Community Flood Risk Assessment in Selected Areas in Muntinlupa City

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Abstract
The likelihood of property and life damage is high as people have less time to prepare before the flood occurs in the subject area. The study's objective is to hopefully create a profound awareness in the city government of Muntinlupa of the plight the community is experiencing. A quantitative research design was utilized in this study. Flood risk perception: The probability of whether a retention pond, increasing the diameter of the existing reinforced concrete pipes, and or increasing the road elevation can be a permanent or a quick-fix solution is still unknown until the local government can conduct a comprehensive technical and environmental assessment of the different vulnerability factors in the community. No significant differences were found between age, years of residency, and flood risk perception. Flood risk preparedness: No significant differences existed between age, years of residency, and flood risk preparedness. Substantial differences were found between gender and flood preparedness, and they favor the male gender. *Flood risk awareness:* No significant differences existed between age, years of residency, and flood risk awareness. There were substantial differences between gender and flood awareness, and they favored the male gender. The study's recommendations encourage the local government of Muntinlupa to conduct a comprehensive administrative, technical, and environmental assessment of the different vulnerability factors facing the selected areas in the community.

Keywords: Disaster risk reduction, Flood risk assessment, Environmental assessment

Introduction
Guha-Sapir, D. (2020, July 31) claimed that flooding is the most recurrent and expensive natural risk globally. Yadav, S. (2023) categorized two types of floods: flash and river. A rapid on-set flood usually happens fast and lasts for a quicker duration, almost a day or two; this is triggered by heavy rainfall and appears quickly. The likelihood of property and life damage is high as people have less time to prepare before the flood occurs. This rapid on-set flood is frequently encountered in the selected areas in Muntinlupa City whenever there is light to heavy rainfall. Usually, the residents have less time to prepare and predict the occurrence of rapid on-set floods in the vicinity. The vulnerability of vehicles being stranded in the flood and damage to appliances and furniture is very probable. Wang, Y.V. & Sebastian, A (2021) asserted that a successful assessment of flood susceptibility and threat is imminent for communities to manage flood hazards. McEwen, L.J. (2024) claimed that flooding is an environmental hazard that can significantly impact the economies and livelihoods of developed countries. The author mentioned that local communities have significant responsibilities in mitigation and adaptation, whether active or passive roles of the community. Srivastava, A.K. & Sahay, A. (2023) defined climate mitigation as those activities or measures that reduce greenhouse gas emissions in the atmosphere and increase the sink for carbon sequestration, while climate adaptation is concerned with reducing the impact of climate change through reduction in vulnerability and risk related to human and material loss.

The research gap found in the study is a theoretical gap from the theory generated by Srivastava, A.K. & Sahay, A. (2023), which emphasizes that risk-affected communities of flooding should adapt or live with nature-based solutions rather than engineering intervention. In this study, the urban resilience theory to flood can be challenged because engineering interventions are imperative when there are no nature-based solutions in an urban setting. This can be supported by the study by Glago (2021), wherein advanced

technological tools, such as geographic information systems, remote sensing, the Internet of Things, and Big Data, should be available to flood managers in the development of effective early detection and flood decision support systems that uplifts the resilience of societies to flood disasters.

The study's objective is to hopefully create a profound awareness in the city government of Muntinlupa of the plight the community is experiencing. Our fervent prayer is that with this research, the city government can allocate funds and prioritize necessary rectification projects to improve the flooding situation in the community.

Statement of the Problem
1. What is the demographic profile of the respondents in terms of:
  a. Age
  b. Gender
  c. Years of Residence in the Community?
2. What are the assessment levels of the community toward flood risk perception, flood risk preparedness, and flood risk awareness?
3. Are there significant differences between age and years of stay in the community and the different levels of the community toward flood risk perception, flood risk preparedness, and flood risk awareness?
4. Are there significant differences between the gender of the respondents and the different levels of the community toward flood risk perception, flood risk preparedness, and flood risk awareness?

5. What are the community's assessment proposals to the City Government of Muntinlupa for continuous development and improvement in the selected flood-prone areas in Muntinlupa City area?

Hypothesis
HO1: There are significant differences between the gender of the respondents and the different levels of the community toward flood risk perception, preparedness, and awareness.
HO2: There are significant differences between ages and years of residency in the community and the different levels of the community toward flood risk perception, preparedness, and awareness.

Conceptual Paradigm:
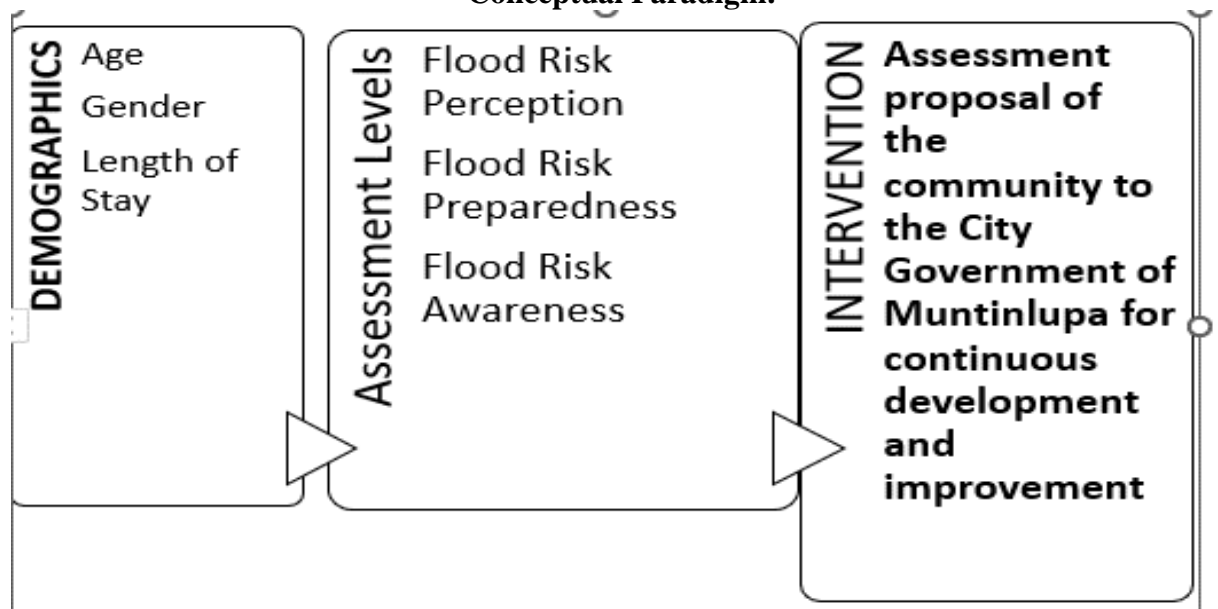
Theoretical Framework:
The study is grounded in the theory that Payne, Y. (2022) explained about *Risk Management Theory*. The author elaborated that risk management theory is a strategy that organizations use to determine, evaluate, and control risk. By determining probable risks, organizations can develop plans to avoid or minimize them. In addition, there is no bullet-proof risk management strategy; this theory can be priceless for organizations

intending to lessen risk vulnerability. The theory is significant to the study because the data gathering identifies and evaluates the flood risk perception, preparedness, and awareness of the affected communities in Muntinlupa City.

Significance of the study

The study will create public awareness for the City Government of Muntinlupa to assess and evaluate the appropriate engineering interventions needed in the local community and allocate the necessary funds to implement any proposed solution to minimize the community's flooding risk.

To the communities of Summit Circle, Summit Home, and Allman Ville. the study will minimize the residents' exposure to flood risk, preventing the loss of lives and properties.

The study will provide the Disaster Risk Reduction Management Office of Muntinlupa with an awareness of how to assist the local barangay unit and the affected community in implementing a flood evacuation plan and drills to minimize the loss of lives and properties.

The study will provide the local barangay unit of the selected areas with continuous awareness to include the affected community in regular drainage cleaning and their flood evacuation program.

The study will bring hope and prayer to the researcher and fulfill a sense of duty and responsibility as a concerned citizen that the City Government of Muntinlupa can augment the community's suffering.

Methodology:

A quantitative research design was utilized in this study. The respondents were the community members of selected flood-prone areas in Purok 1, Barangay Bayanan, Muntinlupa City. The instrument was a Likert-four scale with different levels: agreement, frequency, concern, knowledge, awareness, worries, safety, preparedness, confidence, and likelihood. Descriptive analysis was used to assess the community's level of awareness regarding different flood risk perceptions, preparedness, and understanding. Consequently, the descriptive and inferential results will magnify the answers to the problem statements.

Research Population and Locale:

The respondents in the study were located in Summit Circle, Summit Homes, and Allman Ville, regardless of whether the population was homeowners or tenants. The total population was 49 respondents.

Sample and Sampling Techniques

Population sampling was used in the study because the respondents were few in numbers and could easily be reached in the community.

Data Gathering Procedures

1. A self-made instrument was used in the study. A pilot test was run on 30 respondents on August 10, 2023, and these 30 respondents were excluded from the final survey. The instrument's reliability, using Cronbach Alpha, was 0.85, and the validity of all the statements was significant at 0.05 level using Pearson Moment of Correlation.
2. The final survey was administered to 49 respondents on August 16, 2024, and the data was processed using IBM SPSS version 21 software.

Statistical Analysis of the Data

1. Frequency and Percentage were used to compute the demographic profile of the respondents, which were age, gender, and years of residency in the community.
2. Measures of Central Tendency were used to compute the assessment levels of the respondents toward flood risk perception, preparedness, and awareness. The mean and standard deviation were presented in the study.
3. One-way analysis of variance was used to compute the inferential problems of whether to reject or accept the null hypothesis, particularly the significant differences between ages and length of residency in the community and the assessment level of the respondents toward the different flood risks.
4. A T-test for Independent Samples was used to compute the inferential problems of whether to reject or accept the null hypothesis, particularly the significant differences between gender and the assessment level of the respondents toward the different flood risks.

5. Cronbach's Alpha was used to test the instrument's reliability.
6. Pearson Moment of Correlation was used to test the validity of the statements of the instrument.

Results and Discussion

Table 1: Demographic Profile of the Respondents

Age	Frequency	Percent
20 – 29 years old	1	2.0
30 -39 years old	5	10.2
40-49 years old *	16	32.7
50-59 years old *	16	32.7
60 years old and above	11	22.4
Total	49	100.0

*Legend: * = highest percent*

Gender	Frequency	Percent
Male *	43	87.8
Female	6	12.2
Total	49	100.0

*Legend: * = highest percent*

Years of Residency	Frequency	Percent
6 – 8 years	1	2.0
12 -15 years	1	2.0
16-20 years	1	2.0
21-25 years	6	12.2
26-30 years	10	20.4
31 years and above *	30	61.2
Total	49	100.0

*Legend: * = highest percent*

The ages of the respondents ranged from 40 years old to 59 years old, and the majority were male gender. The status of ownership who participated in the survey were homeowners and had resided there for over 31 years. According to Cherry (2024), middle adulthood is those who are between 40 and 65 years old, and based on Erick Erickson's theories of development, middle adulthood belongs to stage seven (7), which is characterized by generativity versus stagnation. The author defined generativity as sympathetic to others, building and doing things that improve the world. At the same time, stagnation refers to the negligence or disconnection in finding a way to contribute to the community or society as a whole. The literature is helpful to the study because it can associate the majority of the respondents' ages to be generative. After all, they are concerned with the situation the community frequently faces whenever there is moderate to heavy rainfall. This group is expecting some areas of improvement in their current situation. Based on the 2020 Census of Population and Housing by the Philippine Statistics Office (2022) the total population in the Philippines is 109,035,343, and there were 55.02 million males and 53.65 females. In addition, the sex ratio was 103 males per 100 females in 2020. This literature is helpful in the study because it shows the reason why the respondents in the study were mostly male.

Torunczyk-Ruiz, S. and Martinovic, B. (2020) studied the pros and cons of individuals residing in the community for a long time. The study revealed that people staying long in the community feel more attached to the neighborhood, earn entitlement in decision-making, and promote local participation. This literature is essential because most respondents have resided in the community for over 31 years and were legitimate homeowners. They are entitled and attached to voice out continuous improvement and betterment of the community.

2. Assessment Levels of the Community Toward Flood Risk perception, Flood Risk Preparedness, and Flood Risk Awareness

A. Flood Risk Perception:

Table 2: Flood Risk Perception Statements One and Two

STATEMENTS 1 & 2	Mean	Standard Deviation	Interpretation
Are you aware that floods will quickly occur in the area when it rains and pours for more than 30 minutes?	4.00	0.000	Extremely aware
Have you personally experienced localized flooding near your home?"	4.00	0.000	Very frequently

Legend: Extremely aware/Very frequent = 4.00 – 3.00; Aware/Frequently = 2.99- 2.00; Somewhat aware/Rarely = 1.99- 1.00; Not aware/ Never = 1.00- 0.99

Are you aware that floods will quickly occur in the area when it rains and pours for more than 30 minutes?	Frequency	Percent
Extremely aware	49	100
Total	49	
Have you personally experienced localized flooding near your home?"	Frequency	Percent
Very frequent	49	100
Total	49	100.0

The community is extremely aware (100 %) that floods will quickly occur in the area when it rains and pours for more than 30 minutes (mean of 4.00 and standard deviation of 0.000) and very frequently (100 %) experienced localized flooding near their homes (mean of 4.00 and standard deviation of 0.000. This unexpected flooding eventually threatened vehicles parked on the street and went unnoticed. Flood waters can easily penetrate residential houses, destroying furniture and appliances, which is stressful and can cause health problems such as leptospirosis when feet are submerged in flood waters.

According to Hong et al. (2020), the Philippines is enormously at risk of the impacts of climate change, including increased frequency of risky weather events such as hefty rainfall. Life-threatening rain events have brought about landslides and floods, with a loss of life and the weakening of infrastructure.

Table 3: Flood Risk Perception Statement Number Three:

STATEMENT # 3	Mean	Standard Deviation	Interpretation
Do you agree that a retention pond or retention basin (which stores excessive runoff water) can help mitigate the risk of flooding?	3.632	0.487	Strongly and highly agree.

Legend: Strongly & highly agree = 4.00 – 3.00; Highly agree = 2.99- 2.00; Agree = 1.99- 1.00; Strongly & highly disagree = 1.00- 0.99

	Frequency	Percent
Strongly highly disagree	18	37
Strongly and highly agree	31	63.3
Total	49	100.0

The respondents strongly and highly agree (63.3 %) that a retention pond or basin (which stores excessive runoff water) can help mitigate the risk of flooding (mean of 3.6.3 and standard deviation of 0.487). This means the respondents were unanimous in their perceptions that a retention pond can help mitigate the risk of flooding. AAA Paving (2024, May 6) explained that retention ponds are engineering works or unearthed basins to handle surplus stormwater and runoff from urban, agricultural, or industrial areas. The purpose is to collect and store runoff water as a critical buffer to prevent flooding and erosion in the surrounding regions. Through natural and mechanical filtration methods, this engineered basin significantly improves water characteristics by trapping contaminants and deposits.

This literature is essential to the study because the probability of whether a retention pond can be a permanent or a quick-fix solution is still unknown until the City Government of Muntinlupa can conduct a comprehensive assessment of the different vulnerability factors affecting the community and technical study on the cost and benefit of this engineering intervention.

Table 4: Flood Risk Perception Statement Number Four:

STATEMENT # 4	Mean	Standard Deviation	Interpretation
Do you agree that elevating the roads can help mitigate the risk of flooding?	2.89	1.460	Highly agree.

Legend: Strongly & highly agree = 4.00 – 3.00; Highly agree = 2.99- 2.00; Agree = 1.99- 1.00; Strongly & highly disagree = 1.00- 0.99

	Frequency	Percent
Agree	17	35
Strongly and highly agree	32	65.3
Total	49	100.0

The community strongly and highly agrees (65.3 %) that elevating the roads can help mitigate the risk of flooding (mean of 2.89 with a standard deviation of 1.460). The data shows that even though the respondents strongly and highly agree with road elevation as a mitigation measure, it seems unreliable because of the standard deviation value, which is far from the mean score, which means that the respondents were not unanimous in their perceptions. There is an economic risk on the part of the homeowners because of the need to increase the elevation of the house's finished floor line to equal the height of the road elevation.

In the study by De La Pena (2020), she presented different vulnerability factors in solving flooding problems in Metro Manila. These are population density, estimated economic loss to affected individuals, slope, elevation rainfall, and land cover. One of her recommendations was that the government occasionally review the situations of cities and municipalities surrounding the big cities and extend holistic evaluation to countrywide considerations for funds allocation to other provinces and regions.

This literature is relevant to the study because it allows the City Government of Muntinlupa again to assess the different vulnerability factors affecting the community and what engineering solutions are viable in solving the flooding problem in the community.

Table 5: Flood Risk Perception Statement Number Five

STATEMENT # 5	Mean	Standard Deviation	Interpretation
Do you agree that increasing the diameter of the concrete drainage pipe can help mitigate the risk of flooding?	3.30	0.961	Strongly & highly agree.

Legend: Strongly & highly agree = 4.00 – 3.00; Highly agree = 2.99- 2.00; Agree = 1.99- 1.00; Strongly & highly disagree = 1.00- 0.99

	Frequency	Percent
Agree	17	35
Strongly and highly agree	32	65.3
Total	49	100.0

The community strongly and highly agrees (65.3%) that increasing the diameter of the concrete drainage pipe can help mitigate the risk of flooding (mean of 3.30 with a standard deviation of 0.961). The study by Sohn et al. (2020) regarding the effectiveness of drainage systems in mitigating flood losses confirmed that the efficiency of drainage systems depends on facility type and environmental setting.

In addition, it was encouraged that the recovery of wetlands and inclusion of retention ponds in flood-prone areas be part of community development to arrest potential future economic losses. In addition, County Materials Corporation (n.d.) claimed that reinforced concrete pipes (RCP) in drainage systems are sustainable and cost-efficient for stormwater or sewer systems because of their reliability and durability.

Both literature are essential in the study because increasing the diameter of the existing concrete pipes in the community is only a bullet-proof alternative to solving the flooding problem if a thorough survey of the drainage system facility type and environmental setting is done. In addition, including a retention pond in the master plan of the City Government of Muntinlupa might be a probable option based on the literature review read by the researcher.

Table 6: Flood Risk Perception Statement Number Six

STATEMENT # 6	Mean	Standard Deviation	Interpretation
Do you agree that regular drainage cleaning and de-clogging can help mitigate the risk of flooding?	3.30	0.961	Strongly & highly agree.

Legend: Strongly & highly agree = 4.00 – 3.00; Highly agree = 2.99- 2.00; Agree = 1.99- 1.00; Strongly & highly disagree = 1.00- 0.99

	Frequency	Percent
Agree	17	35
Strongly and highly agree	32	65.3
Total	30	100.0

The community strongly and highly agrees (65.3 %) that regular drainage cleaning and de-clogging can help mitigate the risk of flooding (mean of 3.30 with a standard deviation of 0.961). This means the respondents were in harmony with their understanding that regular cleaning or de-clogging can lessen the risk of flooding. JBG (2024) announced that the Honorable Mayor of Muntinlupa City, Ruffy Biazon, ordered the Engineering Department to exaggerate the cleaning of drainages to avoid city flooding in preparation for the La Nina phenomenon. In addition, Lim (2023) mentioned that the City of Muntinlupa also launched the PAMANANG NAKAKAPROUD last 2023, encouraging subdivisions in a neighborhood competition for the cleanest and most orderly subdivision in Muntinlupa aim to promote cleanliness and orderliness in the communities.

DC Merret & Company Limited (n.d.) concluded that drainage systems have pros and cons. The advantages are that it can prevent flooding, enhance sanitation, and improve sustainable land use. On the other hand, the disadvantages are possible expenses, environmental impact, and technical challenges/limitations. Diligent planning, environmentally friendly best practices, and regular maintenance are required to balance the pros and cons.

The literature mentioned is relevant to the study because it asserts that the City Government of Muntinlupa is doing due diligence and empowering communities to do their share in preventing city flooding. On the other hand, it also informed the researcher that planning, regular maintenance, and environmentally friendly best practices are needed to balance the advantages and disadvantages of a drainage system.

Table 7: Flood Risk Perception Statement Number Seven

STATEMENT # 7	Mean	Std. Deviation	Interpretation
How concerned are you about the ecological impact of flood management practices?"	3.85	0.500	Extremely concerned

Legend: Extremely concerned = 4.00 – 3.00; Very concerned = 2.99- 2.00; Slightly concerned = 1.99- 1.00; Not concerned = 1.00- 0.99

	Frequency	Percent
Not concerned	1	2.0
Very Concerned	4	8.0
Extremely Concerned	44	90
Total	49	100.0

The community was extremely concerned (90%) about the ecological impact of flood management practices (mean of 3.85 with a standard deviation of 0.500). Flood management practices can have

significant environmental influences, both positive and negative (Sarma J. & Rajkhowa S., 2021). Green infrastructure, floodplain restoration, and wetland conservation are examples of the advantages of ecological impact. The disadvantages are river channelization, dams, and levees.

The United States Environmental Protection Agency (8 April 2024) defined green infrastructure as a methodology that filters and absorbs stormwater where it falls, such as the use of plant or soil systems, permeable pavement or other porous surfaces or substrates, stormwater harvest, and reuse, or landscaping to store, infiltrate, stormwater. National Geographic (n.d.) defined a floodplain as a leveled land adjacent to a river or stream extending from the river's banks to the valley's external edges. In contrast, Wetland Conservation was defined by the Department of Environment and Natural Resources Biodiversity Management Bureau (n.d) as "Ecosystems that may be natural or artificial and are permanently or seasonally saturated or flooded with water that may be static or flowing or any land areas that have waterlogged soil."

The review of different literature is appropriate for the study because of the potential solutions available to reduce the risk of flooding in the community. The challenge is the political will and sincerity of the local government to provide appropriate funding for the improvement project and due diligence in conducting technical and environmental assessments for the endeavor.

Synthesis Flood Risk Perception

The community knew of the sudden and unexpected flooding during heavy rainfall, endangering lives and property. The probability of whether a retention pond, increasing the diameter of the existing reinforced concrete pipes, and or increasing the road elevation can be a permanent or a quick-fix solution is still unknown until the City Government of Muntinlupa can conduct a comprehensive technical and environmental assessment of the different vulnerability factors affecting the community including the drainage system, facility-type, and ecological setting in the community. Many potential engineering solutions are available to reduce the risk of flooding in the community. The challenge is the political will and sincerity of the local government to provide appropriate funding for the improvement project and due diligence in conducting technical and environmental assessments to minimize flood risk in the community.

B. Flood Risk Preparedness

Table 8: Flood Risk Preparedness Statement One

STATEMENT # 1	Mean	Standard. Deviation	Interpretation
Are you aware that the community has flood evacuation plans?	1.79	1.257	Somewhat aware

Legend: Extremely aware = 4.00 – 3.00; Very aware= 2.99- 2.00; Somewhat aware= 1.99- 1.00; No idea = 1.00- 0.99

No Idea	Frequency	Percent

Somewhat aware		34	69.4
Very aware		1	2.0
Extremely aware		4	8.2
	Total	10	20.4
		49	100.0

Based on the frequency and percentage statistics, most respondents have "no idea" that the community has flood evacuation plans (69.4%), and it conflicted with the mean score of 1.79, having an adjectival interpretation of "somewhat aware.'. This can be attributed to the respondents' responses, which were not unanimous because the standard deviation of 1.257 was closer to its mean score. According to Wang Z. et al. (2020), vulnerable communities in urban areas exposed to flooding or other emergencies should prioritize well-timed and protected evacuations of their residents. In addition, The United States Conservation and Food-Prepared Communities (2022) claimed that when communities consider first mitigation programs before a flood, it gives residents more opportunities for safety and security, decreases recovery costs, and reduces harm to the local economy and the environment. The literature above is relevant to the study because it confirms that the affected community does not have flood evacuation plans. If there was within the local barangay unit of Bayanan, the flood evacuation program was not disseminated downline to the community. Furthermore, the community officers should proactively initiate and design their flood evacuation plan in collaboration with the local barangay unit.

Table 9: Flood Risk Preparedness Statement Two

STATEMENT # 2	Mean	Standard Deviation	Interpretation
Do you have an emergency kit preparedness for flood situations?"	2.04	0.575	Very prepared

Legend: Extremely prepared= 4.00 – 3.00; Very prepared = 2.99- 2.00; Somewhat prepared = 1.99- 1.00; Not prepared = 1.00- 0.99

		Frequency	Percent
	Not prepared	6	12.2
	Somewhat prepared	36	73.5
	Very prepared	6	12.2
	Extremely prepared	1	2.0
	Total	49	100.0

The central tendency data interpretation showed that the respondents were "very prepared" (mean of 2.04 and a standard deviation of 0.575), while the frequency count was "somewhat prepared." The inconsistency in their interpretations was attributed to the frequency of respondents (six) who chose the scale of "very prepared" as compared to the 36 respondents who selected "somewhat prepared." The respondents' favorability was "somewhat prepared" regarding their preparedness to have an emergency kit for flood situations. Lumina (2020) explained that an emergency kit is crucial and lifesaving. The items should be placed inside a backpack containing basic supplies such as water, food, battery-powered radio, flashlight, extra batteries, whistle, face masks, duct tape, wrench or pliers, can opener, essential family documents, cellphone with chargers, power bank, personal hygiene, and first aid kit. This literature is relevant to the study because it confirms that having an emergency kit in unwanted situations is essential and life-sustaining, considering that the community assessment regarding having emergency kits was somewhat prepared.

Table 10: Flood Risk Preparedness Statement Three

STATEMENT # 3	Mean	Standard Deviation	Interpretation
Do you have community flood preparedness drills or exercises?	1.26	0.670	Somewhat prepared

	Frequency	Percent
Not Prepared	42	86
Somewhat Prepared	1	2.0
Very Prepared	6	12.2
Total	49	100.0

The mean data interpretation showed that the respondents were "somewhat prepared" (mean of 1.26 and a standard deviation of 0.670), while the frequency count was "not prepared." The inconsistency in their interpretations was attributed to the frequency of respondents (one respondent who chose the scale of "somewhat prepared" as compared to the 42 respondents who selected "not prepared." The respondents' favorability was "unprepared" regarding their readiness to have community flood preparedness drills or exercises.   Gwyne S. (2020) explained that evacuation drills (ED) are methodologies for continuous improvement and evaluation of the dweller's accomplishments in emergency events, while the drawback is the difficulty in evaluating the effectiveness and proof for sustained training benefits. This literature is essential in the study because it asserts that evacuation drills in flood-prone areas are necessary and lifesaving to anticipate future emergencies. Considering that the community has no flood evacuation drills or exercises, they were also unprepared for any flood evacuation drills.

Table 11: Flood Risk Preparedness Statements Four and Five

STATEMENT # 4 & 5	Mean	Standard Deviation	Interpretation
How often do you participate in community flood preparedness drills or exercises?	1.40	0.788	Rarely
Do you know the location of emergency shelters in your area?	1.73	1.16	Somewhat aware

How often do you participate in community flood preparedness drills or exercises?	Frequency	Percent
Never	37	75.5
Rarely	5	10.2
Frequently	6	12.2
Very Frequently	1	2.0
Total	49	100.0
Do you know the location of emergency shelters in your area?	Frequency	Percent
No idea	32	65.3
Somewhat aware	7	14.3
Very aware	1	2.0
Extremely aware	9	18.4
Total	49	100.0

The frequency of participation by the community in flood preparedness drills or exercises manifested an adjectival interpretation of "rarely" (mean of 1.40 with a standard deviation of 0.788). Still, contrary to the frequency data, most respondents "never" participate. This may be accounted for the six respondents who chose "frequently" rather than the five participants who answered "rarely." The overall interpretation of community drill participation was denoted as "never." Burton R. (2020) asserted that the essence of the emergency drill is an exercise scenario of an emergency action plan. It gives opportunities for the stakeholders to anticipate an actual emergency procedure. He further added that two components are

necessary. The first is the risk assessment that will process the emergency action plan to create the drill's emergency procedures. The literature suggests the need to participate in evacuation drills to anticipate emergencies. In reality, no flood evacuation drill ever happened in the community, and, therefore, the community was unprepared and never participated in any exercise.

Next was the location of emergency shelters in the area; most respondents have yet to learn, but some were "somewhat aware" (mean of 1.73 and standard deviation of 1.16) of the location of the emergency shelters. In Barangay Bayanan, Muntinlupa City, the local barangay unit has designated three evacuation areas in strategic places, which were at the Barangay motor pool, Baywalk covered court, and Bayanan Elementary School Unit 1 (Hicap J. 2024).

Table 12: Flood Risk Preparedness Statement Six

STATEMENT # 6	Mean	Standard Deviation	Interpretation
Have you taken steps to elevate or protect your home from flood damage?	2.38	0.758	Significant action
Legend: Comprehensive action = 4.00 – 3.00; Significant action = 2.99- 2.00; Minimal action = 1.99- 1.00; No action taken = 1.00- 0.99			

	Frequency	Percent
No action taken	1	2.0
Minimal Action	35	71.4
Significant Action	6	12.2
Comprehensive Action	7	14.3
Total	49	100.0

The assessment levels of the respondents in taking steps to elevate or protect their houses from flood damage ranges from "significant action" (mean of 2.38 with a standard deviation of 0.758) to "minimal action" (57%). Every homeowner is willing to protect their dwellings. However, this decision is dependent on their economic capacity. Zoleta V. (2022) mentioned that house renovation is expensive and the owner should be sensible in their budget spending. She suggested some cost-saving practices, such as sticking to the budget, early planning, source of funds, identifying cheap sources of materials, do-it-yourself for minor renovations, asking for quotes from different contractors, and communicating the budget to the final contractor. This literature is helpful to the study because the author suggested cost-saving practices in planning, budgeting, forecasting, procurement, and communication in the event of house renovation.

Table 13: Flood Risk Preparedness Statement Seven

STATEMENT # 7	Mean	Standard Deviation	Interpretation
How well-informed are you about flood insurance options?	1.44	0.843	Somewhat aware
Legend: Extremely aware = 4.00 – 3.00; Very aware = 2.99- 2.00; Somewhat aware = 1.99- 1.00; No idea = 1.00- 0.99			

	Frequency	Percent
No Idea	38	78
Very Aware	11	22
Total	49	100.0

The assessment levels of the respondents about flood insurance options range from "somewhat aware" (mean of 1.44 with a standard deviation of 0.843) to 'no idea "(78 %). This means that availing of flood insurance is an investment and a subset of risk management, and the mitigation concept is transferring the risk to the insurance provider, entailing a premium price. The insurance coverage should include the dwellings and our vehicles. In other words, this flood insurance option is the same as doing a house renovation. You are talking about the capacity to pay for the homeowners. Piamonte (2023) explained that the minimum average cost of home insurance ranges from 700 to 3,000 Philippine pesos. Still, insurance costs 10 million Philippine pesos for those who intend to get premium coverage. She recommended that homeowners in flood-prone areas get flood insurance packages for better protection. Furthermore, Autodeal (2021) recommended "Acts of Gods" or "Acts of Nature" for car flood insurance coverage. The literature references are essential because they assert that the insurance options needed by homeowners in flood-prone areas are home and vehicle insurance.

Table 14: Flood Risk Preparedness Statement Eight

STATEMENT # 8	Mean	Standard Deviation	Interpretation
Are you aware of community resources for flood risk reduction?"	1.48	0.892	Somewhat aware
Legend: Extremely aware = 4.00 – 3.00; Very aware = 2.99- 2.00; Somewhat aware = 1.99-1.00; No idea = 1.00- 0.99			

	Frequency	Percent
No Idea	37	75.5
Somewhat Aware	1	2.0
Very Aware	10	20.4
Extremely Aware	1	2.0
Total	49	100.0

The awareness level of the community regarding community resources for flood risk reduction ranges from "somewhat aware" (mean of 1.48 with a standard deviation of 0.892) to "no idea" (75.5 %). The International City/County Management Association (2019) illustrated some examples of community resources that can prepare, mitigate, and respond to flooding in the community. These are the local mitigation planning handbook, green infrastructure guide for water management, stormwater management, flood hazard management planning, FEMA application, podcast, leading-edge research about leadership, and disaster recovery. Guzman, J. (2024) shared with the City Government of Muntinlupa about the construction of the box culvert and 373.45 linear meters of retaining wall in Cupang Muntinlupa City in mitigating the flood impacts on the residences of Cupang Muntinlupa. In addition, Carrasco, C. (2021) highlighted the state-of-the-art disaster resilience mobile learning hub of the City Government of Muntinlupa in improving the community resilience and level of disaster preparedness of Muntinlupa city residents. The literature references are essential in the study because of the different community resources presented locally and internationally on how to mitigate flooding in the area. However, the researcher prays that much attention from the city government will be extended to the selected community in the study.

Table 15: Flood Risk Preparedness Statement Nine

STATEMENT # 9	Mean	Standard Deviation	Interpretation
How likely are you to assist neighbors during a flood event	3.42	0.978	Very likely
Legend: Very likely = 4.00 – 3.00; Likely = 2.99- 2.00; Unlikely = 1.99- 1.00; Very unlikely = 1.00- 0.99			

	Frequency	Percent
Very unlikely	4	8.2
Unlikely	5	10.2
Likely	6	12.2
Very Likely	34	69.4
Total	49	100.0

The likelihood of the community assisting neighbors during a flood range from very likely (mean of 3.42 with a standard deviation of 0.978) to "very likely" (69.4 %). This means that the Filipino trait of compassion toward each other is endearing in the community. Gallimore (2023) mentioned that BPO companies venture into business in the Philippines because of Filipino values and culture. Among one of the values was being helpful and generous people. They help their families and even strangers when needed, especially during calamities. This literature confirmed that in times of need, Filipinos will support and help one another because of these traits and values of being compassionate.

Synthesis:
The community needs a flood evacuation plan, or if there was, the flood evacuation program was not disseminated downline to the community by the local barangay authorities. Furthermore, the community officers should proactively initiate and design a flood evacuation plan in collaboration with the local barangay unit. Each household should be equipped with a vital and life-sustaining emergency kit. Considering that the community has no flood evacuation drills or exercises, this should be required and organized by the community with the help of the local barangay unit because it is a lifesaving measure. The need to participate in evacuation drills is mandatory, and the community should know the different evacuation sites designated by the local barangay unit, which were at the Barangay motor pool, Baywalk covered court, and Bayanan Elementary School Unit One. Future planning, budgeting, forecasting, procurement, and communication are required for house improvement and flood insurance coverage in flood-prone areas. In terms of preparedness, it confirmed that in times of need, Filipinos will support and help one another because of these traits and values of being compassionate.

C. Flood Risk Awareness:
Table 16: Flood Risk Awareness Statement One
STATEMENT # 1	Mean	Standard Deviation	Interpretation
How knowledgeable are you about flood management regulations?	1.63	1.112	Somewhat Knowledgeable

Legend: Extremely Knowledgeable = 4.00 – 3.00; Very Knowledgeable = 2.99- 2.00; Somewhat Knowledgeable = 1.99- 1.00; Not Knowledgeable = 1.00- 0.99

	Frequency	Percent
Not Knowledgeable	36	73.5
Somewhat Knowledgeable	1	2.0
Very Knowledgeable	6	12.2
Extremely Knowledgeable	6	12.2
Total	49	100.0

The community assessment regarding their knowledge about flood management regulations ranged from being "somewhat knowledgeable" (mean of 1.63 with a standard deviation of 1.112) to not knowledgeable (50%). The City Government of Muntinlupa City (2022) has a comprehensive operations and warning division regarding Disaster Resilience and Management. They also have different emergency call assistance for all concerned departments and even the availability of an ambulance service. This literature confirms that

the City Government of Muntinlupa has the capability and readiness to react to disasters and emergencies. The suggestion is to have this information cascaded to all the communities, especially in flood-prone areas, through the effort of the local barangay unit.

Table 17: Flood Risk Awareness Statement Two

STATEMENT # 2	Mean	Standard Deviation	Interpretation
Do you actively seek information about flood risks and preparedness?	2.38	0.785	Frequently

Legend: Always = 4.00 – 3.00; Frequently = 2.99- 2.00; Rarely = 1.99- 1.00; Never = 1.00- 0.99

	Frequency	Percent
Never	3	6.1
Rarely	30	61.2
Frequently	10	20.4
Always	6	12.2
Total	49	100.0

The community assessment regarding actively seeking information about flood risks and preparedness manifested that the respondents were "rarely" searching for information, showing 61.2% with a mean of 2.38 and a standard deviation of 0.785. Glago, F.J.(2021) claimed that society can be aware of a flood risk; however, if it is not terrified of the risk, it will not take any action plan for preparation. There is a positive association between the level of worry awareness and preparedness. A higher level of worry is more likely to result in a higher level of awareness and preparedness. The literature is viable in the study because it asserted that if the community worries more about the risk of flooding, their awareness and preparedness will be higher.

Table 18: Flood Risk Awareness Statement Three

STATEMENT # 3	Mean	Standard Deviation	Interpretation
How well-informed are you about the effort from the local barangay unit, such as cleaning the drainage system in your area?	1.71	1.00	Somewhat informed

Legend: Extremely Informed s = 4.00 – 3.00; Very Informed = 2.99- 2.00; Somewhat Informed = 1.99- 1.00; Not Informed = 1.00- 0.99

	Frequency	Percent
Not Informed	32	65.3
Very Informed	16	32.7
Extremely Informed	1	2.0
Total	49	100.0

The assessment level regarding how well-informed the community is about the effort from the local barangay unit, such as cleaning the drainage system, ranged from being "somewhat informed" (mean of 1.71 with a standard deviation of 1.00) to "not informed"(65.3%). Team Orange (2024) reported that Barangay Bayanan Muntinlupa City had adopted the "Mobile Materials Recovery Facility" turned over by the Metropolitan Manila Development Authority (MMDA), and for the past two years, it has led to significant achievements. However, the challenge was the initial resistance to the new waste segregation policies. Still, through continuous education and community involvement, the local barangay unit successfully increased the participation of the community. This literature is essential because it confirms that a constant information dissemination drive is critical to any campaign beneficial to the community. Likewise, the local

barangay unit has a significant role in informing the community about this mobile material recovery facility to reduce waste and improve the flow of flood water in the mainstream.

Table 19: Flood Risk Awareness Statement Four

STATEMENT # 4	Mean	Standard Deviation	Interpretation
How often do you check flood forecasts and alerts?	3.06	0.591	Very Frequently

Legend: Very Frequently = 4.00 – 3.00; Frequently = 2.99- 2.00; Rarely = 1.99- 1.00; Never = 1.00- 0.99

		Frequency	Percent
	Never	1	2.0
	Rarely	4	8.2
	Frequently	35	71.4
	Very Frequently	9	18.4
	Total	49	100.0

The community assessment regarding their frequency of checking flood forecasts and alerts manifested that the respondents were "frequently" monitoring the situations, showing 71.4% with a mean of 3.06 and a standard deviation of 0.591. There are many sources of information about flood forecasts and alerts in Muntinlupa and nationwide, such as PAGASA Weather Bureau, AccuWeather, The Weather Channel, and leading broadcast companies. Zoleta (2023) reminded us in her article about what to do before a typhoon. One of her recommendations was to monitor weather reports and not ignore rainfall warning alerts through text. The literature is relevant because monitoring weather reports and not ignoring those alerts allows us to be aware and prepared if the situation worsens.

Synthesis:

The City Government of Muntinlupa has the capability and readiness to react to disasters and emergencies. Information should be disseminated to all community levels through collaboration with the local barangay unit. In addition, if the community worries more about the risk of flooding, their awareness and preparedness level will also increase. A constant information dissemination drive is critical to any campaign that benefits the community. Likewise, the local barangay unit has a significant role in informing the community about this mobile material recovery facility to reduce waste and improve the flow of flood water in the mainstream. Furthermore, monitoring weather reports and not ignoring those alerts allows us to be aware and prepared if the situation worsens.

3. Significant Differences between Age and Flood Risk Perception, Preparedness, and Awareness.

Table 20. Age and Flood Risk Perception, Preparedness, and Awareness.

1. AGE

ANOVA					
Flood Perception					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.473	4	.618	2.403	0.064
Within Groups	11.323	44	.257		
Total	13.796	48			

ANOVA					
Flood Preparedness					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.755	4	.689	1.804	0.145
Within Groups	16.801	44	.382		
Total	19.556	48			
ANOVA					
Flood Awareness					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.262	4	.565	1.364	0.262
Within Groups	18.236	44	.414		
Total	20.497	48			

Table 20 is about whether there were significant differences between the respondents' age and flood risk perception, preparedness, and awareness. The inferential statistics using One-way analysis of variance showed there were no statistically significant differences between the group means (F value of 2.403, 1.804, and 1.364, respectively) with a degree of freedom value of 4 for between groups and a degrees of freedom value of 44 for within groups, with probability values of 0.064, 0.145 and, 0.145 which were not significant with an alpha level of 0.05. This suggests that flood risk perception, preparedness, and awareness did not substantially affect the respondents' age. In addition, we reject the null hypothesis and accept the alternative hypothesis.

Table 21. Inferential Statistics for Significant Differences between Years of Residency and Flood Risk Perception, Preparedness, and Awareness.

2. Years of Residency

ANOVA					
Flood Perception					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.220	5	.444	1.649	0.168
Within Groups	11.576	43	.269		
Total	13.796	48			

*Legend: * = Significant at 0.05 level*

ANOVA					
Flood Preparedness					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1.969	5	.394	0.963	0.451
Within Groups	17.587	43	.409		
Total	19.556	48			

ANOVA					
Flood Awareness					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1.087	5	.217	0.482	0.788
Within Groups	19.410	43	.451		
Total	20.497	48			

Table 21 concerns whether significant differences existed between the respondents' years of residency in the community and flood risk perception, preparedness, and awareness. The inferential statistics using One-way analysis of variance showed there were no statistically significant differences between the group means (F value of 1.649, 0.963, and 0.482, respectively) with a degree of freedom value of 5 for between groups and a degrees of freedom value of 43 for within groups, with probability values of 0.168, 0.451 and, 0.788 which were not significant with an alpha level of 0.05. This suggests that flood risk perception, preparedness, and awareness did not substantially affect the respondents' community residency years. In addition, we reject the null hypothesis and accept the alternative hypothesis.

4. **Significant Differences between Gender and Flood Risk Preparedness**

Table 22: **Differences between Gender and Flood Risk Preparedness**

Variable	Gender	Mean	Standard Deviation	Mean Difference	T value	Sig
Do you have community flood preparedness drills or exercises?	Male	1.8605	1.30167			
	Female	1.3333	.81650	0.30233	2.799	.008*
Do you know the location of emergency shelters in your area	Male	1.3023	.70828			
	Female	1.0000	.00000	0.64729	2.591	.017*
How well-informed are you about flood insurance options	Male	1.8140	1.21999			
	Female	1.1667	.40825	0.51163	3.800	.000*
Are you aware of community resources for flood risk reduction?"	Male	1.5116	.88296			
	Female	1.0000	.00000	0.55814	3.920	.000*

In the T-test for independent samples between the gender and the assessment levels regarding flood risk preparedness of the respondents, four variables were found with significant differences. Surprisingly, the variables were" *community flood preparedness drills or exercises*" followed by "*location of emergency shelters in the area,*" then "*flood insurance options,*" and "community resources for flood risk reduction," respectively. The t-values of 0.30233, 0.64729, 0.51163, and 0.55814, respectively, with the corresponding probability values of 0.008, .017, .000, and 0.000, were significant at alpha 0.05. The mean difference of 0.30233, 0.64729, 0.51163, and 0.55814 favored the male gender. We can accept the null hypothesis and reject the alternative hypothesis. This means that there was sufficient sample evidence to prove that the male respondents were somewhat prepared for flood drills or exercise, slightly aware of the location of emergency shelters, somewhat mindful of the option of flood insurance, and slightly aware of community resources for flood risk reduction that their female counterparts.

According to Brown G.D. et al. (2021), the gender coefficient is strongly associated depending on the risk involved. This means that the female gender positively impacts involuntary risk more than the male

one, which means that the female gender tends to accept the consequences of flooding the community since they have already lived there for more than 31 years. While the male gender might not seem in conformance with involuntary risk, that was why the male gender was somewhat prepared, aware, and mindful of flood drills, the location of emergency shelters, flood insurance, and community resources for flood risk reduction.

Table 23: **Significant Differences between Gender and Flood Risk Awareness**

Variable	Gender	Mean	Standard Deviation	Mean Difference	T value	Sig
How knowledgeable are you about flood management regulations?"	Male	1.7209	1.16139			
	Female	1.0000	.00000	0.72093	4.070	0.000*
Do you actively seek information about flood risks and preparedness?"	Male	2.4419	.82527			
	Female	2.0000	.00000	0.44186	3.511	.0001*
How well-informed are you about the effort from the local barangay unit, such as cleaning the drainage system in your area?	Male	1.8140	1.02947			
	Female	1.0000	.00000	0.81395	5.185	0.000*

*Legend: * = Significant at 0.05 level*

In the T-test for independent samples between the gender and the assessment levels regarding flood risk awareness of the respondents, three variables were found with significant differences. Amazingly, the variables were" *knowledgeable about flood management regulations,*" followed by "*seeking information about flood risks and preparedness,*" and then "*well informed about the activity of local barangay unit regarding cleaning of the drainage system in the area,*" respectively. The t-values of 4.070, 3.511, and 5.185, respectively, with the corresponding probability values of 0.000, .0001, and 0.000, were significant at alpha 0.05. The mean difference of 0.72093, 0.44186, and 0.81395 favored the male gender. We can accept the null hypothesis and reject the alternative hypothesis. This means that there was sufficient sample evidence to prove that the male respondents were somewhat knowledgeable about flood management regulations, frequently seeking information about flood risks and preparedness, and slightly informed about the efforts of the local barangay in cleaning the drainage system than their female counterparts.

Conclusion:
The City of Muntinlupa should conduct a comprehensive administrative, technical, and environmental assessment of the different vulnerability factors, including the drainage system, facility type, and ecological setting facing the selected areas in the community. Many potential engineering solutions are available to reduce the risk of flooding in the community, subject to the result of their assessment, budget allocation, and excellent and honest governance. The community should have flood evacuation drills; all stakeholders should require and organize these. Participation in evacuation drills should be mandatory, and the community should know the different evacuation sites designated by the local barangay unit. Information should be disseminated to all community levels through collaboration with the local barangay unit, including the mobile material recovery facility.

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Conflict Of Interest

The author declares that there is no conflict of interest regarding the submission of this manuscript. In addition, the author has observed ethical issues, including plagiarism, informed consent, misconduct, data fabrication and falsification, double publication and submission, and redundancy.

Abbreviations

Brgy.	Barangay
D.E.N.R.	Department of Environmental and Natural Resources
D.O.S.T.	Department of Science and Technology
Sig	Significant
M.R.F.	Material Recovery Facility
N.G.O.	Non-governmental office
R.A.	Republic act

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