vegetables, among others have low income and reveal higher damages during typhoons. The Sorsoganons are generally resilient able to move forward despite all the challenges and difficulties brought by the typhoon. The provision of the relocation sites, advice, and monitoring of LGUs are important precautionary measures in reducing the impact of the typhoon along with coastal areas.

Keywords: Disaster risk reduction management, coastal areas, Crop production, Farming profile, Sorsogon City, super typhoon damages, quantitative design, Philippines

INTRODUCTION

Tropical storms, including typhoons and hurricanes, are the most extreme weather events affecting coastal wetland ecosystems and the adjacent marine area, and the concomitant heavy rains can cause damage to areas hundreds of kilometers from the storm center (Herbeck et al., 2011). This is considered as a natural disaster with catastrophic consequences for living things in the vicinity (Sivakumar, 2005) that causes a perturbation to the functioning of the economic system with a significant negative impact on assets, production factors, output, employment, or consumption (Hallegatte & Przyluski, 2010).

The study of Yao and Bond (2011) found out that the impact of typhoon disasters depends on the intensity and strengths of the typhoon, which is also linked with the precautionary concerns and knowledge of local residents. Tropical typhoons have become recurrent events in the Asia-Pacific region which is projected to be more intense in the future (Gatto et al., 2021). The Philippines is one of the country's most prone to tropical storms in the world (Blanc & Strobl 2016) with a predicted increase in intensity due to climate change (Knutson et al., 2010). Moreover, regardless of any increase in intensity or frequency, their effects are likely to be exacerbated by the Philippines' rapidly growing population, particularly along the coast, and its localized environmental degradation (Holden & Marshall, 2018).

An average of 20 tropical cyclones enters the Philippines each year, with 8 or 9 of them making landfall (PAGASA, 2020). Particularly, from late October to November 2020, the Philippines was hit by a series of three major typhoons with Super Typhoon *Rolly* that crossed the country on November 1, 2020, has caused extensive damage and disruption as it intensified the Bicol Region. The Philippine News Agency (PNA) reported that it was the strongest tropical cyclone of 2020, with maximum sustained winds up to 225 kph and guts up to 280 kph.

Super Typhoon Rolly brought heavy rains that cause floods and threaten the livelihood of rural people who are dependent on agriculture. In the damage assessment of the National Disaster Risk Reduction Management Council (NDRRMC, 2020) in the Province of Sorsogon, the Agriculture sector recorded 2,148 hectares (2,077 totally and 71 partially) damaged during the onslaught of super Typhoon Rolly. The typhoon damaged rice, corn, abaca, and other high-value crops. It also destroyed boats, fishing gear, agricultural equipment, and other livelihood resources, significantly affecting those who are dependent on farming and fishing as their primary or secondary source of livelihood (UNOCHA, 2020).

The study of Zhang et al., (2017) shows that residents' risk perception of health and life threat caused by a typhoon is inadequate and the government should further make strategies to develop educational activities, in order to eliminate the gap and improve the ability to prepare for typhoon among rural residents. In southern Thailand, Usher et al., (2013) found out that people with previous experience with calamities have high-risk perceptions which were expressed as a heightened fear of a typhoon and a tendency to take threatened disasters seriously.

Correspondingly, Rivera and Vargas (2018) showed up in their research study the interventions of some local government units (LGU's) to the affected community, farmers, and fisherfolks in the aftermath of typhoons. These include the post-disaster risk assessment planning and meeting in the assessment on the damages of every facility, cleaning operations, and de-clogging of canals which they perceived as the primary reason for flood in some areas. The Municipal Agriculture Office (MAO) provided rehabilitation programs to the affected farmers and fisherfolks and organized tree planting activities. Hence, this study accounted for the damages caused by Typhoon Rolly in various aspects highlighting the agricultural sector in the selected coastal areas in Sorsogon City, Province of Sorsogon, Philippines. The study provided also useful information on how diverse coping mechanisms minimize its given effects.

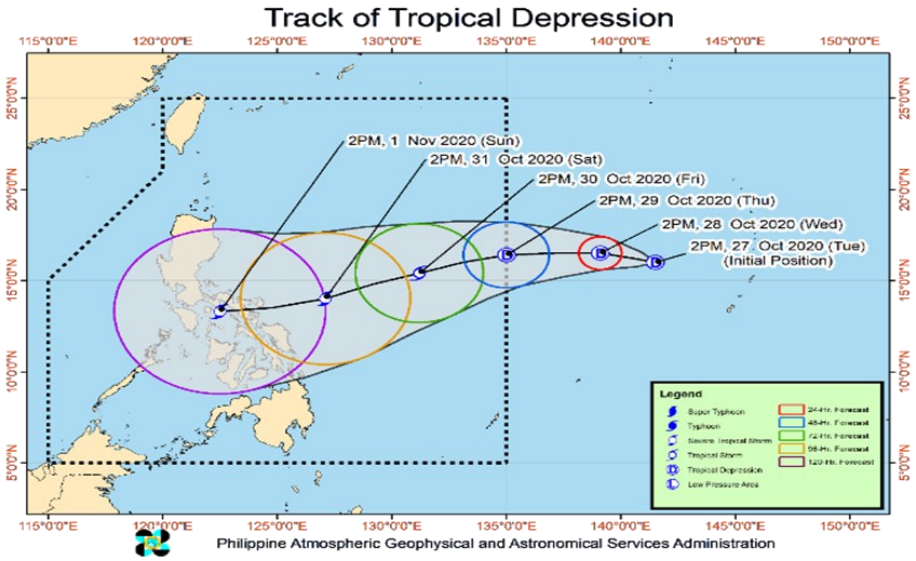

Figure 1: Track of Super Typhoon Rolly

METHODOLOGY

Research Methods

This descriptive-correlational research design gathered the data through a survey. The records of prospect respondents who were affected by the typhoon Rolly from the Office of Social Welfare and Development of the locality were requested for profiling. Field visits and interviews with the barangay officials and representative residents were conducted to the identified coastal barangays to further validate the secondary data and information. Images such as actual pictures and reports were also requested to support the bases in qualifying the damages of the typhoon in the identified coastal barangays.

Respondents

The study has identified four coastal barangays in the City of Sorsogon, namely, Bogña with 96 resident respondents, Buenavista with 354 respondents, Caricaran with 327, and Sampaloc with 223 respondents which are affected by the super typhoon "Rolly". Out of a total of 1000 respondents, 604 or 60.4% has an age range of 31-60 years, 238 or 23.8% are senior citizens (above 60 years old), and only 159 or 15.8% belong to 30 years old and below age group. The respondents in this study are dominated by married (505 or 50.5%) males (540 or 54%) residing for more than 15 years in the area (864 or 86.4%) and have attended high school level (430 or 43%) of education. There were six selected informants from the covered coastal barangay to support the data from the survey.

The Instrument

The questionnaire from the Bicol Council of Agriculture, Aquatic and Natural Resources Research and Development (BCAARRD) was the main instrument used in this study. The content validity of the questionnaire was ensured by the three experts to suit the purpose of the research. The questionnaire is composed of four major parts: part I – Socio-demographic profile, part II – Farming profile, part III- Damage report, and part IV- Coping mechanism.

The farming profile deals with crop (palay, corn, vegetable, coconut, abaca, and other crops) production, and livestock (piggery, ruminants, and poultry) production. The damage report refers to the percentage of damages as identified by the respondents themselves to their houses and properties including damages to the crop and livestock production for those who are engaged in farming. The last part of the questionnaire deals with the general coping mechanism of the respondents of the covered barangays during and after the typhoon. The data gathered from the questionnaire were supported by the interview from the informants of the covered barangay. The interview focused on the two key questions: (1) *What are the usual damages of the Super Typhoon Rolly in*

your household/barangay? (2) *How do you deal with the damages after the typhoon?*

Data Analysis Procedures

The data gathered were tabulated and translated into the frequencies and percentages of the socio-demographic profile, farming profile, typhoon damages, and coping mechanism of the respondents per covered barangay. Multiple regression analysis was executed to determine whether the barangay location, water resources, flood experienced together with the age, education, employment status, occupation, and civil status of household head are predictors of typhoon damages with the use of the SPSS software. Moreover, an appropriate chart such as a horizontal bar graph was used to show the magnitude and the most frequent coping mechanism. Coding of the responses from the interview of selected key informants was executed to arrive at the different themes supporting the quantitative data gathered from the study.

RESULTS AND DISCUSSION

Farming Profile of the Affected Coastal Barangay

The data revealed that there are 357 out of 1000 respondents in the four selected coastal barangay engaged in farming as their main occupation. There are 108 farmers who are engaged in crop production (palay, corn, cassava, vegetables, coconut), 119 are engaged in livestock production (pig, carabao, cow, goat, chicken, duck, others), and 263 are engaged in fishing. Out of the 108 engaged in crop production, 40 are also engaged in livestock and 19 of them made crop production as their alternative source of income. Moreover, there are 47 out of 119 farmers who were engaged in livestock production revealed that this is their alternative source of income, and also the 23 out of 263 engaged in fishing as other sources of income.

Most of the farmer respondents have more than 20 years of engagement (60 out of 108 or 55.6%) in crop production, tilling below the one-hectare size of land (40 or 37%) near their residency (53 or 49.1%) as tenant (83 or 79.6%) either through leasehold or usufruct. The cropping system utilized by the farmers along coastal areas is usually mono-cropping (72 or 66.7%), very few of them used multiple cropping, crop rotation, and sequential cropping.

Rice or "palay" was the widely known crop produced by the farmers (59 out of 108) along the coastal areas and followed by the coconut (37 out of 108) which are mostly for sale. The mono-cropping system of production revealed a low annual income (< Php5,000) as reported by the farmers (25 out of 74 or 33.8%) of "palay", corn, cassava, and vegetables. Moreover, most of the coconut farmers (27 out of 37 or 72.9%) obtained annual income of at least Php2,501. The data strengthened the common perceptions of low income among the farmers engaged in crop production. In order to get higher income and improved their livelihood, farmers may explore engaging other cropping systems such as intercropping, mixed cropping, and rotational for the sustainability of yield.

Along with the livestock production, majority of the farmers (43 out of 119 or 69.8%) were newly engaged ($\leq$ 5years) in managing piggery (34 out of 119), ruminants (38 out of 119), and poultry (73 out of 119). In terms of piggery, almost all of the farmers have at most 5 pigs raised (32 out of 34) in their backyard and feed them of what is available from the farm (30 out of 34). Almost similar results can be derived to ruminants where all of the farmers have at most 5 carabaos, or goat raised and feed them of what is available from the farm (35 out of 38). In the case of poultry production, the majority of the farmers (41 out of 73 or 56.2%) raised at most 5 chickens or ducks and 32 of them (43.8%) raised more than 5 chickens or ducks usually in the backyard (69 or 94.5%) and feeding those materials from the farm.

Damages Caused by Typhoon "Rolly" to the Affected Coastal Areas

The majority of the respondents (834 out of 1000) reported damages in their housing. This is because the majority of the houses along the coastal areas are made of light materials such as plywood and nipa with no proper foundation. A female resident of Barangay Sampaloc reported "*Some houses have been completely destroyed, electricity and water have been cut off, and mobile phones have been*

without service for several days", which justifies the results of the data in terms of damages in the housing and properties. This was also backed up with feedback from a female resident of Barangay Caricaran who lives near the coastal area, "*Nasira ang bubong ng aming bahay dahil bukod sa hagupit ng bagyo, lumakas din ang hampas ng alon* [The roof of our house was damaged since, in expansion to the storm, the waves moreover intensified]".

Figure 2: Housing Damages of Super Typhoon Rolly in Barangay Bogna (Left) and Barangay Buenavista (Right)

One of the most affected areas of concern among the respondents is their livelihood, especially those who were engaged in farming, specifically crops and livestock productions. A farmer from Barangay Bogña of Bacon District remarks the damages of the Super Typhoon Rolly in his livelihood, "*Nalugi ang aking hanapbuhay tulad ng pagtatanim ng mga gulay at palay, at naapektuhan rin ang aking pangingisda* [My livelihood, which included cultivating vegetables and rice, as well as my fishing, was jeopardized]". Along with the crop production, 40.5% of those farmers engaged in crop farming experienced 1-25% to 76-100% range of damages in the rice field or "palay", corn, cassava, vegetable; and 48.6% of them experienced at least 26% damages in coconut field. Moreover, the majority of the respondents (>50%) engaged in crop farming reported no damages. This indicates that the farmers are knowledgeable enough and aware about the storm season and applied appropriate action to prevent further damages by changing their planting calendar for specific crops or harvesting earlier prior to the arrival of the super typhoon "Rolly".

The data revealed that the majority of the respondents reported no damages in their livestock production, specifically in piggeries. Along with the ruminants, there is no reported damage in their carabao and goat raising. Moreover, only one farmer respondent in Brgy. Buenavista reported 26-50% damage in their chicken production.

Socio-Demographic and Farming Profiles as Predictors of Typhoon Damages

Table 1 shows the regression analysis results of predicting the typhoon damages in the housing properties of the coastal residents using the barangay location, household water sources, flooding experience, age, education, employment status, occupation, and civil status of the household head as the independent variables. The typhoon damages to the housing properties of the residents in the coastal barangays were expressed in terms of percentages as revealed by their responses.

The overall multiple regression predicting the typhoon damages in the housing properties from the considered independent variables was significant $F(8,983)= 33.630$, $p<0.001$, $R^2= 0.22$ with the corresponding positive autocorrelation value (DW =1.618) among residuals. Table 1 reveals that among the independent variables considered, only the barangay location (β = -9.866), water resources (β =5.197), households who experienced flooding (β =6.067), and household head age (β =0.135) were statistically significant predictors of typhoon damages.

Variable	β	S.E.	T	95% CI		P
				LL	UL	
(Constant)	38.655	3.990	9.687	30.825	46.486	0.000
Barangay location	-9.866	0.713	-13.842	-11.265	-8.467	0.000
Household water sources	5.197	1.449	3.586	2.353	8.041	0.000
Experienced flooding	6.067	1.353	4.484	3.412	8.722	0.000
Household head age	0.135	0.044	3.054	0.048	0.221	0.002
Education attainment	-0.839	0.708	-1.186	-2.228	0.549	0.236
Status of employment	-0.380	1.024	-0.371	-2.389	1.630	0.711
Occupation	1.339	0.802	1.669	-0.235	2.913	0.095
Civil status	0.157	1.390	0.113	-2.571	2.885	0.910

Note. $F(8,983) = 33.630$, $p<0.001$, $R^2 = 0.22$, N=991

The degree of damages of the typhoon as revealed in this study is generally strengthened by the geographical location and characteristics of the barangay. Hence, the local government units (LGUs) intervention before, during, and after the typhoon such as the provision of the relocation site, advises, and monitoring is very important especially in the areas which prone to flooding without natural windbreakers. Yao and Bond (2011) revealed in their investigation that the impact of typhoon disasters depends on the intensity and strengths of the typhoon that struck the covered area. The precautionary measures and knowledge of local residents might help reduce the impact of the typhoon.

The overall multiple regression predicting the percentage of crop production damages of typhoon using the mentioned independent variables was significant $F(11,81)= 2.376$, $p<0.05$, $R^2= 0.24$. The data reveals that among the independent variables considered, only the cropping system (β =-6.197) and education attainment of the farmers (β =18.279) were statistically significant predictors of typhoon damages in crop production. The study found out that farmers who used mono-cropping in any of the rice, corn, cassava, coconut, vegetables, among others have low income and reveal higher damages during a typhoon. The farmers who used crop rota-

tion, sequential and mixed cropping revealed lesser damages of typhoon (<6.20%) in the crop production.

The education attainment of the farmers engaged in crop production also shows a significant result since those with higher education attainment are mostly employed with farming as the secondary source of income while those farmers with lower education attainment are mostly full-time farmers. The data reveals that for every farmer with higher education attainment will increase by 18.28% damages in the crop production. This only shows that farmers' readiness, preparedness, time, and hands-on in farming will lead to a reduction of typhoon damages in crop production. Residents with farming as the secondary source of income have the tendency to prioritize their primary work or occupation as well as their housing properties over the existing farming assets.

Coping Mechanism of the Affected Coastal Areas

Figure 3 highlights the coping mechanism of the respondents during and after the typhoon. It can be shown in the figure that the farmers from the different barangays along with the coastal areas consistently repair damaged properties after typhoons as their coping mechanism. The respondents with damaged housing and properties usually evacuated and lived with relatives and/or temporarily lived in a shelter provided by the local government units (LGU). They also seek assistance from institutions such as DSWD, LGU, DA, among others to fully recover.

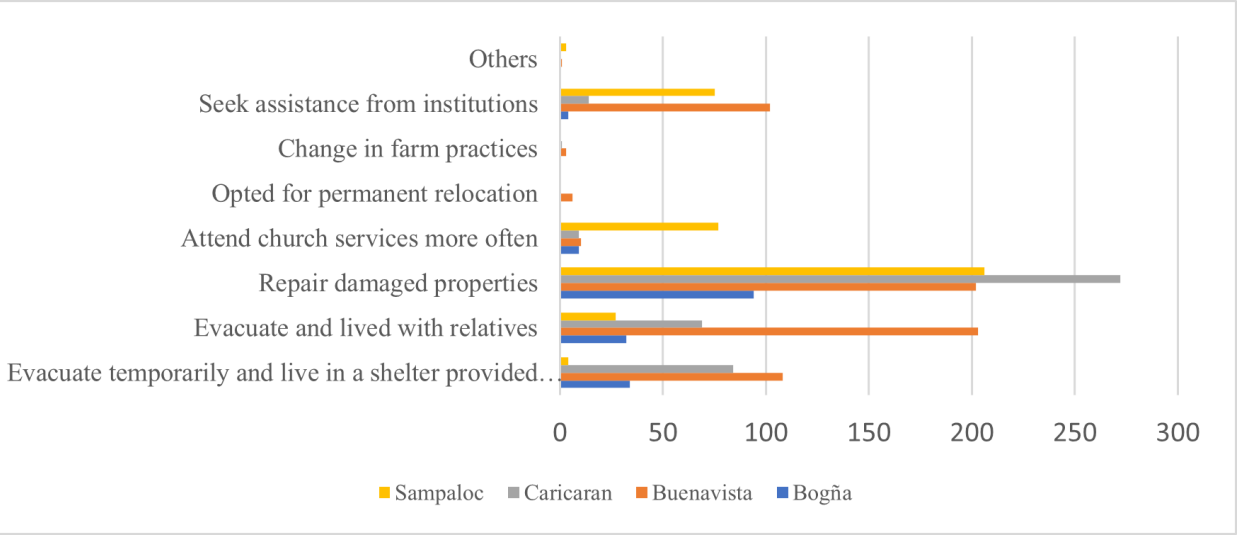

Figure 3: Coping Mechanism of Respondents after Typhoon

The data in the figure signifies that Sorsoganons are generally resilient able to move forward despite all the challenges and difficulties amidst damages brought by the typhoon. This result was supported by the feedback of a female respondent from Barangay Sampaloc on how they deal with the effect of the Typhoon Rolly, "*Bayanihan [Filipino term for civic unity] as usual, think positive and slowly fix and restore our house with the available materials*". When there are damages, they repair them by themselves to stand again and continue with their daily living.

On the other hand, a barangay official from Barangay Bogña remarks their actions, "*Pinupuntahan lahat ng purok/sitio para makita ang mga kalagayan kun gaano kalaki ang epekto ng bagyo* [All streets are visited to assess the effect of the typhoon to their respective houses and livelihood]". The local leader also mentioned "*Gumagawa din kami ng report para sa lubos na naapektuhan at ipinapadala namin sa CSWD, Red Cross, PDRRMO/CDRRMO at City Agriculture Office* [We also prepare a report of damages which we send to the CSWD, Red Cross, PDRRMO/CDRRMO, and the City Agriculture Office]. Those are the values that typhoons inculcated in each of the Sorsoganon people. Self-recovery efforts, combined with a scaling up of local government-led interventions and

leaning on their faith become the start of the rehabilitation of affected communities.

CONCLUSION

The residents of the affected coastal barangay by super typhoon *Rolly* in Sorsogon City, Philippines are engaged in several socio-economic activities. Barangay location, water resources, households who experienced flooding, and household head age were statistically significant predictors of typhoon damages in the housing properties along the coastal barangay. The farmers who used mono-cropping in any of the rice, corn, cassava, coconut, vegetables, among others have low income and reveal higher damages during a typhoon. The farmers who used crop rotation, sequential and mixed cropping reveal lesser typhoon damages in the crop production. Farmers' readiness, preparedness, time, and hands-on in farming will lead to a reduction of typhoon damages in crop production.

The Filipino people are generally resilient able to move forward despite all the challenges and difficulties amidst damages brought by the typhoon. When there are damages, they repair them by themselves to stand again and continue with their daily living. Since the degree of damages of the typhoon is generally strengthened by the geographical location and characteristics of the barangay, the local government units (LGUs) intervention before, during, and after the typhoon such as the provision of the relocation site, advises, and monitoring is an important precautionary measure in reducing the impact of the typhoon.

ACKNOWLEDGEMENT

The research team would like to extend their appreciation to the Department of Science and Technology – Bicol Consortium for Agriculture, Aquatic, and Natural Resources Research and Development (DOST-BCAARRD) for funding support, and the City Government of Sorsogon for the assistance all through the duration of the project.

REFERENCES

Blanc, E., & Strobl, E. (2016). Assessing the impact of typhoons on rice production in the Philippines. *Journal of Applied Meteorology and Climatology*, *55*(4), 993-1007.

Gatto, M., Naziri, D., San Pedro, J., & Béné, C. (2021). Crop resistance and household resilience–the case of cassava and sweetpotato during super-typhoon Ompong in the Philippines. *International Journal of Disaster Risk Reduction*, *62*, 102392.

Hallegatte, S., & Przyluski, V. (2010). The economics of natural disasters: concepts and methods. *World Bank Policy Research Working Paper*, (5507).

Herbeck, L. S., Unger, D., Krumme, U., Liu, S. M., & Jennerjahn, T. C. (2011). Typhoon-induced precipitation impact on nutrient and suspended matter dynamics of a tropical estuary affected by human activities in Hainan, China. *Estuarine, Coastal and Shelf Science*, *93*(4), 375-388.

Holden, W. N., & Marshall, S. J. (2018). Climate change and typhoons in the Philippines: Extreme weather events in the anthropocene. In *Integrating disaster science and management* (pp. 407-421). Elsevier.

Jiang, L. P., Yao, L., Bond, E. F., Wang, Y. L., & Huang, L. Q. (2011). Risk perceptions and preparedness of typhoon disaster on coastal inhabitants in China. *American journal of disaster medicine*, *6* (2), 119-126.

Knutson, T., Landsea, C., & Emanuel, K. (2010). Tropical cyclones and climate change: A review. *Global perspectives on tropical cyclones: from science to mitigation*, 243-284.

Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) official website. Online source: http://bagong.pagasa.dost.gov.ph

Philippine News Agency (PNA) official website. Online source: http://bagong.pagasa.dost.gov.ph

Rivera, N. A. D., & Vargas, D. (2018). Community disaster resilience: the case of Typhoon Karen (Sarika) affected Barangays in San Miguel, Bulacan. *CLSU International Journal of Science & Technology*, *3*(1), 1-13.

Sivakumar, M. V. (2005). Impacts of natural disasters in agriculture, rangeland and forestry: an overview. *Natural disasters and extreme events in Agriculture*, 1-22.

Usher, K., Buettner, P., West, C., Millis, J., Woods, C.,

Mason, M., ... & Chamberlain-Salaun, J. (2013). Preparedness for and impact of tropical Cyclone Yasi in North Queensland, Australia. *Prehospital and disaster medicine*, *28*(3), 272-278.

Zhang, W., Wang, W., Lin, J., Zhang, Y., Shang, X., Wang, X., ... & Ma, W. (2017). Perception, knowledge and behaviors related to typhoon: A cross sectional study among rural residents in Zhejiang, China. *International journal of environmental research and public health*, *14*(5), 492