Analysis of Policy Implementation on Pedestrian Traffic Casualties and Pedestrian Road-Use Experience

Group G

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Abstract

The Taiwanese government has been promoting pedestrian safety improvement measures since 2017[2], but the national trend of pedestrian fatalities and injuries continues to be on the rise. Due to this phenomenon, in 2023, pedestrian related guidelines and policies were introduced. Therefore, we would like to find out whether the policies enacted in 2023 have positive impacts on the number of pedestrian casualties in Taiwan, effectively reducing the number of pedestrian casualties nationwide. In this paper, we use open government data to conduct regression analysis, supplemented by a survey aiming to understand pedestrians' road-use experience, and to compare the results, in order to observe whether the policy objectives are consistent with the actual experiences of the public.

In this paper, we use the ratio of transportation budget to total budget, the density of Taiwanese population, the density of foreign population in Taiwan, and the total number of vehicles as the variables affecting the number of pedestrian fatalities and injuries. From the empirical results, we find the proportion of transportation budget to have a significant positive correlation, which may be explained by inefficient use of the budget, the time constraints of our research period, or the ineffectiveness of facility-upgrading and policy-promotion. In terms of population density, a positive correlation was found for the density of foreign residents. Finally, the total number of vehicles also shows very significant positive relationship. In addition, through our survey, we find that most of the pedestrians in the target locations experienced improvements in road conditions, but there were no significant results for gender, whether they filled out the form roadside, or their occupation.

[2] See Executive Yuan, 行人優先交通安全行動綱領 (https://www.ey.gov.tw/Page/5A8A0CB5B41DA11E/6bb0a2a4-51ee-4655-ad59-e7fad2dd095c)

1. Introduction

The Vision Zero program was introduced in Sweden in 1997 with the goal of having no one killed or seriously injured in traffic accidents (M.-A˚. Belinet al., 2011), which was implemented with significant results. Subsequently, many countries have adopted the same policy in an attempt to reduce the number of traffic casualties in their countries. In 2023, the number of road traffic casualties in Taiwan reached 402,926 cases, of which pedestrians cases account for more than 4%. At the same time, the "Pedestrian Priority Traffic Safety Action Plan"[3] and "Policy Guidelines for Pedestrian Traffic Safety"[4] were released in June and August of 2023, respectively, and fines for failing to stop for pedestrians and visually impaired people were also raised to NT$1,200~6,000 and NT$2,400~7,200, hoping to help reduce the number of deaths by pedestrian traffic accidents by 30% by 2030 and continue the work towards the Vision Zero goal.[5]

The Ministry of Transportation and Communications (MOTC) introduced the "Policy Guidelines for Pedestrian Traffic Safety" to improve Taiwan's long-standing deficiencies when it comes to human-centered transportation ideology through short, medium, and long-term implementation projects. As Taiwan's transportation policy changes, the budgets used by county and municipal governments for transportation are also adjusted. Therefore, this paper examines whether the size of each county and city government's transportation budget from 2012 to 2023 has affected the number of pedestrian casualties, as well as the number of vehicle registrations, and the density of local and foreign populations. The data in this paper of annual-level, which is a constraint this paper faces as the policy has only been in place for one year. In addition, in order to investigate whether this new policy has actually affected road users, this paper also utilized a survey to collect pedestrians' experiences and impact on yielding, traffic safety facilities, policy sufficiency, and road usage.

This paper is divided into six sections. The first section is the introduction, followed by the literature review section. In Section 3, we present our data and methodology for both of the government data and survey data analysis; in Section 4, we report our results for the

[3] See Executive Yuan, 行人優先交通安全行動綱領 (https://www.ey.gov.tw/Page/5A8A0CB5B41DA11E/6bb0a2a4-51ee-4655-ad59-e7fad2dd095c)

[4] See Executive Yuan, 行人交通安全政策綱領 (https://www.ey.gov.tw/Page/5A8A0CB5B41DA11E/e85f9aba-1e7f-48df-9643-d972bc819ee6) or Policy guidelines for pedestrian traffic safety (2023-2027) (https://english.ey.gov.tw/News3/9E5540D592A5FECD/6a434a82-b2d3-40c8-a73e-ba3160f177a9)

[5] See MOTC, 停讓行人 你做到了嗎？(112 年) (https://168.motc.gov.tw/theme/pedestrian/post/2306211845390)

government data, and that of the survey data is provided in Section 5. We conclude in Section 6 by comparing the results and sharing some of our findings.

2. Literature Review

Pedestrian safety has always been a great concern in urban transportation. Every year, many pedestrians are injured or killed on the road, which not only has a serious impact on individuals, but also brings challenges to the whole society. With the continuing urbanization and the increasing of traffic, the issue of pedestrian safety has become more and more prominent. Therefore, it is crucial to study the causes and solutions of pedestrian accidents in depth to promote traffic safety, and the establishment of a safer and more orderly traffic environment requires a series of integrated measures.

To address the problem of pedestrian accidents, the incidence of pedestrian accidents can be effectively reduced through strict enforcement (e.g. bans, etc.) and the promotion of effective traffic safety education to enhance pedestrians' awareness of safety and self-protection. In addition, past empirical studies have found that the severity of pedestrian injuries and deaths is related to the deficiency of facilities such as sidewalks, buffer zones, highways, and the insufficiency of traffic lighting during moonlight hours (Christopher S. Hanson et al., 2013). It is evident that providing safer pedestrian spaces is a necessary step towards achieving traffic safety.

2.1 Traffic Budget

Reasonable planning and utilization of the budget can insure the protection of the construction and investment in traffic safety projects. Appropriately increasing investment in traffic safety and improving road facilities not only reduces the incidence of traffic accidents, but can also increases accessibility and improves the safety and comfort of people on the road. Although the allocation of funds may invite many challenges, funding and resource allocation mechanisms still need to be carefully considered, given that decision-making and infrastructure improvements may lead to the migration of accidents along the traffic route (Soathong, A., 2019). However, if an assessment is made between a lower budget and a higher risk index, a reduced budget will not result in real benefits as the additional incident costs and future maintenance (or reconstruction) costs are much higher. Therefore, if the government reduces the budget cost, they will be increasing the risk of road usage (Rojo M et al., 2018).

2.2 Number of Vehicles

The National Safety Council (NSU) [6] has referred to 2021 as the second consecutive year of increased automobile accident fatalities in the U.S. However, even with this spike in fatalities, the number of fatalities divided by the number of registrations per 10,000 vehicles decreased by 95% between 1913 and 2021, from 33 to 1.66, respectively. Another study demonstrated that with an increase in the number of motor vehicles, an increase in the number of traffic accidents can be observed. However, this is limited by the selection of the period, as 2020 being a year burdened by the pandemic, was included as one of the years of re-observation, implying some amount of uncertainty (Milanko Damjanović et al., 2022). Therefore, the results of this variable are still uncertain and further research is needed.

In addition, excluding perpetrator factors, weather conditions, pavement conditions, and natural lighting conditions may also contribute to the occurrence of pedestrian accidents (Luis Miguel Martín-delosReyes et al., 2021; Yue Ke et al., 2019; Bashar H. Al-Omari, 2013). However, these factors are not discussed in this paper due to the inaccessibility of the data.

2.3 Foreign Population

There are both positive and inconclusive findings on the association between immigrant or foreign populations and pedestrian accidents. The following is a review of a number of articles, which we hope to learn and gain insight from in order to hopefully provide some valuable contribution of our own.

A study of the NYC Pedestrian and Bicycle Crashes Data from 2001 to 2003 found that immigrants were of higher percentage in pedestrian and bicycle crashes, but these differences may disappear over time and that immigrant traffic behaviour will grow to be the same as that of U.S. natives. It has also been shown that neighbourhoods with higher concentrations of immigrants have more accidents (Cynthia Chen, et al., 2011).

Similar results have been found in articles from a driver's perspective. A study in Greece analyzed the crash risk of foreign and native (Greek) drivers in various road environments. The results confirm that in Greece, foreign drivers have an amplified risk, and their presence at intersections has the most significant effect on risks of accidents. However, the risk for permanent immigrant residents appears to be lower than that of tourists, regardless of the environment (George Yannis, et al., 2007).

[6] See NSC, Injury Facts Overview (https://injuryfacts.nsc.org/motor-vehicle/overview/introduction/)

In a study of one of the most ethnically diverse regions in North America, Donald A. Redelmeier, et al. (2011) found that residents who were immigrants near 2011 were less likely to be involved in serious motor vehicle crashes than permanent residents, and immigrants were as likely to be involved in serious motor vehicle crashes as permanent residents. In all, immigrants make up of less to serious road accidents than the population average. In other words, these results challenge the risk perception and negative stereotypes of immigrants.

In addition, there are also studies targeting foreign tourists, such as the one published in the British Medical Journal (A Baldwin, et al., 2008), where they showed that traffic accidents are one of the main causes of injuries and deaths among foreign tourists, and that international tourists within the European Union have a higher rate of injury deaths than the local population, and are also at a higher risk of being involved in road traffic accidents. At the time of the study, up to 61% of HMEs (Helicopter Medical Emergency Services) missions involved pedestrian and vehicle collisions, with only 16% involving UK residents. Under this mission classification, serious injuries to pedestrians were particularly prevalent for groups traveling in London.

3. Data and Methodology

3.1 Government data and research period

This study focuses on the counties and cities in Taiwan, with the sample period spanning from 2012 to 2023, a total of 12 years.

There are two main criteria for selecting the samples in this study. First, the sample period needs to be of a certain length in order to effectively evaluate whether the county and municipal governments have reduced the number of pedestrian casualties when adjusting the proportion of the transportation budget in the total budget. Second, since the completeness of the data provided by each county and city government varies, in order to avoid missing values and the incompleteness of the data for the year of 2024, we chose to select the period of 2012 to 2023. Based on the above considerations, a total of 264 valid samples from 22 counties and cities in Taiwan were utilized, with a time period of 12 years. The variables are defined in Table1.

Table 1 Government Data Variable Definition

Variable	Variable Definition
CASUALTIES	Number of Pedestrian Casualties
BUDGET_PER	Percentage of Traffic Budget on Total Budget
TWDENSITY	Density of Taiwanese Population
FDENSITY	Density of Foreign Population
MOTOR	Number of Motor Vehicles Registered
CAR	Number of Cars Registered

3.2 Government data model design

In this study, we use a panel data model to perform OLS regression, which is designed as follows.

$$CASUALTIES_{it} = \beta_0 + \beta_1 * BUDGET_{PER\,it} + \beta_2 * TWDENSITY_{it} + \beta_3 * FDENSITY_{it} + \beta_4 * MOTOR_{it} + \beta_5 * CAR_{it} + u_{it} \quad (1)$$

The objective of this regression model is to analyze the factors affecting the number of pedestrian casualties in different locations and points in time. $CASUALTIES_{it}$ is the dependent variable of our regression model, which represents the number of pedestrian fatalities and injuries in year t for county i.

3.3 Pedestrian survey research design and period

Our survey aims to compare the results of the government data regression model with the actual pedestrian experience after the pedestrian priority policy[7] was implemented, and to compare the consistency between the two, and to provide a more detailed explanation and analysis.

The physical paper survey and the online survey were used simultaneously; the period spanned from May 2nd to May 16th of 2024. 214 pedestrians were surveyed, and their

[7] Here we generalize the policies introduced in June and August of 2023, as the periods of time introduced were too close and as to not confuse those being surveyed.

biological sex, occupation, location were collected. Biological sex was categorized as male, female or inconvenient to disclose[8]; occupation was categorized as studying, working, and other. The locations we surveyed included Taipei City, Taoyuan City, Hsinchu City, Taichung City, and Kaohsiung City. With these cities being located in the north, center, and south of Taiwan, we hope to understand more comprehensively the actual experience of pedestrians in Taiwan after the implementation of the policy.

Four questions were used as indicators of pedestrians' experience, and each question was answered according to the level of feeling, with a scale of 0 to 5, with 0 being extremely disagree and 5 being extremely agree. Respondents chose a number in this scale as the level of feeling that most closely resembled their actual experiences. Respondents were also randomly selected to minimize errors. The questions are: After the policy implementation, have you observed more cars yielding? After the policy implementation, have you observed improvements in pedestrian traffic safety facilities (e.g. crosswalks etc.)? After the policy implementation, do you think the pedestrian safety related policies in Taiwan are sufficient? After the policy implementation, do you feel safer whilst using the road?

The promotion of "Policy Guidelines for Pedestrian Traffic Safety" focuses on four aspects: law enforcement, engineering, education and supervision. Our first two questions on the survey reflect the fruits of law enforcement, the third question is about the observations of the engineering aspect, and the last question is about the feelings of pedestrians about their own safety on the road.

The maximum fine is also increased for not giving way to pedestrians walking on the crosswalk when the pedestrian green light is on.[9] Through the pedestrians' experience of the willingness of vehicles to yield, we can understand whether the policies have true effects. Improvement of sidewalks and crosswalks is one of the key items mentioned in "Policy Guidelines for Pedestrian Traffic Safety", therefore, the second question was asked to find out whether the implementation is in line with what the pedestrians actually experience. The third question aims to understand whether the pedestrians believe the policy is strict enough

[8] We forfeited the data for those who chose to not disclose their biological sex due to insufficiency in number of data collected in that area.

[9] Originally, Article 48 of the Road Traffic Management Penalty Act states that a driver who fails to yield to pedestrians when turning, except for roadway sections where pedestrians are prohibited from crossing, shall be subjected to a fine of not less than NT$1,200 and not more than NT$3,600. Starting from June 30, 2023, a driver near a pedestrian crossing or other intersection where pedestrians can legally cross, and does not stop to allow pedestrians to cross first, shall be fined not less than NT$1,200 and not more than NT$6,000. For more information, see the National Laws & Regulations Database (https://law.moj.gov.tw/LawClass/LawSingle.aspx?pcode=K0040012&flno=44)

to achieve the improvement of the pedestrian environment. Lastly, the respondents were asked to compare the changes in their own safety level before and after the policy with their actual experience with respect to road usage.

3.4 Pedestrian survey model design

The answers were collected in a scale of 0 to 5, with 0 being extremely disagree and 5 being extremely agree. For our study, we grouped the answers 0 to 2 as “No” and 3 to 5 as “Yes”, we then ran an OLS regression using a probit model where “No” is 0 and “Yes” is 1 with the variable description shown in table 2 and the model shown in equation 2.

Table 2 Survey Data Variable Definition

Variable	Variable Definition
YIELD	=1 if observed improvements in vehicles yielding
FACILITY	=1 if observed improvements in pedestrian safety facilities
POLICY	=1 if believed the current pedestrian-related policies are sufficient
SAFETY	=1 if felt safer whilst using the road
SEX	=1 if biological female
ROAD	=1 if surveyed roadside
LT	=1 if location is Taipei
LY	=1 if location is Taoyuan
LH	=1 if location is Hsingchu
LC	=1 if location is Taichung
LK	=1 if location is Kaoshung
OS	=1 if is student
OW	=1 if is worker
OO	=1 if non-student and non-worker

We ran four separate regressions for each of the questions in the survey, using each question topic as the dependent variable, and the same independent variables, each individual's sex, place where the survey was taken, location, and occupation, we also omit LH (=1 if Location is Hsingchu) and OO (=1 id Occupation is Other).

$$STOP_i = \alpha_0 + \alpha_1 * SEX_i + \alpha_2 * ROAD_i + \alpha_3 * LT_i + \alpha_4 * LY_i + \alpha_5 * LC_i + \alpha_6 * LK_i + \alpha_7 * OS_i + \alpha_8 * OW_i + \varepsilon_i \quad (2)$$

4. Government Data Analysis

4.1 Government Data Descriptive Statistics

This paper uses STATA for statistical and metrics analysis. The total number of valid samples after screening is 264, and the study period is 12 years, the descriptive statistics of each variable are as follows in Table 3.

Table 3 Government Data Descriptive Statistics

Variable	Mean	Std. Error	Min	Max	N
CASUALTIES	736.25	802.85	0	2954	264
BUDGET_PER	8.07	5.26	1.26	39.44	264
TWDENSITY	1478.88	2093.71	59.34	9671.31	264
FDENSITY	49.7	76.86	0.76	398.58	264
MOTOR	641255	650788.6	5190	2368911	264
CAR	361294.4	340177.5	2468	1176373	264

4.2 Government Data VIF test

After performing the regression with the number of pedestrian casualties as the dependent variable, the R squared of the model is about 0.92, which indicates that the model has some explanatory power. However, when analyzing the regression results, we found that the t-values of some of the variables were not of significance. Therefore, we used VIF to check whether there were any multicollinearity issues in the regression model in (1). The following table presents the results of VIF on the original variables.

Table 4 Government Data Variable VIF

Variable	VIF	1/VIF
CAR	22.25	0.044951
MOTOR	19.79	0.050525
FDENSITY	11.28	0.088651
TWDENSITY	9.02	0.110830
BUDGET_PER	1.02	0.983342
Mean VIF	12,67	

From the results, we can see that the VIF values of CAR and MOTOR are both much larger than 10, which indicates that there is a serious multicollinearity problem between the two variables. Considering the high correlation between these two variables, we decided to combine these two variables into one new variable, VEHICLE, and conduct a second VIF test. The following table shows the results of the VIF test after replacing the variables.

Table 5 Government Data Variable VIF

Variable	VIF	1/VIF
FDENSITY	8.37	0.119513
TWDENSITY	8.18	0.122312
VEHICLE	1.08	0.924489
BUDGET_PER	1.01	0.986749
Mean VIF	4.66	

The results show that the VIF values of all variables including the new variable VEHICLE are now less than 10, and the VIF value of the new variable is equal to 1.08, which indicates that the multicollinearity problem can be solved effectively by combining the two variables. The following table shows the descriptive statistics after implementing the new variable VEHICLE.

Table 6 Government Data Descriptive Statistics with variable VEHICLE

Variable	Mean	Std. Dev	Min	Max	N
CASUALTIES	736.25	802.85	0	2954	264
BUDGET_PER	8.07	5.26	1.26	39.44	264
TWDENSITY	1478.88	2093.71	59.34	9671.31	264
FDENSITY	49.7	76.86	0.76	398.58	264
VEHICLE	1002549	981567.2	7658	3357114	264

4.3 Government Data Regression Analysis

After the VIF testing and the introduction of the new variable, we adjust equation (1) to equation (3)

$$CASUALTIES_{it} = \beta_0 + \beta_1 * BUDGET_{PER_{it}} + \beta_2 * TWDENSITY_{it} + \beta_3 * FDENSITY_{it} + \beta_4 * VEHICLE_{it} + u_{it} \quad (3)$$

Table 7 shows the results of our regression. First of all, we can observe that the percentage of transportation budget has a significant positive relationship with the dependent variable. This is somewhat in correspondence with our original observation that despite the policy implementation, the number of casualties maintains on increasing. However, this does go against what is usually believed, that is, when the county government increases the proportion of transportation budget, it can effectively reduce the occurrence of pedestrian casualties. For this, we speculate that the inefficient use of transportation budgets may be at play or that upgrading transportation facilities, signage, and policy advocacy takes time and have not come into fruition, and may show different results in the longer term.

In the analysis of population density variables, it can be observed that FDENSITY shows a very significant positive relationship compared to the non-significant and negative results of TWDENSITY. Taking into account the differences in traffic rules and signals of different countries, as well as the fact that foreign populations are less informed about Taiwan's latest policies, the significant positive relationship between FDENSITY and CASUALTIES seems to be reasonable. We expected that increase in policy- promotion of traffic rules for the foreign population and prioritization of the improvement of traffic facilities in dense foreigner-populated areas can assist in lowering pedestrian casualties.

Finally, the regression results of VEHICLE after the merger are analyzed. It can be observed that VEHICLE has a very significant positive relationship with the corresponding variable, which is consistent with the expected results, indicating that the total number of vehicles significantly affects the number of pedestrian fatalities and injuries.

Table 7 Government Data Regression Results

Variable	VIF
BUDGET_PER	5.259429*
	(2.920962)
TWDENSITY	-.025128
	(.0208359)
FDENSITY	3.230376**
	(.5741781)
VEHICLE	.0007006**
	(.0000162)
_CONS	-131.9583**
	(32.10329)
R^2	0.9065

Note. **Significant at the 5% level, *Significant at the 10% level

5. Survey Data Analysis

5.1 Survey Data Descriptive Statistics

In Table 8, we show the descriptive statistical results for the full data of the survey. From the table, it is clear that the majority of those surveyed felt improvements for all four of the after policy change indicators. In Charts 1 to 4, we show the observations of each indicator by each surveyed location. From Chart 1, we see high percentages from four of the locations, indicating the majority observed improvements in cars yielding to pedestrians apart from Hsingchu, where only 33% of those surveyed observed improvements in that criteria. From Chart 2, we find slightly lower percentages on average for observed improvements in pedestrian-safety related facilities; however there is a higher percentage from Hsingchu and above 50% for all other locations. From Chart 3, it is obvious that there is an even lower percentage on average of those who believe the current pedestrian-relates policies are enough post polices' implementations, with 2 locations having less than 50% agreement. From Chart 4, we see the percentages on average have gone up, with all but Hsingchu's majority observing feeling safer on the road after the policy. Additionally, we see more optimistic

results from Taichung and Kaoshung as a whole, with more than 50% of those surveyed observing improvements after policy implementation.

Table 8 Survey Data Variable Definition

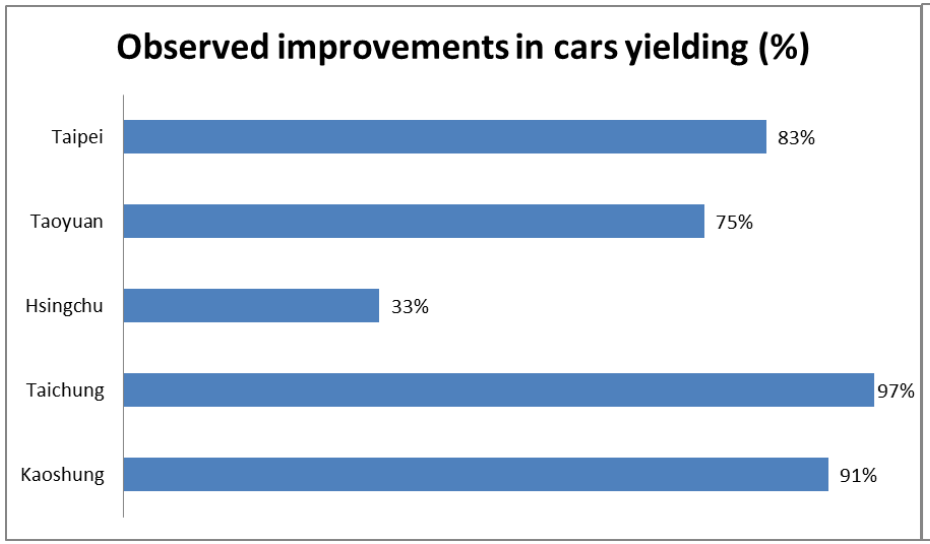
Variable	Mean	Std. Dev.
YIELD	.7943925	.4050924
FACILITY	.6495327	.478235
POLICY	.5093458	.5010848
SAFETY	.6915888	.4629202
SEX	.5841121	.49403
ROAD	.2523364	.4353717
LT	.2242991	.4180979
LY	.1308411	.3380172
LH	.1542056	.3619925
LC	.1728972	.379045
LK	.317757	.4666961
OS	.3364486	.4736022
OW	.546729	.4989788
OO	.1168224	.3219617

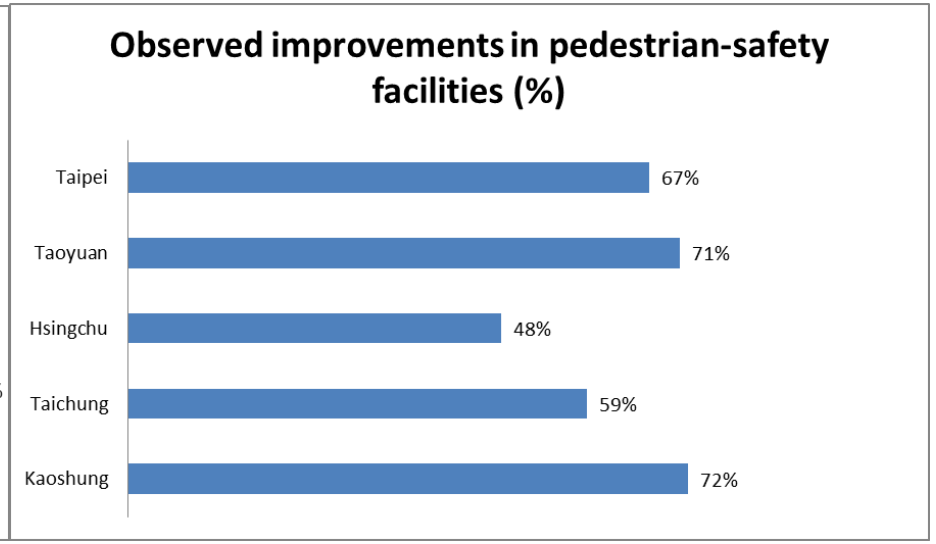
Note: Each variable's minimum value is 0 and maximum value is 1, N=214

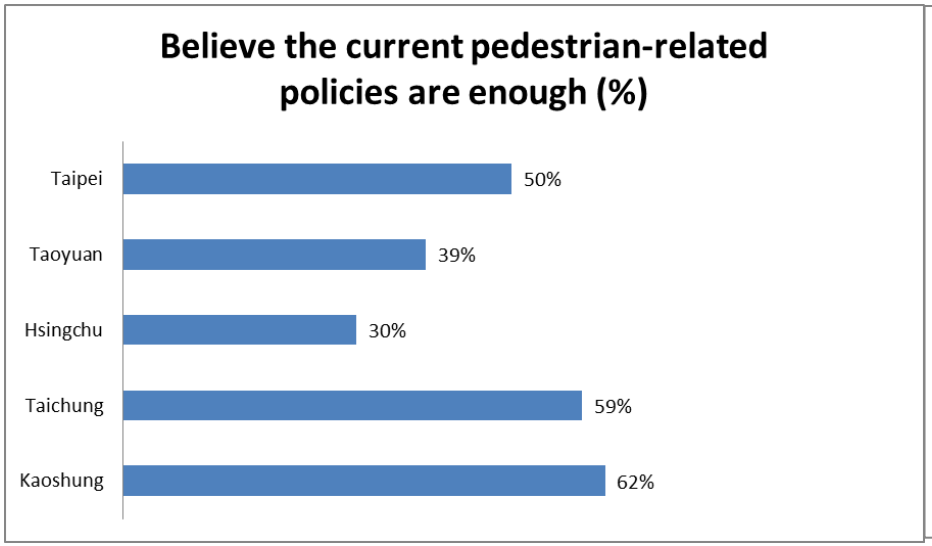
In Charts 5 to 8, we show the observations of each indicator by the surveyed sex, and we can easily see that there are not many differences between the percentages of observed improvements and beliefs of each post-policy indicator between sexes. Similar to that by location, we also notice lower percentages on average when it comes to whether or not they believe the current policies are enough post implementation.

In Charts 9 to 12, we show the observations of each indicator by whether or not the survey was taken roadside. Once more, we see that there are no obvious differences between the place where the survey was taken and the surveyed observed improvements and beliefs and also see lower percentages on average when it comes to policy sufficiency.

Chart 1, 2, 3, 4 Surveyed indicators based on pedestrian's observation post policy implementation by location







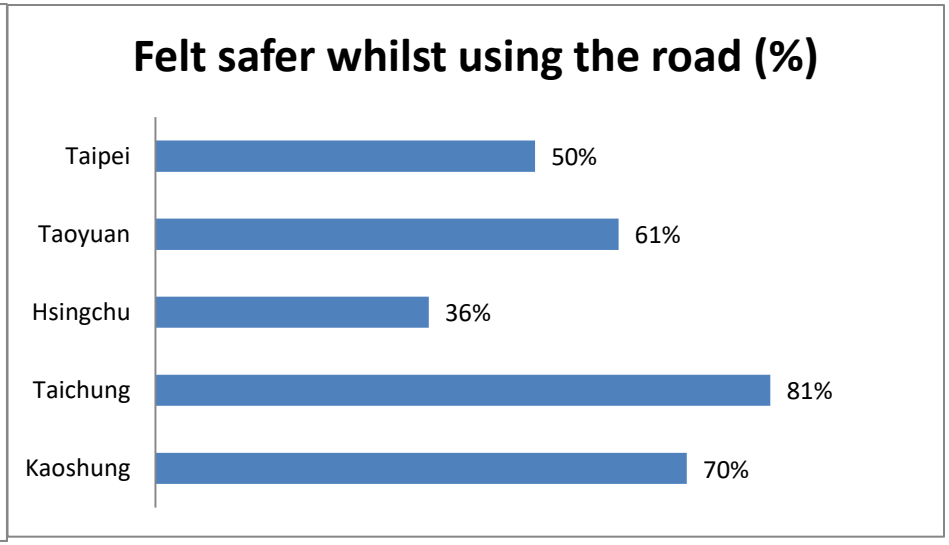


Chart 5, .6, .7, 8 Surveyed indicators based on pedestrian's observation post policy implementation by sex

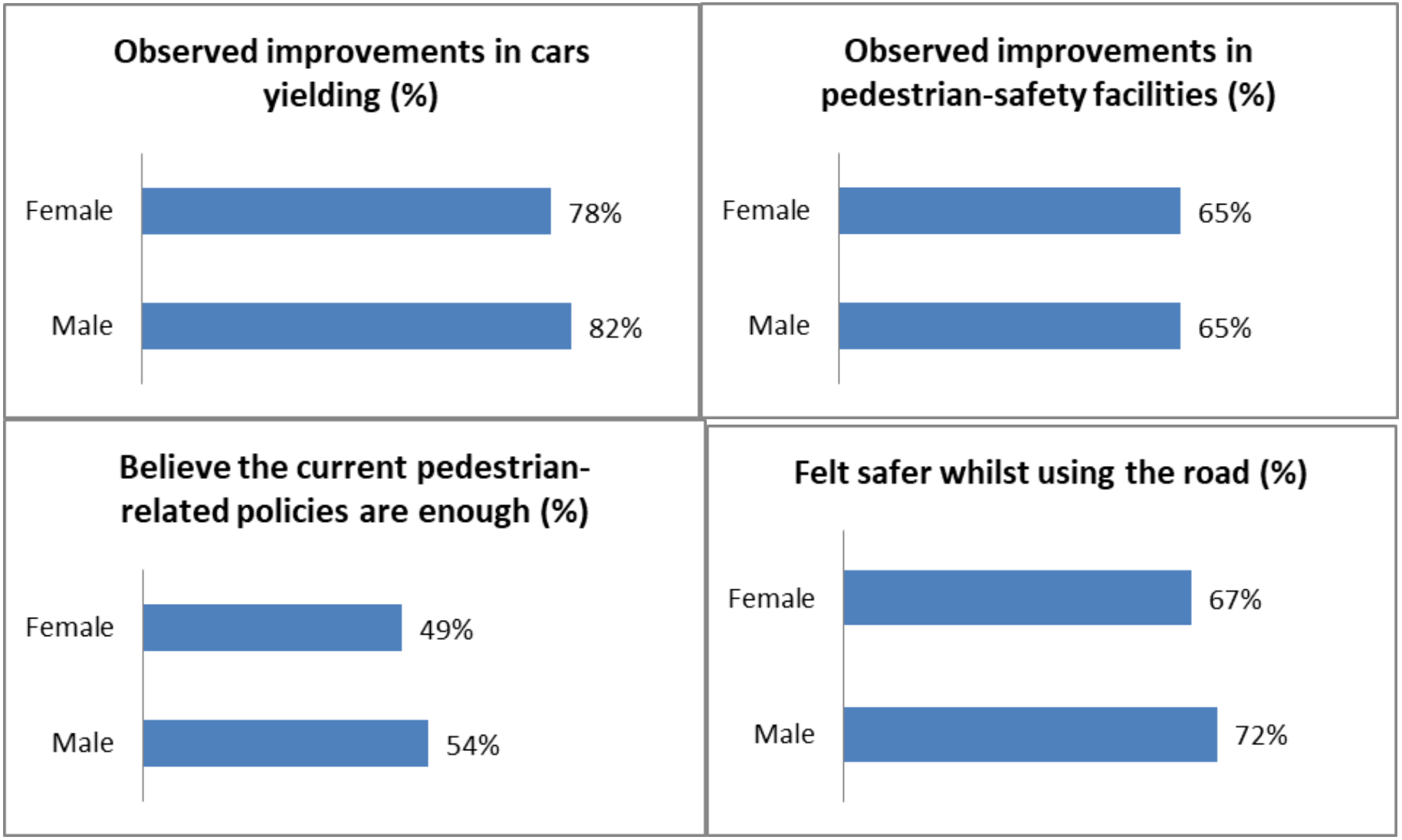
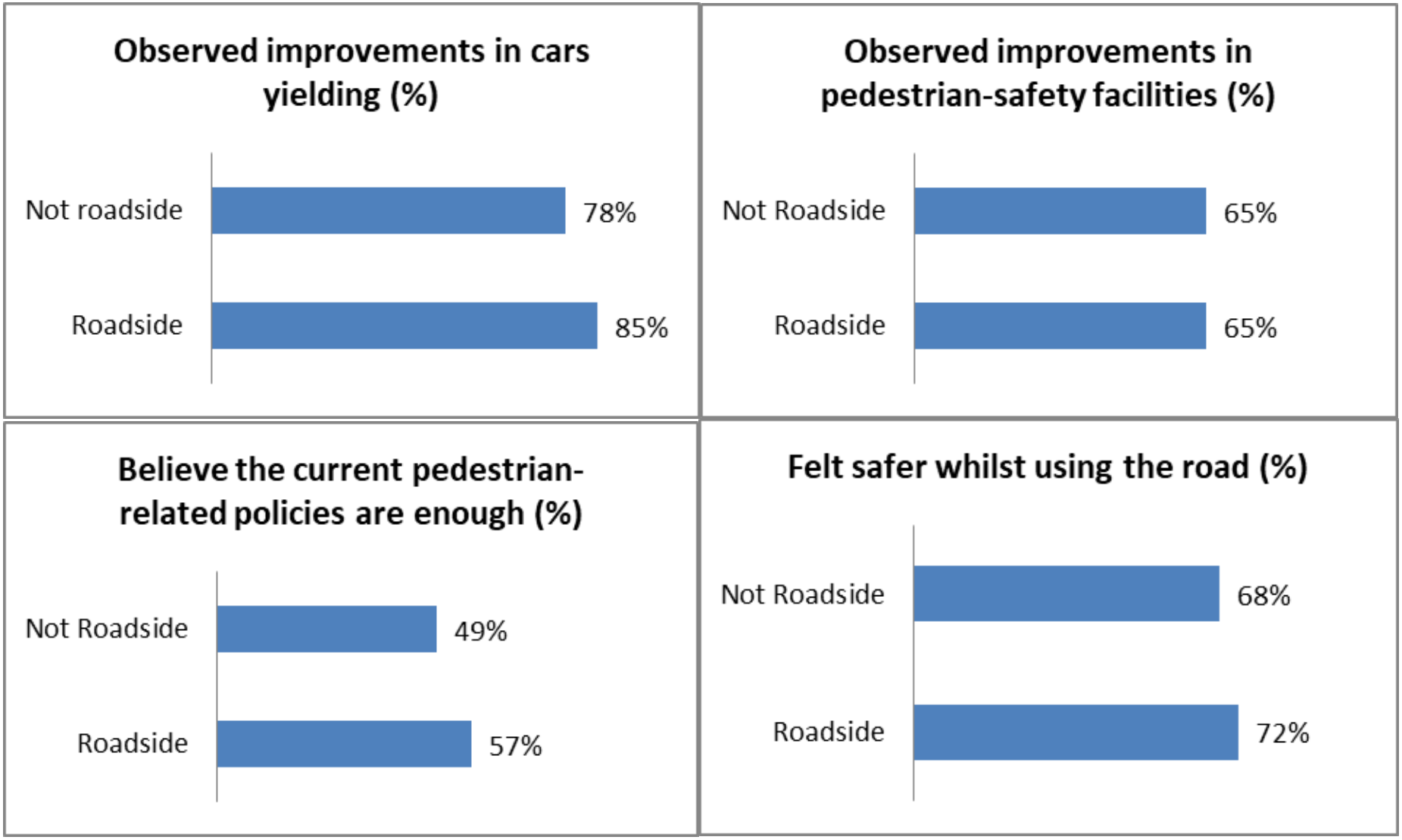


Chart 9~12 Surveyed indicators based on pedestrian's observation post policy implementation by whether surveyed roadside



5.2 Survey Data Regression Results

In Table 9, we show the regression results for the full data of the survey using location of Hsingchu and occupation of other as bases, we can observe significant results for most of the coefficients of the location variables for each of post-policy indicator, especially for LK (Location of Kaoshung), where we can observe positive, significant coefficient estimates for all four of the indicators, and 3 out 4 indicators for the other locations. That is something we do not see if we use any other location as the omitted base, as shown in Table 10, where we use Location of Taoyuan as the omitted base. In Table 10, we see nearly no statistically significant coefficient estimates apart from those of Location of Hsingchu for 3 of the 4 columns, we also observe column 1 now having a statistically significant constant term.

We do not observe any significant coefficient estimates for any other independent variables from both Table 9 and Table 10. However, we can see that all four of the coefficient estimates of the sex variable are negative, suggesting that biological females and those who were surveyed roadside are more likely to have not observed much improvements after the policy change. There seems to not exist much of a relationship between observation of road-related improvements with occupation, which might be expected, as road usage does not necessarily depend on the current stage of occupation of an individual.

Table 9 Pedestrian Survey Using LH as omitted base

	YIELD (1)	FACILITY (2)	POLICY (3)	SAFETY (4)
SEX	-.4225809	-.1222547	-.1463163	-.201735
	(.2750674)	(.2009273)	(.1974978)	(.2140851)
ROAD	-.283379	-.0857038	-.0042612	-.1473902
	(.3174264)	(.2275151)	(.2220131)	(.2438014)
LT	1.433151**	.4730718	.5183957*	1.095422**
	(.3185235)	(.2906826)	(.2945909)	(.301658)
LY	1.233356**	.6801289**	.331329	.6930294**
	(.3661251)	(.3472754)	(.3447704)	(.3410576)
LC	2.493602**	.2442646	.7162303**	1.246797**
	(.5198163)	(.3135383)	(.3198687)	(.3405349)
LK	1.961081**	.6172437**	.8173375**	1.106553**
	(.3620424)	(.3015119)	(.304232)	(.3118304)
OS	.0097448	-.0015864	.0193071	-.0858436
	(.4371557)	(.345543)	(.3370649)	(.3681133)
OW	-.0587128	.2096754	.1903837	-.027955
	(.3938115)	(.304405)	(.2946383)	(.3248639)
_CONS	-.1664542	-.0606898	-.5460863	-.1714291
	(.4770597)	(.3949613)	(.3915801)	(.4131297)

Table 10 Pedestrian Survey Using LY as omitted base

	YIELD (1)	FACILITY (2)	POLICY (3)	SAFETY (4)
SEX	-.4225809	-.1222547	-.1463163	-.201735
	(.2750674)	(.2009273)	(.1974978)	(.2140851)
ROAD	-.283379	-.0857038	-.0042612	-.1473902
	(.3174264)	(.2275151)	(.2220131)	(.2438014)
LT	.1997956	-.2070571	.1870666	.4023921
	(.3656306)	(.3332572)	(.3191494)	(.3306155)
LH	-1.233356**	-.6801289**	-.331329	-.6930294**
	(.3661251)	(.3472754)	(.3447704)	(.3410576)
LC	1.260246**	-.4358643	.3849013	.5537681
	(.5508651)	(.3604482)	(.348596)	(.3748959)
LK	.7277253*	-.0628852	.4860084	.4135239
	(.4030177)	(.3483129)	(.3320689)	(.3460605)
OS	.0097448	-.0015864	.0193071	-.0858436
	(.4371557)	(.345543)	(.3370649)	(.3681133)
OW	-.0587128	.2096754	.1903837	-.027955
	(.3938115)	(.304405)	(.2946383)	(.3248639)
_CONS	1.066901*	.619439	-.2147573	.5216003
	(.567292)	(.4639067)	(.4445403)	(.4759584)

Note: Each column presents results from the regression based on each question of our survey.

**Significant at the 5% level, *Significant at the 10% level

6. Findings and Discussion

As pedestrian safety continues to be a growing concern in the minds of many, the Taiwanese government is no different, through the introduction of the Policy Guidelines for Pedestrian Traffic Safety (2023-2017) and other efforts made in the latter half of 2023, the government aims to have 30% fewer pedestrian traffic deaths by 2030, and to ultimately achieve the "Vision Zero" goal.

Firstly, we can easily observe that the pedestrian traffic deaths have not experienced downturns as of late from the open information from the M.O.T.C.[10] . Then, we further support our hypothesis that government policy implementation via budgeting does not decrease pedestrian traffic deaths from our analysis using data from M.O.T.C and M.O.I, where it shows a positive and statistically significant at the 10% level coefficient estimate for the budget percentage on pedestrian traffic casualties. Through our analysis, we also find positive and statistically significant results for the effect of foreigner density and vehicle amount on pedestrian traffic casualties. Lastly, despite these results, through our survey, we find that people have observed improvements after the introduction of the policy guidelines in 2023 for all indicators: whether more vehicles yield to pedestrians; whether there are improvements in pedestrian safety facilities; whether the existing policies on pedestrian safety are enough; and whether they felt safer on the road. Those of the first and last indicator are especially of significance.

Although our results from the data analysis and the survey analysis may seem contradictory, we believe there are reasons behind this phenomenon. Including the fact that the policy guideline had only commenced in late 2023. This could suggest that even if the government had increased their budget for pedestrian traffic safety related affairs, there may exist a lag of effect, which is not uncommon with government policies, and as our annual data spans only to 2023, we fail to capture any beneficial effects that may have sprouted in 2024 in our data analysis that we have captured in our survey analysis, which was held in May of 2024. This opens the room for further research when more data becomes available.

Our results also suggest that perhaps the government could revise their budgeting, perhaps by putting some focus on the education of pedestrians on road safety issues, as suggested by Pan at al. (2005), that other than drivers, it is also important for the pedestrians themselves to

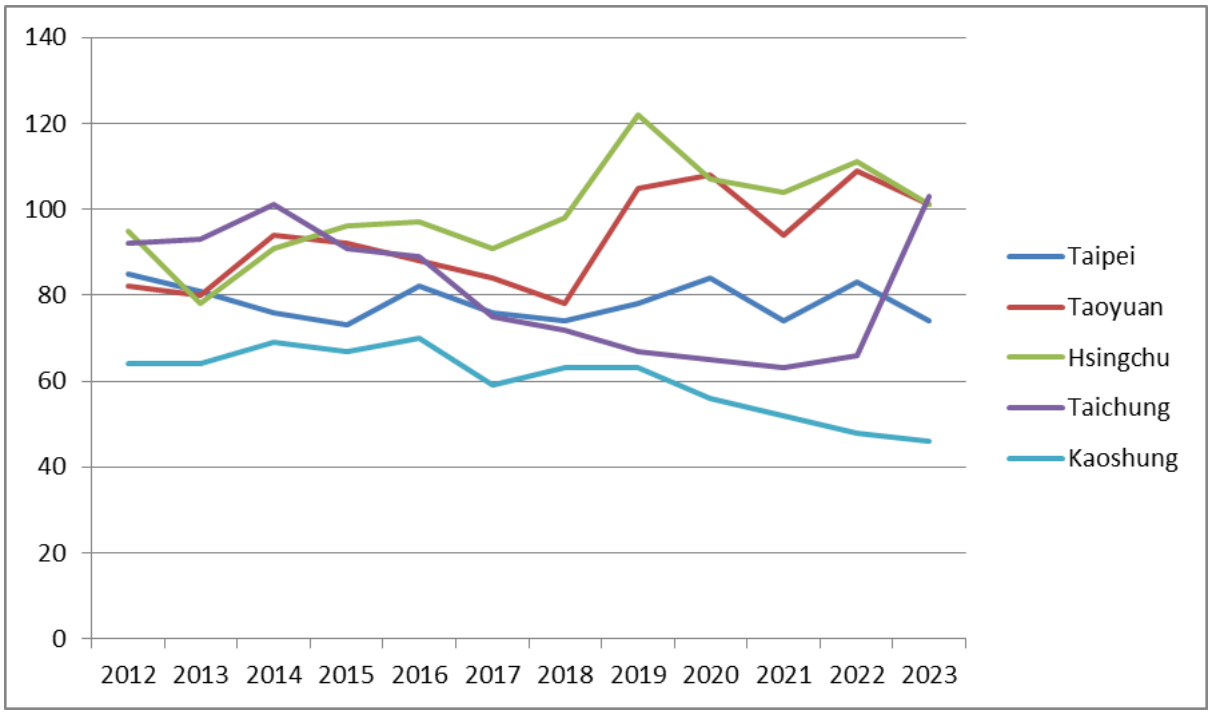
[10] See Road Safety Query Information Network (https://roadsafety.tw/Dashboard/Custom?type=%E7%B5%B1%E8%A8%88%E5%BF%AB%E8%A6%BD%E5%9C%96%E8%A1%A8)

have a clear understanding of road safety concepts. We further emphasize government assistance on education of road safety concepts for foreigners, as they are more likely to not be familiar with the traffic signs and usage in Taiwan, which may lead to improper pedestrian activities that lead to increased pedestrian casualties.

We also find some evidence of uneven development or improvement between the locations surveyed from the differences in the outlooks of those surveyed, with those in Kaoshung having the most optimistic takes and those in Hsingchu being the most pessimistic. The locations we chose to survey are some of the more populated and developed areas in Taiwan, with all except Hsingchu (the provincial city) being special municipalities of Taiwan, which may have also attributed to the uneven development. From Chart 13, we can see that whilst the pedestrian casualties per 100,000 people in 101 are around 60 to 100 for each of the locations, they become more widely spread in 112, spanning from 40 to more than 100 casualties per 100,000 people. It is also evident that Hsingchu has had the highest rates since 2015 (aside from the brief overtake by Taoyuan in 2020), it would make sense for those surveyed in Hsingchu to have a more negative take on improvements. This further supports our findings as we also see Kaoshung continuously having the lowest rates.

In conclusion, our results suggest that while there may not be direct effects in lowering pedestrian traffic casualties by increasing budget percentage just yet, there may be benefits in doing further research as more data are released. We also realize there are limited capabilities to our research as there are other variables that may influence pedestrian traffic casualties, such as attendance of road-safety lectures, amount of licenseless drivers, weather, road conditions, and so on. As they are not available at the annual city-state data, we were unable to include them into our consideration, however, if they were to become attainable, it would certainly be valuable for future research. We also witness that while most people do observe improvements post policy guidelines, it is also suggested that some believe that the current policies may not be sufficient, and that it may be favorable for there to be more implementations in general and in special consideration of the lesser developed (traffic-safety wise) cities in the future. Finally, we also suggest more ways the government may achieve the goal of zero pedestrian fatalities, such as an increase of focus in pedestrians' or non-drivers' participation. Such as, increase in pedestrians' road safety education (Pan at al., 2005) with special care towards foreigners, and encouragement of the establishment of "safe communities" (Kang, 2010).

Chart 13 Pedestrian Casualties per 100,000 people



Note. This chart was made using data from M.O.T.C.'s Road Safety Query Information Network.[11]

[11] See MOTC, Road Safety Query Information Network (https://roadsafety.tw/Dashboard/Custom?type=%E7%B5%B1%E8%A8%88%E5%BF%AB%E8%A6%BD)

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Appendix A Survey

期末專題--行人優先政策與行人死傷數的影響

大家好，我們是修習清大計量經濟學的學生

這份問卷是為了了解行人優先政策上路後，行人實際的用路感受。

請您在下列方格"□"處勾選表示您的想法，謝謝大家花費寶貴的時間填寫！

❗統計資料將只作為課堂報告使用，不會外流也不會要求您留下基本資料❗

- 您目前所在的縣市

□臺北市□桃園市□新竹市□新竹縣□台中市□高雄市□其他:_____

- 請依您實際的用路感受，勾選下列問題

問題	0 非常沒有	1	2	3	4	5 非常有
1. 在您的用路經驗中，是否有觀察到更多車輛願意停讓？						
	□	□	□	□	□	□
2. 您是否認為行人交通安全設施(人行道、行人穿越道等)有改善？						
	□	□	□	□	□	□
3. 您覺得台灣的行人交通安全政策是否足夠嚴格？						
	□	□	□	□	□	□
4. 請問您在用路時，是否有感到比較安全？						
	□	□	□	□	□	□