Exploring Travel Patterns of Mobility of Care in Guiuan, Eastern Samar: Assessment of Gender and Sociodemographic Factors Using Spatial Analysis

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Abstract: This paper explores the lesser-known area of care-related mobility patterns in Guiuan, Eastern Samar, focusing on gender and sociodemographic factors. To fill this gap, the study introduces "Mobility of Care" as a category and sets three objectives: 1) to determine care-related travel's proportion compared to overall mobility, 2) to perform descriptive analysis of travel patterns, and 3) to explore the spatial distribution of care-related travel using spatial analytical techniques, such as Global Moran's I, Anselin Local Moran's I, and Grouping Analysis. Utilizing a usable sample of 357 adults, the study reveals that care-related travel constitutes 49% of Guiuan's trips – even exceeding work-related travel. Through spatial analysis, the paper was able to establish the distribution of care-related trips, identify distinct clusters and traveler types, and uncover spatial differences, which were critical in identifying target strategies to enhance transport services, while advocating for a comprehensive approach that recognizes gender dynamics and spatial considerations.

Keywords: Mobility of Care, travel patterns, gender, spatial analysis, spatial autocorrelation, grouping analysis.

1. INTRODUCTION

The concept of mobility, encompassing the daily practice of spatial and temporal movement, lies at the heart of everyday life organization. Unraveling the intricate dynamics that dictate the movement of people, objects, and ideas – addressing the "who, what, where, when, and why" – is paramount for the advancement of urban and transportation studies (Wang, 2012). This understanding is further nuanced by the realization that travel needs are far from uniform, with a tapestry of social, economic, structural, and cultural factors shaping the spatiotemporal experiences of individuals (Jirón et al., 2010; Jirón et al., 2020; Vecchio, 2020). Notably, the impact of gender on travel preferences has gained prominence in recent times, challenging the traditional gender-neutral approach prevalent in transportation planning (Larsson, 2006).

Central to this discourse is the introduction of the "Mobility of Care" concept within the realm of transportation planning. This conceptual framework serves as a compass for recognizing, quantifying, revealing, valuing, and accurately accounting for the travel intrinsic to caregiving and home-related tasks, essential for the maintenance of life's rhythm (Sánchez de Madariaga, 2013). The canvas of these predominantly unpaid endeavors involves navigating specific city locations at specific times, utilizing available transportation systems, while considering aspects like cost, comfort, and safety. Crucially, these activities must coalesce

harmoniously with paid employment commitments, adding layers of complexity to the journey (Larracilla Razo, 2021; Sánchez de Madariaga & Zucchini, 2019).

In this context, researchers have critically examined prevailing biases evident in data collection, analysis methodologies, policy frameworks, and urban planning endeavors. A recurring inclination emerges among decision-makers to channel investments into tangible infrastructures that spur economic growth within the productive sphere. In contrast, the essential support needed for care travel – a spectrum of daily practices that enrich individual well-being, encompassing household management, social interactions, and psychological health – remains relatively overlooked (Gabauer et al., 2021; Jang et al., 2022; Sánchez de Madariaga, 2013). Noteworthy is the identification of care work as a pivotal driver of female travel, an observation underscored across multiple studies (Jirón & Gómez, 2018; Sánchez de Madariaga & Zucchini, 2020; Soto-Villagrán, 2022).

Undeniably, the introduction of the "Mobility of Care" concept represents a paradigm shift in transportation planning. It proffers a more holistic lens with which to view, analyze, and prepare for the diverse travel needs intrinsic to modern society (Olivieri & Fageda, 2021; Sánchez de Madariaga & Zucchini, 2019). Yet, despite the urgency and importance, the lion's share of scholarly attention has been cornered by predominantly Western contexts. There exists a compelling need for research that encompasses a diverse range of socio-cultural contexts, introducing other parts of the world into the conversation.

This paper argues that the "Mobility of Care" concept, far from being an esoteric subject of academic debate, directly impacts the quality of life for many families, communities, and societies. This perspective takes an expanded view on shaping policies and plans to cater equitably to diverse travel needs, particularly those related to care. This not only signals a fundamental shift in understanding transportation but is also critical in fostering societal well-being.

The inclusion of the Philippines in this discourse is particularly noteworthy, introducing otherwise overlooked socio-economic and geographical contexts. Insights from the Philippines, specifically Guiuan, Eastern Samar, offer a unique lens within the broader scope of "Mobility of Care" research. Guiuan provides an opportunity to explore care trips in a city with a different hierarchy than the primary focus areas of metropolitan capitals. The city embodies a clear vision of developing inclusive, adequate, and accessible transportation systems prioritizing safety. Additionally, the unique geographic landscape of Guiuan offers a distinct perspective on the way individuals strategize their movement across an island-based city for numerous activities.

This paper steps into this discourse as a beacon, shedding light on the nascent field of mobility of care through an exploratory analysis in Guiuan, Eastern Samar. By unearthing the significance of care activities within transportation planning, the research underscores “Mobility of Care” as a linchpin influencing travel patterns and gender dynamics. Through this pursuit, the study positions itself as a critical contributor to the growing body of knowledge, simultaneously setting the groundwork for more inclusive and thoughtful transportation policies.

2. LITERATURE REVIEW

2.1 The Relevance of Care

The definition of care remains multifaceted and lacks unanimous agreement. Conceptually, care is recognized as a form of labor with an emphasis on reciprocal relationships, highlighting its embodiment within the interactions between caregivers and recipients (Gabauer et al., 2021). It

encompasses daily practices that rejuvenate both physical and mental well-being, encompassing household management, social interactions, and psychological support (Raghuram et al., 2009; UN Women & ECLAC, 2018). Care encapsulates not just actions and interactions, but also their spatial and mobile dimensions, tightly woven into notions of place and movement (Gabauer et al., 2021; Raghuram et al., 2009).

Urban planning traditionally adheres to a binary perspective, categorizing spaces as either public-productive or private-reproductive, thereby constraining daily life (Larracilla Razo, 2021; Valdivia, 2018). Viewing care as an active practice with mobility potential enables its inclusion in public spaces, transcending domestic confines and unfolding as dynamic actions in the urban fabric (Soto-Villagrán, 2022). Neglecting to integrate care into urban planning leads to environments ill-equipped to accommodate these vital activities, ultimately diminishing the quality of life for those involved (Valdivia, 2018).

Introduced by Inés Sánchez de Madariaga in 2009, the "Mobility of Care" concept offers a framework for acknowledging, quantifying, and valuing travel associated with caregiving and domestic responsibilities, essential for life's sustenance. This encompasses escorting others, that is, older and younger persons who cannot move by themselves, to school, to sports, to other extra-curricular activities; shopping for daily living; household maintenance, organization and administrative errands; and visits to take care of sick or older relatives (Sánchez de Madariaga, 2013).

2.2 Care Travelers: Who is doing care?

Insights from care-related travel and research on travel patterns reveal nuanced distinctions in women's mobility compared to men's (Larsson, 2006; Law, 1999; Olivieri & Fageda, 2021). Women predominantly undertake care-related trips, characterized by diverse goals, complex routes, off-peak timing, shorter distances near home, and companionship with dependents (Jaimurzina et al., 2017; Ng & Acker, 2018). In contrast, men's travel centers around work, covering varied distances, often circular paths, with fewer companions and minimal baggage (Hidayati et al., 2020; Plyushteva & Schwanen, 2018). Historically rooted responsibilities account for these variations (Plyushteva & Schwanen, 2018; Sánchez de Madariaga, 2013).

Identifying the characteristics of those who provide care enriches our understanding of the diversity inherent in care mobility (Soto-Villagrán, 2022). Such variables may highlight barriers impeding growth and access to opportunities in the urban context (CIVITAS WIKI, 2020; Larracilla Razo, 2021).

2.3 Spatiality of Care

The narrow confinement of care within private spheres has hindered its integration into discussions of urban justice and inhibited its transformative potential (Raghuram et al., 2009). As a spatial manifestation, care transcends boundaries, flowing through urban networks and contemporary landscapes (Gabauer et al., 2021; Plyushteva & Schwanen, 2018).

A rising focus within the scientific community centers on applying spatial statistics and Geographic Information Systems (GIS) for data analysis (Wang, 2012). Spatial autocorrelation analysis, proven valuable in diverse domains, informs travel patterns and interactions. This technique identifies trends, hidden patterns, and clusters aiding the comprehension of travel dynamics and influencing factors (Perotti, n.d.; Plyushteva & Schwanen, 2018; Vich, 2019)

The significance of spatial analysis permeates sectors, supporting strategy development and informed decision-making (Cameña & Castro, 2017; Encarnacion et al., 2023; Stankov et al., 2017). Despite GIS applications focusing on data collection and visualization, their

untapped potential in describing intricate travel patterns, particularly in care-related contexts, remains a frontier to explore.

2.4 Measuring Mobility of Care

Another challenge for understanding "Mobility of Care" is the current data collection and analysis practices, which demonstrates gender bias in the way in which they gather, interpret, analyze and visually represent data (Sánchez de Madariaga & Zucchini, 2019).

The current surveys of origin-destination, commonly used for travel patterns analysis worldwide, undermine care due to their fixed questions and structure. For instance, short trips on foot of less than 1 km or 15 min and chained trips are excluded; and trips related to care are hidden under other headings such as visiting, strolling, leisure, escorting or others. This redistribution under many small categories, together with the significant number of trips not counted, leads to the underquantification, undervaluation and invisibility of travel related to care (Jaimurzina et al., 2017; Larracilla Razo, 2021; Sánchez de Madariaga & Zucchini, 2019).

Sánchez de Madariaga (2019) recommends for future research, that quantitative analyses must be designed carefully, looking to avoid potential gender biases that can occur at any stage during the process, from the early stages of designing a survey, to the implementation stage, to the analysis of results and the graphical representation of results. Quantitative analyses should include all trips, the means of transport, times and purposes that are at the basis of each trip.

3. METHODS

3.1 Study Area

Guiuan is a municipality nestled at the southernmost tip of Samar Island in the Province of Eastern Samar. Its vicinity is bordered by Mercedes to the north and west, the Pacific Ocean to the east, and the Surigao Strait to the south. This scenic municipality encompasses 175.49 sq. km of land, a 160 km shoreline, and 3,138.97 sq. km of municipal waters.

Comprising 60 barangays, 19 of which are on islands, Guiuan blends coastal charm with an urban core comprising 16 barangays, including Poblacion and adjacent areas like Hollywood, Campoyong, Lupok, and Salug. Accessibility to Guiuan occurs through air, sea, and land routes. While Guiuan has its own airport, access is primarily via Tacloban's Daniel Z. Romualdez Airport, situated 157 km away.

The Guiuan Integrated Transport Terminal (GITT) is pivotal for land and sea travel, spanning 1.17 hectares and catering to diverse modes of transportation: buses, jeepneys, tricycles, pedicabs, delivery vans, and passenger boats. Tricycles dominate local transit with three routes, while jeepneys serve the Sulangan route, and vans connect to Borongan and Tacloban.

Guiuan's selection as a study site stems from distinct factors. Firstly, it offers an opportunity to examine care travel in a non-metropolitan context, diverging from capital-centric studies. Secondly, the municipality showcases an explicit commitment to fostering inclusive transport systems prioritizing safety. Lastly, Guiuan's archipelagic configuration, symbolic of Southeast Asia, promises unique insights into travel patterns and strategies amidst island dynamics, shaping a distinctive backdrop for exploration.

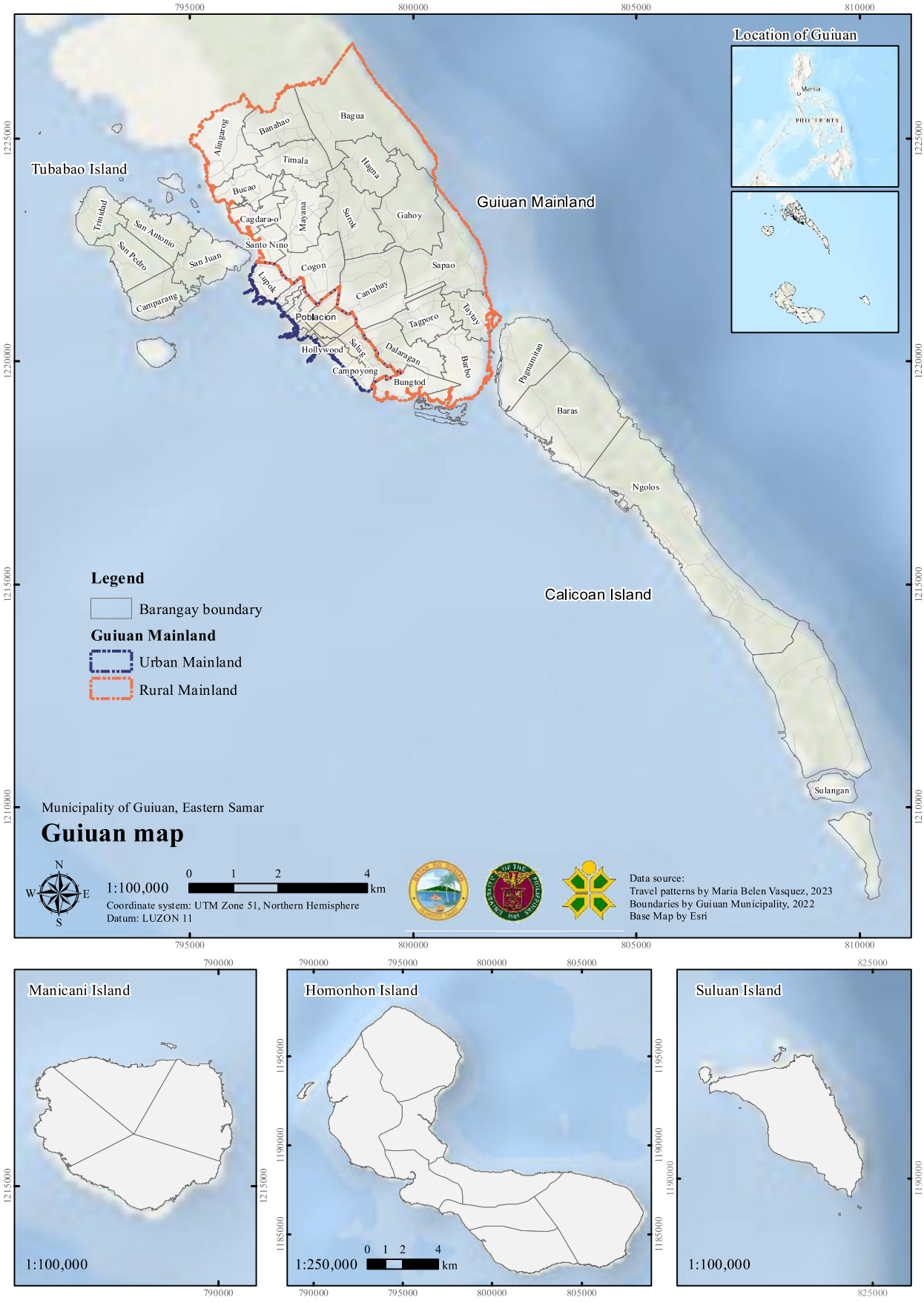

Figure 1: Guiuan, Easter Samar, The Philippines

3.2 Research Framework

Figure 2 presents the conceptual framework used in this study. It aims to shed light on mobility of care in the context of the Philippines and attempts to address the existing bias in data collection and analysis practices, which have often underestimated the importance of care-related travel.

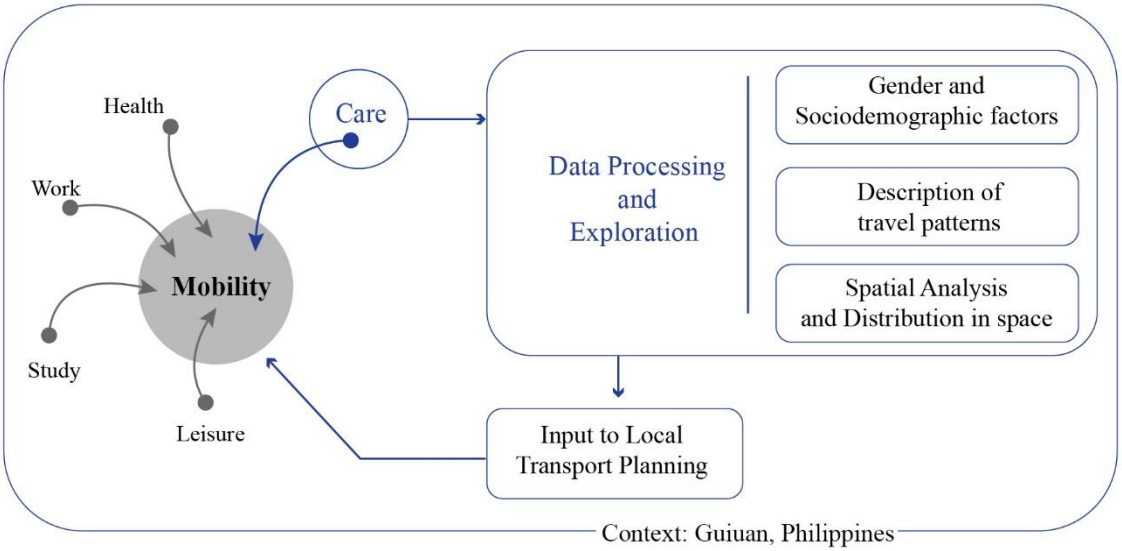

Figure 2: Conceptual framework

3.3 Sample

The study population under analysis is comprised of adult travelers, encompassing both men and women aged between 18 and 64 years. This age range was selected based on existing research, which indicated that individuals within this demographic were more likely to engage in care labor rather than being recipients of care (Ravensbergen et al., 2022; Sánchez de Madariaga & Zucchini, 2019).

Drawing upon the studies conducted by Laracilla Razo and by Sanchez de Madariaga and Zucchini, a non-probabilistic quota sampling method is employed. This method is particularly suited to transportation studies as it permits researchers to specify essential characteristics of the population being examined, leading to insights about travel patterns. Notably, the selected sample size of 362 individuals (181 men and 181 women), maintaining a 5% margin of error and a 95% confidence level, mirrors the approach of Laracilla Razo as well as Sanchez de Madariaga and Zucchini, thereby further validating this study's methodology.

In order to investigate the practices of daily mobility of care, in accordance with the second research objective, a qualitative approach through in-depth interviews with residents was also carried out. The profile of the interviewees was defined based on three main criteria: an adult person, resident of Guiuan, and someone who responded to the common type of care travelers.

3.4 The Survey

The surveyed people filled out a General Survey of Sociodemographic Characteristics and then proceeded to complete a face-to-face second part of the survey, which involved specific answers about the trips they made during the day.

The survey asked about all the trips they made a day before the interview, with special

detail into care-related trips. The starting place was Home, and the day finished at 11.00 P.M. The survey took as a starting point the study “Measuring Mobilities of Care, a Challenge for Transport Agendas” by Sánchez de Madariaga and E. Zucchini in 2019, where both researchers developed a methodology to measure “Mobility of Care”.

3.5 The Interview

This approach involved asking the traveler through the day to observe and record their travel patterns and experiences. The researcher gained information from the traveler and their own appreciation of the barriers during the daily travel for care tasks. This method was intended to provide a more in-depth and nuanced understanding of the travel patterns and experiences of the study population.

3. 6 Ethical considerations

All participants involved in this study willingly agreed to take part and provided their authorization for participation and recording of their stories through an Informed Consent Form handed by the researcher. This form outlined the purpose of the study, detailed the nature of their participation, clarified how their data would be managed, and committed to maintaining the confidentiality of their identities. As a result, all names used in this research have been anonymized and coded to further protect individual participants. All collected data, including interview transcripts and surveys, have been securely stored and are only accessible to members of the research team to ensure data integrity and confidentiality.

This study abides by the ethical guidelines of the University of the Philippines, ensuring the protection of participant rights and adherence to ethical standards throughout the research process.

3.7 Data Analysis

The initial phase of analysis aimed to gain a holistic understanding of the extent and significance of care-related mobility in comparison to overall mobility in Guiuan.

In the second stage of data analysis, the emphasis shifted towards focusing on mobility for the purpose of care and examining the relationships between the selected variables; namely gender, age range, presence of dependents, and civil status, with care-related travel patterns. The analysis encompassed various techniques including descriptive statistics and cross tabulation analysis from the surveys and interviews.

Finally, in the last stage, spatial statistics and analysis were performed to better understand the spatial distribution and concentration of care trips. Global Moran I, Anselin Local Moran I, and Grouping analysis techniques in ArcGIS Desktop 10.8 measured the level of spatial autocorrelation in the distribution and concentration of care trips.

4. RESULTS AND DISCUSSION

A survey was conducted with a total of 364 individuals, including 183 (50.3%) women and 181 (49.7%) men. Two additional participants were included compared to the original sample and 7 surveys were deemed invalid for a total of 357 usable samples. Throughout the survey, a total of 1,374 trips were identified and recorded. In this context, the term "trip" refers to the number of displacements individuals make in a day to reach their main activities and destinations. Both trips to the mainland and to the islands were recorded. The majority of them located in urban

barangays, such as Poblacion (including its 16 divisions).

Out of the total trips registered, 734 trips were undertaken by females, and 640 by males. Notably, women were found to make more journeys per day on average than men, with women making four trips daily on average while men undertake three.

4.1 Travel characteristics

4.1.1 Trip purpose

The study's findings offer compelling evidence of the significance of care in daily mobility. Care travel, encompassing all trips related to caregiving and home-related tasks crucial for life's sustenance, accounted for 49% of overall travel. These results reinforce the claims made in existing literature and emphasize the imperative to acknowledge and consider care mobility in the policy-making processes.

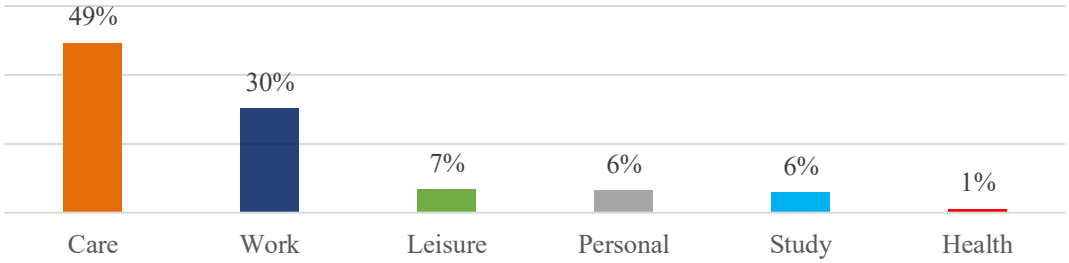

Figure 3: Overall trip purpose in Guiuan

4.1.2 Care Purpose vis-à-vis Work Purpose

A compelling representation of women and men's engagement in care and work trips is provided in Figure 4. Within their respective gender groups, men exhibited similar frequencies of travel for work and caregiving purposes. In contrast, women's travel patterns predominantly revolved around caregiving responsibilities, accounting for approximately two-thirds of their total trips, while work-related journeys represented the next most frequent type of travel.

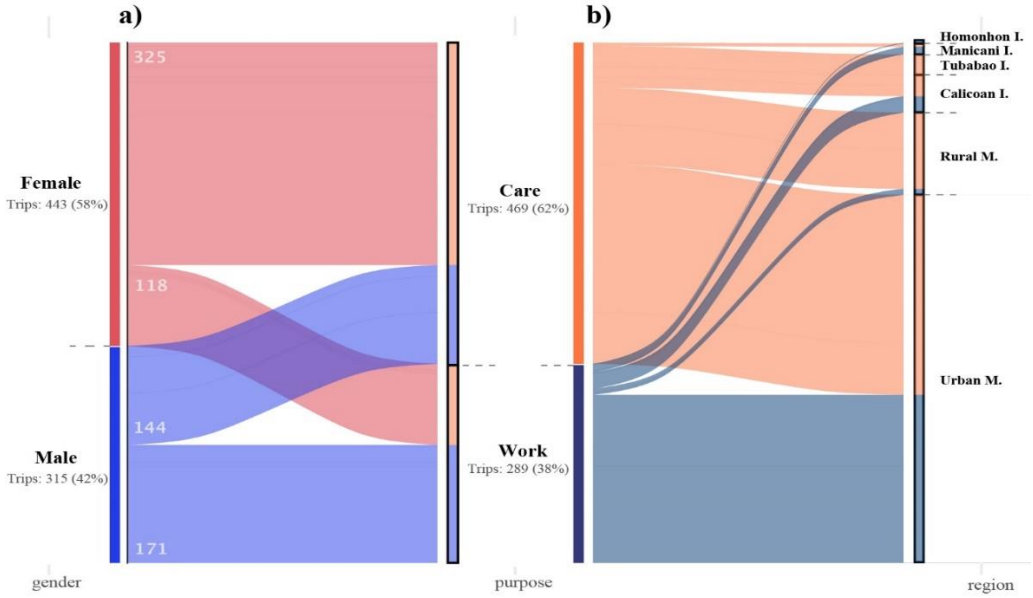

Figure 4: a) Care trips and Work trips by gender, b) Care trips and Work trips by region

Moreover, the regional analysis of care and work trips in Guiuan unveiled distinct patterns of mobility. In the urban and rural mainland areas of Guiuan, there was a relatively equitable distribution between care and work trips, with care trips slightly outnumbering work trips by 5%. However, in almost all the remaining rural areas, specifically the islands of Guiuan, care trips clearly dominated the travel landscape.

4.1.3 Care trip purpose

A subset of trips solely attributed to caregiving activities was extracted from the data collected through the 357 usable samples. The results reveal a total of 469 trips (49%) exclusively devoted to care in 43 barangays, encompassing a range of activities such as escorting older or younger persons who cannot travel independently to school, sports, or other extracurricular activities, shopping for daily living, running household maintenance and organizational tasks, competing administrative errands, and visiting sick or elderly relatives.

Figure 5 further illustrates a clear predominance of care activities related to children, such as pick up and drop off for school (40%) and accompanying them to health appointments (9%). Additionally, the analysis revealed a strong care dynamic for all family members, which is primarily represented by trips associated with daily shopping for household goods as well as activities such as traveling for meal preparation and errands.

Based on the results, elderly care predominantly involved providing support through visiting them, accompanying them to medical appointments, and assisting them in completing administrative tasks such as paying bills or collecting remittances.

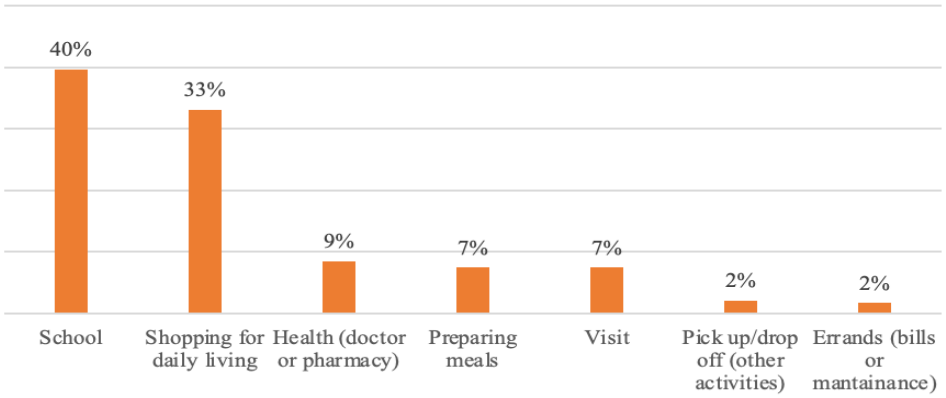

Figure 5: Reported care activities

4.2 Gender in the local context of Guiuan

The local context of Guiuan offers insightful findings regarding gender in the mobility of care based on merging quantitative data from surveys and qualitative narratives from caregivers.

Quantitative findings indicate a significant gender disparity in travel patterns. Women undertake twice as many care-related trips compared to men. This trend seems to reflect societal norms which traditionally allocate caregiving tasks mainly to women. Further differentiation is seen in transportation preferences; men lean towards private motorcycles, while women's choices fluctuate, presumably due safety considerations or physical attributes of certain transport modes.

On the qualitative aspect, interviews with caregivers echo the different experiences while performing care. The multitasking nature of the caregivers' duties resonates with the experiences of most women in Guiuan. Caregiving, primarily assigned to women, carries travel considerations of safety, punctuality, accessibility, and comfort.

Interestingly, a promising societal shift is hinted at - men's increasing participation in care-related tasks - such as escorting children to school. While this might indicate a shift toward shared caregiving responsibilities within households, it begs for deeper analysis to ascertain whether it represents a true societal shift or is simply an anomaly within Guiuan's societal landscape. This engaging review of gender within Guiuan's local context is pivotal to understanding gender-specific influences on the mobility of care, thus offering considerable contributions to the dialogue on gender-responsive transportation planning.

4.3 Global Moran's I: Spatial Autocorrelation

The utilization of the Spatial Autocorrelation method in ArcGIS encompassed an analysis of attribute values, focusing specifically on the number of care trips, within the 43 observed barangays, as indicated in Table 1. Notably, among these barangays, 38 were interconnected through infrastructure and bordered one another, while the remaining 5 were not physically connected. Despite this geographical distinction, the study recognized the inherent interdependency and interrelation between the mainland and the islands, considering the interlinked activities and mobility patterns between these regions.

To establish spatial relationships among the locations, the Inverse Distance conceptualization was selected. This approach considers distance as a pivotal parameter between locations, wherein neighboring features in close proximity hold a greater influence on the computations for a target feature compared to distant features.

Table 1: Care trips distribution based on trip destination

Destination Barangay	Type	Attribute value – Care trips	Destination Barangay	Type	Attribute value – Care trips
Poblacion 6	Urban	100	Poblacion 10	Urban	6
Cogon	Rural	40	Poblacion 2	Urban	5
Poblacion 8	Urban	39	Ngolos	Rural	5
Poblacion 4	Urban	34	Hollywood	Urban	5
San Juan	Rural	22	Santo Nino	Rural	5
Poblacion 11	Urban	22	San Jose	Rural	4
Poblacion 1	Urban	18	Taytay	Rural	4
Sulangan	Rural	17	Poblacion 12	Urban	4
Poblacion 9A	Urban	13	Alingarog	Rural	3
Timala	Rural	11	Bungtod	Rural	2
Salug	Urban	11	Sapao	Rural	2
Poblacion 4A	Urban	10	Barbo	Rural	2
Surok	Rural	9	Cantahay	Rural	2
Pagnamitan	Rural	9	Bucao	Rural	2
Camparang	Rural	8	Buenavista	Rural	1
Gahoy	Rural	8	Lupok	Urban	1
Campoyong	Urban	7	Cagdara-o	Rural	1
Tagporo	Rural	7	Poblacion 3	Urban	1
Poblacion 7	Urban	7	Poblacion 5	Urban	1
Poblacion 9	Urban	7	Bagua	Rural	1
Dalaragan	Rural	6	Bitaugan	Rural	1
Mayana	Rural	6			

The z score of 1.8915 indicates that the observed clustering pattern of care travel in Guiuan is statistically significant. This indicates that the likelihood of such a clustering pattern occurring purely by random chance is less than 10%. As per ArcGIS documentation, a 90%

level of significance is deemed acceptable for this analysis. Therefore, we can infer that the clustering of care trips in Guiuan is not merely a result of random distribution – rather, it suggests a meaningful spatial pattern that opens the door for a detailed examination.

4.4 Anselin Local Moran's I: Clusters and outliers of care trips

Given that the global statistics indicated a significant clustering pattern, this method was then applied to identify clusters and outliers of care trips recorded in the destination barangays within Guiuan. Figure 6 displays the results of the Anselin Local Moran's I analysis, which identified spatial clusters based on the care trips in the study area. The map highlights the barangays in each cluster and revealed that there were six barangays in the high-high cluster and ten in the low-high cluster.

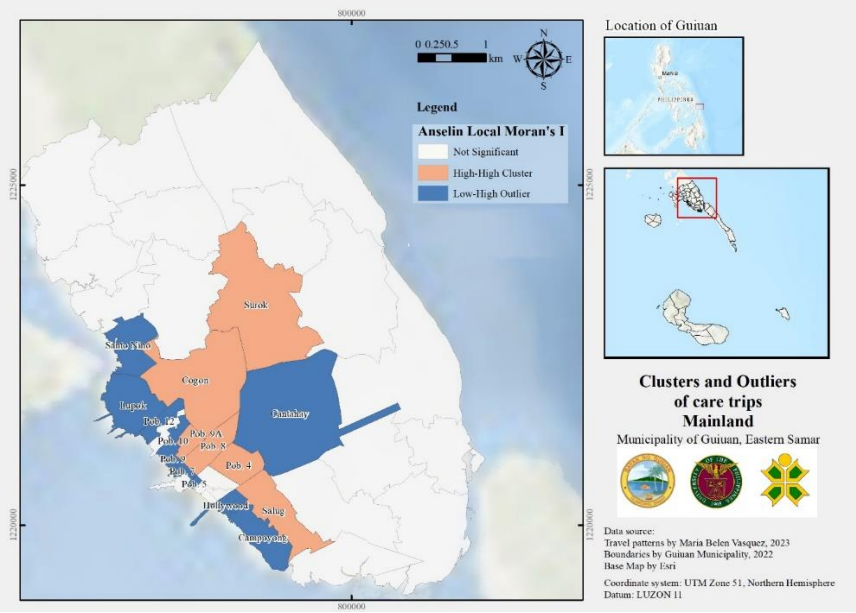

Figure 6: High-High clusters and Low-High outliers in Guiuan Mainland

Table 2: Count of care trips in High-High and Low-High clusters

Destination Barangay	Type	Range of care trips
High-High cluster		
Surok	Rural	9
Salug	Urban	11
Poblacion 9A	Urban	13
Poblacion 4	Urban	34
Poblacion 8	Urban	39
Cogon	Rural	40

Destination Barangay	Type	Range of care trips
Low-High cluster		
Poblacion 5	Urban	1
Lupok	Urban	1
Cantahay	Rural	2
Poblacion 12	Urban	4
Hollywood	Urban	5
Santo Nino	Rural	5
Poblacion 10	Urban	6
Campoyong	Urban	7
Poblacion 9	Urban	7

4.4.1 High-High Clusters

In the Anselin Local Moran's I analysis, high-high clusters were identified as areas with a high number of care trips, surrounded by neighboring areas with similarly high numbers of care trips.

These clusters represented distinct concentrations ranging from 9 to 40 trips of travel activity in both urban and rural regions. Among the six barangays forming the high-high cluster (Poblacion 4, Poblacion 8, Poblacion 9A, Cogon, Salug, Surok), urban areas had a higher concentration of care trips, but rural areas like Barangay Cogon also made significant contributions.

Table 3: Barangays in the high-high cluster characterization

Barangay	Type	Population (2020)	Area (ha)	Density (ha)	Function
Poblacion 4	Urban	975	29.38	33.19	The role and function of Poblacion 4, Poblacion 8 and Poblacion 9A, are to serve as a heavily developed residential and commercial hub with a concentration of businesses, financial, educational and health facilities.
Poblacion 8	Urban	2283	26.37	86.58	
Poblacion 9A	Urban	568	16.22	35.02	
Salug	Urban	1529	61	25.07	Serves as a growing commercial and educational center.
Cogon	Rural	3635	140	25.96	Plays a significant role in education and serves as a resettlement area with housing programs
Surok	Rural	1215	189	6.43	Serves as a catchment area for health facilities and offers education facilities in the rurality.

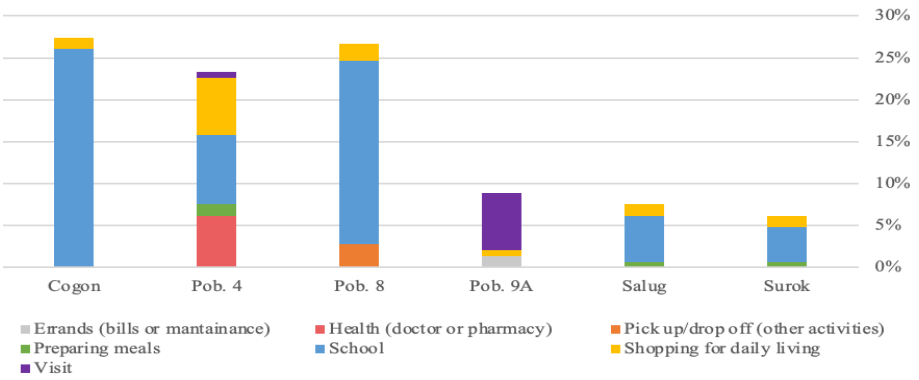

Figure 7: Care trips distribution per activity in the high-high cluster barangays

Upon analyzing the attributes of these clustered areas, it was found that urban barangays, particularly Poblacion 4 and Poblacion 8, had high numbers of care trips related to school and daily living shopping, which aligned with their abundance of educational facilities and businesses, such as grocery stores, markets, restaurants, and financial facilities. On the other hand, rural barangays like Cogon and Surok served as essential educational hubs for the municipality and received a notable number of school-related care trips from various neighboring areas. Cogon, in particular, stood out as a prominent destination for school-related trips due to hosting the Guiuan National High School. Notably, these trips were mostly undertaken by male drivers, presumably parents, highlighting the role of parental involvement in facilitating school travel.

Furthermore, the identification of rural barangays in the cluster analysis has revealed two significant considerations. Firstly, these rural barangays are experiencing changing dynamics and may be transitioning towards hosting more urban characteristics and expansion. Secondly, further research is necessary to clearly identify the role of rural areas in care. Since data collection primarily focused on the urban area for practical reasons, conducting specific studies

that address the dynamics of care-related travel in rural settings becomes essential. Such research can shed light on possible vulnerabilities in these areas and explore how care activities evolve differently in rural communities, potentially highlighting communal support networks beyond immediate family, and the role of seniors in supporting care activities.

Another important aspect to consider is the proximity of Poblacion 6, which houses the transport terminal and main market of Guiuan, to the high-high cluster. Although Anselin Local Moran's I did not identify it as a cluster or outlier, our study's data collection, field exploration, and spatial analysis revealed the significance of Poblacion 6's influence on care travel. Notably, Poblacion 6 made a substantial contribution to care trips in Guiuan, accounting for approximately 21% of all care trips recorded in the study. The close proximity of Poblacion 6 to the high-high cluster suggests its potential importance in supporting the mobility needs of the clustered barangays. Additionally, understanding how Poblacion 6 is connected to the surrounding areas and how it enhances the function and roles of other barangays can contribute to their overall development.

4.4.2 Low-High Outliers

The Anselin low-high outliers are of particular interest for investigation - areas that hold potential for growth and development (Cantahay, Campoyong, Hollywood, Lupok, Poblacion 5, Poblacion 7, Poblacion 9, Poblacion 10, Poblacion 12 and Santo Nino). These were the barangays in Guiuan where the number of care trips, ranging from 1 to 7 care trips (see Figure 6 and Table 2), was lower than in neighboring areas, yet were situated in close proximity to high trip value barangays. This seemingly contradicts the principle that things that are near each other are alike. However, it also a unique opportunity for policymakers to investigate the reasons behind these differences and identify ways to improve transportation services and infrastructure to better connect them with neighboring barangays.

By bridging the gap between low-value and high-value barangays, policymakers in Guiuan can ensure that residents in all areas have equal access to essential care services and facilities. Improving transportation services and infrastructure can also promote economic growth and social cohesion within the community. As such, the low-high outliers in Anselin serve as an important reminder that there is always room for improvement and growth, even in areas that appear to be lagging behind.

4.5 Grouping Analysis

The Grouping Analysis method was employed to identify similar groups of barangays based on selected independent and dependent variables, namely gender and sociodemographic factors, and travel patterns in the context of care travel. Through this method, it was possible to obtain a comprehensive and granular understanding of the characteristics of different types of travelers in each barangay.

The application of grouping analysis to identify similar groups of travelers across different barangays has several positive outcomes, including guiding the development of targeted interventions and tailored transportation offerings to meet the specific needs and preferences of each group. Additionally, grouping analysis can inform decisions about resource allocation and infrastructure development, enabling more efficient and effective use of limited resources. However, it is important to acknowledge that the effectiveness of grouping analysis is dependent on the quality and quantity of the data available. Despite these limitations, the exploratory purpose of grouping analysis provided valuable insights to have a clearer picture of the area.

The method was applied by distinguishing the characteristics of both genders. Therefore, the analysis for each gender was obtained using the following independent and dependent variables (Table 4), considering the characteristics of the data and the information obtained from the analysis in the previous sections of this study.

Table 4: Grouping analysis variables

Independent variables	**Dependent variables**
Age range - Productive years: Trips performed by travelers in the 25-49 age range	Number of care trips: Number of trips related to care
Civil status - With a partner: Trips performed by travelers that are married or in a relationship	Use of motorized transportation: Trips that utilized a motorized mode of travel
Presence of dependents - Accompanied: Trips performed by travelers with companions during the journey	Trip in less than 5 min: The duration of the trip is less than 5 minutes

The selection of specific categories in the variables was carried out to convert them into continuous variables due to measurement restrictions of the method and to address the assumptions of multicollinearity, to obtain a model that minimizes biases as much as possible.

Table 5: Type of female travelers

G1 "Versatile travelers"	Encompassed 37 barangays, showcasing female travelers of diverse ages and marital statuses. Their trips were not solely defined by dependents, with both motorized and non-motorized options considered. The average trip frequency was typical, and distances varied, reflecting individual preferences. The group's heterogeneity made it challenging to pinpoint specific travel patterns, highlighting the significant role of individual needs in shaping behavior.
G2 "Non-stop travelers"	Comprised females from one barangay, emphasizing Poblacion 6's importance for care trips. Primarily partnered women aged 25 to 49, often with dependents, focused on frequent care trips, using motorized transportation—motorcycles or tricycles—for short distances under 5 minutes.
G3 "Together on the move"	Included five barangays (Poblacion 1, Poblacion 4, Poblacion 8, Poblacion 11, and San Juan). Female travelers aged 25 to 49 with partners stood out for traveling with companions. Despite lower standardized values than group 2, they maintained a high frequency of care trips, preferring motorized transportation for short distances under 5 minutes.

Table 6: Type of male travelers

G1 "Versatile travelers"	Covering 39 barangays in Guiuan, male travelers exhibited a diverse composition akin to the first female group. Varying in age and civil status, their mobility wasn't solely defined by dependents. Both motorized and non-motorized options were utilized, showcasing adaptability. With an average trip frequency, their journey distances reflected personal preferences, leading to a diverse array of male travelers across the barangays.
G2 "Together on the move"	Represented by Cogon barangay, stood out with the highest standardized values across variables. Mainly aged 25 to 49 and partnered, these men frequently embarked on care-related trips accompanied by their dependents, often children. They favored motorized transport, especially motorcycles, for brief commutes under five minutes.
G3 "Non-stop travelers"	Comprising Poblacion 6, Poblacion 8, and Sulangan barangays, Group 3 featured males aged 25 to 49, sometimes with dependents, notably children. Despite lower standardized values than Group 2, this cohort still undertook frequent care-related trips, using motorized transport for predominantly short journeys lasting under five minutes.

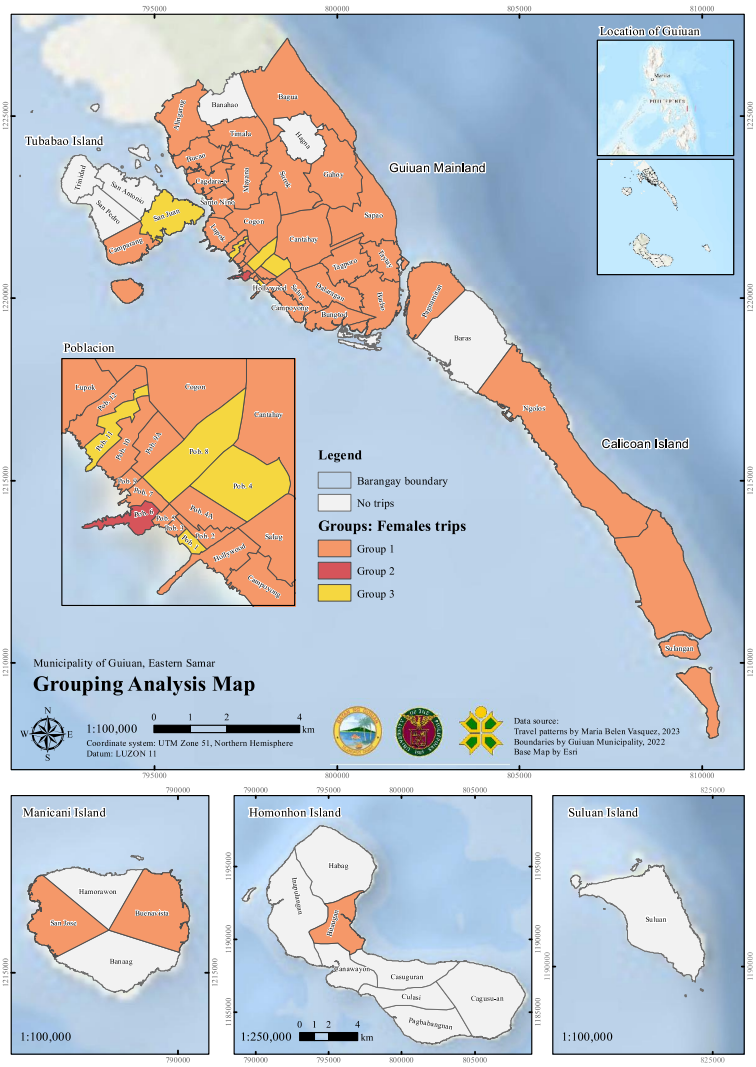

Figure 8a: Grouping Analysis Map: Female Trips

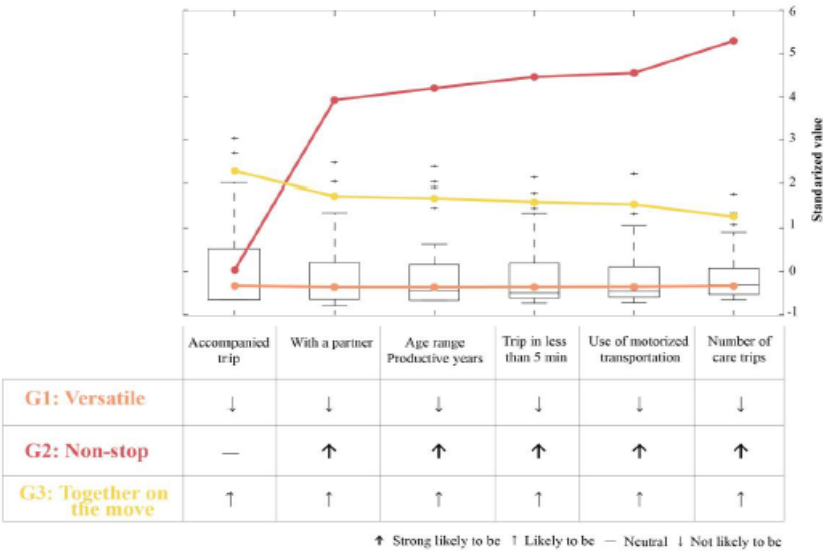

Figure 8b: Grouping Analysis Female Trips: Parallel box plot

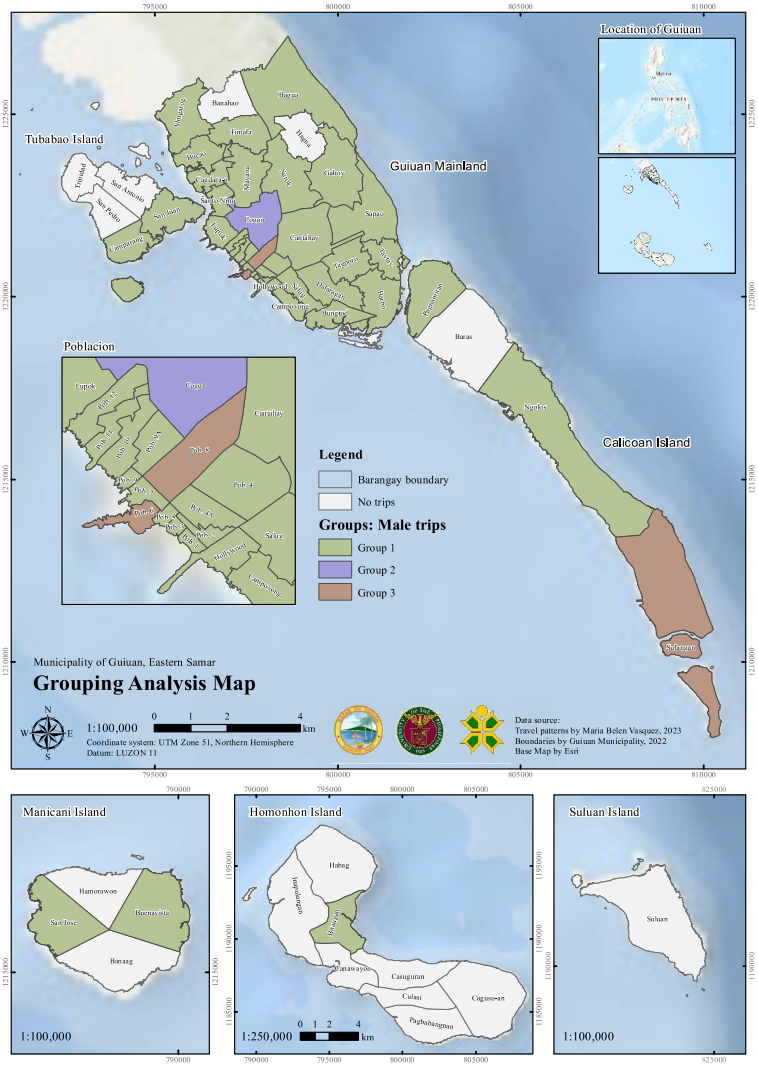

Figure 9a: Grouping Analysis Map: Male Trips

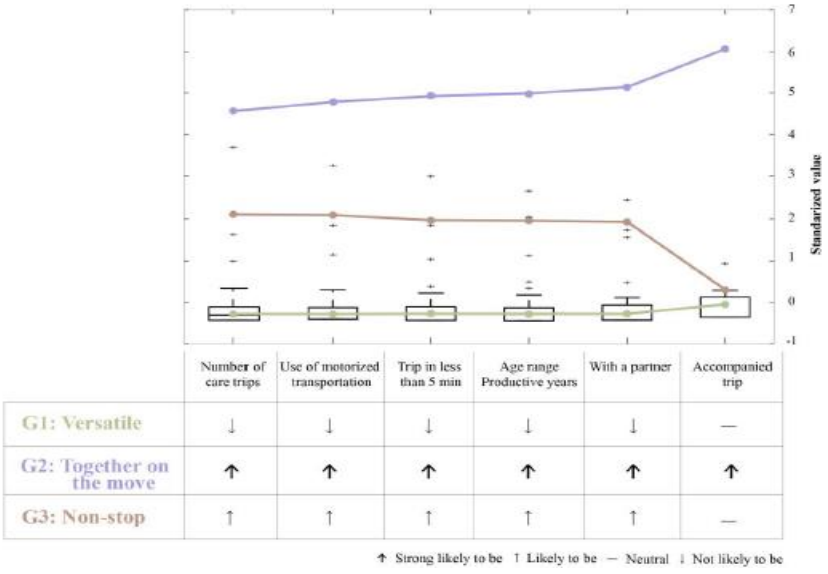

Figure 9b: Grouping Analysis Male Trips: Parallel box plot

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Significance of Measuring Care in Mobility

The findings of this study shed light on the substantial and predominant role of care-related travel in Guiuan, surpassing other conventional purposes such as work. Notably, care-related trips accounted for 49% of the identified travel patterns. This highlights the critical importance of caregiving and emphasizes its consideration in policy development.

5.2 Gender and Sociodemographic Influence in Care Travel

Examining mobility through the analytical lens of care allowed for the visualization of gender-based inequalities in the everyday lives of women and men in Guiuan. The study's findings aligned with international studies conducted in other cities (Larracilla Razo, 2021; Maciejewska, 2020; Sánchez de Madariaga & Zucchini, 2020; Soto-Villagrán, 2022), reinforcing the disproportionate burden of unpaid reproductive work placed on women, which remains largely unrecognized despite its vital role in sustaining life.

The study confirmed the hypothesis that the distribution of care work in Guiuan is influenced by variables such as gender, marital status, age, and caregiving responsibilities. Women were found to undertake more than twice as many caregiving trips compared to men. The presence of school-age children had a greater impact on generating caregiving trips for women, reinforcing the central role of women in childcare activities (Plyushteva & Schwanen, 2018). Age was also found to be a determining factor, with individuals in their productive years (25-34 for men and 35-49 for women) being the most engaged in caregiving trips.

Gender disparities in motorized transportation usage were evident, with men predominantly opting for private motorcycles while women exhibited a more varied choice between private and public modes of transport. These discrepancies can be attributed to factors related to ownership and physical accessibility (Maciejewska, 2020). Challenges caregivers face include inadequate infrastructure, affordability, safety, and sociocultural barriers.

5.3 Spatial Data Analysis and Care Travel Patterns

The analysis conducted revealed the existence of significant spatial clustering of care trips, signifying the concentration of such activities in specific geographical areas. Furthermore, the identification of low-low clusters and low-high outliers brought attention to areas necessitating focused interventions and resource allocation to enhance transportation services and facilitate better connectivity with neighboring barangays.

Moreover, the grouping analysis carried out in this study yielded valuable insights into the diverse profiles of female and male travelers. Noteworthy factors taken into consideration include age, civil status, and the presence of accompanying dependents. Recognizing the inherent heterogeneity within these traveler groups, namely the 1) Versatile, 2) Non-stop, and 3) Together on the move travelers, is pivotal for devising personalized and efficacious transportation solutions that effectively address the distinct needs and preferences of diverse travelers.

5.4 Implications for Planning and Public Policy

The research contributes substantial insights for developing local-level mobility policies and urban planning. The gendered analysis of travel patterns, the basis for which is derived both

from the quantitative survey data and the qualitative micro-narratives of experienced caregivers, proffers several implications.

The central aspect is the pressing need to consider "care" as a pivotal analytical category during the design and interpretation of aggregated mobility data, such as Origin-Destination Surveys. Incorporating this perspective allows for detailed exploration of how gendered and responsibilities influence travel patterns and thereby demand distinct transportation services. Such recognition can lead to more equitable and responsive transport planning, catering not only to the traditional work-commute paradigm but also addressing the significant portion of travel needs related to care.

The research also underscores the value of employing qualitative analysis. Personal narratives complement the survey data, providing rich context and adding depth to our understanding of how people interact with transportation systems. These human-facing perspectives are a critical supplement to data-centered ones, helping shift the focus from traditional, transportation-centric views to more comprehensive, people-centric perspectives.

Furthermore, the application of spatial analysis methods is highlighted as effective means to improve territorial diagnoses and resource allocation for accessible and sustainable mobility. The clustering and spatial representation of care-related trips, for example, could help policy-makers easily identify regions where transportation services may be falling short in meeting care-related travel needs.

Taken together, this study's findings function as a call to action for policy-makers and urban planners. There is a need both to prioritize the integration of care-related travel into planning and policy decisions and to appreciate the gendered nuances within this decision-making process. Each step towards these goals are key components of striving for a more equitable, gender-responsive urban mobility framework.

5.5 Recommendations for further research

It is advisable to include other aspects that contribute to understanding inequalities related to economic status, livelihood information (whether formal or informal), LGBTQ issues, educational level, ethnicity, disability, and caregiving within the male environment, while acknowledging generational transformations and temporal variations. Similarly, considering the geographic composition of the Philippines, it is suggested to focus research on island dynamics and how inter-island movements for caregiving purposes are influenced by the current availability of transportation systems.

Another promising direction for future research involves investigating different types of care travelers, as proposed in this study: Non-stop travelers, Together-on-the-move travelers, and Versatile travelers. Identifying common characteristics and discerning specific traits within each group can offer deeper insights into the behavior of the population in a locality, their distinct needs, and potentials. Utilizing grouping analysis techniques in exploring spatial patterns within the transportation field is highly encouraged, as it holds great potential for the understanding of care-related mobility and facilitating well-informed policy decisions.

In the same sense, future research could focus on integrating spatial analysis with other relevant datasets, such as demographic, land use, and environmental data. By combining multiple data sources, researchers can unveil complex relationships and interactions between transportation and various socio-environmental factors. For instance, analyzing the spatial distribution of transportation patterns in relation to demographic characteristics or land use patterns can yield valuable insights into the underlying socio-spatial dynamics that shape mobility behavior.

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