CHILDREN AT RISK: AN INITIAL COMPARISON OF CHILD PEDESTRIAN TRAFFIC COLLISIONS IN SANTIAGO, CHILE AND SEOUL, SOUTH KOREA

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ABSTRACT

We examine pedestrian traffic collisions involving children in Santiago de Chile and Seoul, Korea in 2010-2011. Descriptive statistics suggest that children in Seoul have a higher risk of being involved in accidents than their counterparts in Santiago; although in Seoul a higher share of children escape without injury than in Santiago. Both cities have temporal patterns unsurprisingly consistent with the school day and school years; although Seoul has slightly lower winter rates. Exploratory regression models reveal varying relationships between different measures of the built form and transportation system and accident density and risk, although further model development is needed.

Keywords: child pedestrian accidents, spatial regression models, descriptive comparison

1 INTRODUCTION

Approximately 1.24 million people die and 50 million are injured every year in road traffic accidents worldwide. Currently, road traffic accidents are the ninth leading cause of disability, globally, and are projected to rise to third by 2020 (ITF, 2012). Globally, approximately 50% of those killed are vulnerable road users (e.g., 22% pedestrians, 5% cyclists, and 23% motorcyclists) (WHO, 2013a). Children and young persons under the age of 25 years old represent more than 30% of traffic deaths and injured in traffic crashes. Road traffic crashes are the leading cause of death among 10–19 year olds globally (Peden, 2009). Furthermore, traffic accidents will be the main cause of death in children under the age of 18 by 2030. In 2004, approximately 262,000 children were killed in pedestrian crashes representing 30% of the total road accident casualties (WHO, 2013).

Despite being a worldwide concern, traffic collision rates vary considerably across contexts. An important issue with understanding relative risks relates to measurement (ITF, 2012). Per capita-based indicators (typically per 100,000 people) measure overall risks, comparable to other causes of death or injury (e.g., disease). Per vehicle-kilometer (or person-kilometer) indicators measure relative transport system risk, although the denominator in this case is rarely broadly and consistently available across contexts. Due to the latter, per vehicle measures (typically per 10,000 registered motorized vehicles) can be used as a proxy, although they require reliable and comparable vehicle fleet statistics (ITF, 2012).

Accident causes and outcomes (e.g., deaths, injury severity) also vary widely, depending upon traffic engineering, driver training, culture, law enforcement, emergency response and health care capabilities, etc. Cross-national empirical evidence suggests a “Kuznets” curve exists for overall risk, with deaths per person increasing up to about $8,600 (international 1985 $) and then declining; deaths per vehicle decline steadily with income until hitting a floor (Kopits and Cropper, 2003)[1]. Among the most dangerous countries in the world in 2010, from an overall traffic risk perspective (deaths per 100,000 persons) include the Dominican Republic (42), Thailand (38), Venezuela (37) and Iran and Nigeria (34); Northern Europe tends to be the safest, including Norway (4.3), Switzerland (4.3), Netherlands (3.9), UK (3.9), Sweden (3), and Iceland (2.8) (WHO, 2013a). Globally, pedestrians account for over 20% of traffic fatalities (derived based on WHO 2013a).

Various studies compare traffic safety between counties, countries or continents, using a variety of techniques (Soderlund and Zwi, 1995; Elvik and Mysen, 1999; Hijar *et al*, 2000; Williamson, 2001; Amoros *et al*, 2003; Nantulya and Reich, 2003; Treurniet *et al*, 2004; Ozkan *et al*, 2006). Elvik and Mysen (1999) performed a meta-analysis of road accident reporting in 13 countries and concluded that reporting levels vary by 21 to 88 percent. Aromos *et al* (2003) analyze injuries and share of fatalities across eight counties in France. To our knowledge, however, no research has attempted a city-level comparative assessment of child pedestrian traffic collisions. Child pedestrian risk is important for a number of reasons: pedestrian activity is an important form of healthy and liberating mobility for the young, ideally helping build and maintain such healthy behaviors over lifetimes; but the risks to children are great and can be compounded as urban land

[1] Somewhat interestingly, Kopits and Cropper (2003) use their models to predict traffic fatalities; ITF’s (2012) actual global estimate for 2011 was equal to their 2020 prediction and 30% higher than Kopits and Cropper’s 2010 forecast.

use and mobility systems become more motorized. We explore children traffic risks in two cities on two continents, in distinct cultures, and at distinct points on the presumed accident risk “Kuznets” curve: Santiago de Chile and Seoul, South Korea. We first compare the situations using descriptive statistics and then specify some initial regression models in order to assess the similarities in relationships between children’s pedestrian collisions and various measures of urban space.

2 THE CONTEXTS

Santiago and Seoul represent interesting comparative cases. Each is the capital and largest city of a dynamic nation. The Republic of Korea (hereafter Korea) has long been one of the economic “success” stories of Asia, entering the OECD in 1996 and ranking 12th on the UN’s Human Development Index (HDI) (just behind Canada). Chile has been one of Latin America’s most dynamic economies over the past 20+ years, entering the OECD in 2010 and ranking 40th on the HDI (just behind Poland). Both have modest population growth rates (<1%) and highly urbanized populations. Korea is roughly twice as wealthy (in per capita terms) and both countries’ economies have been growing at roughly equal rates (per capita) in recent years. Korea has a more manufacturing-, technology-, and trade-oriented economy, with lower unemployment, and higher levels of education and health expenditures. Consistent with their relative stages of economic development, Korea has higher relative CO2 emissions levels, although Chile is increasing more rapidly (or in the case of one indicator, decreasing less slowly). Korea has twice the motorization rate, but Chile’s is growing much more rapidly (Table 1).

Over the past decade, both countries experienced declines in traffic fatalities, overall risk, transport system risk and pedestrian deaths, although in Korea the pedestrian share of all traffic deaths stayed almost the same, about 38% or roughly Chile’s share (Table 2). In other words, overall, the countries have decreased overall risk, consistent with the “Kuznets” theory; Korea, with much higher motorization rates has lower relative transport system risk, about half that of Chile. In both countries, the total youth (under 18) share of pedestrian traffic deaths declined by about 4% (Table 2). According to WHO (2013a), as of 2011, Chile does not have a national road safety strategy, nor is relevant emergency medical training available for doctors or nurses; Korea has a fully funded strategy and relevant training.

The nation’s two capitals are somewhat similar in geographic size (we use Greater Santiago’s 34 *comunas* in this analysis); Santiago covers about 700 km2 while Seoul about 600 km2. Seoul’s population in 2010 almost doubled Santiago’s, 10.3 million versus 5.6 million, resulting in respective gross densities of 160 versus 72 persons per hectare, consistent with the general trend of Asian cities being denser than those of the Americas. Santiago has approximately 16,000 km of roadways, or 20 km/km2, while Seouls’ corresponding figures are 8,666 km and 14.31 km/km2. Almost 22% of the population in Santiago corresponds to school-age children between the ages of 5 and 18.

Table 1: Chile and Korea at a Glace

	Chile		Korea			
Indicator	**Value**	**AAGR**	**Value**	**AAGR**	**CHL**	**KOR**
Population (mns)	17.3	1.0%	49.8	0.5%		
Urban population (% of total)	89.1	0.3%	83.2	0.4%		
Population ages 0-14 (% of total)	21.7	-2.3%	15.9	-2.8%		
GDP per capita, PPP	15251	3.3%	27541	3.3%		
Manufacturing % of GDP	11.9	-3.8%	31.2	2.4%		
Services (% of GDP	57.5	-1.0%	58.1	-0.3%		
R&D Technicians (per mn)	293	0.0%	987	7.7%		2010
Trade % of GDP	72.8	1.4%	110.3	6.0%		
Unemployment (% of labor force)	7.1	-2.2%	3.4	-0.7%		
Health expenditure per capita, PPP	1292	6.7%	2181	9.2%		
Health expenditure, total (% of GDP)	7.5	0.8%	7.2	4.1%		
Hospital beds (per 1,000 people)	2.0	-3.0%	10.3	6.1%	2010	2009
Progression to secondary school (%)	90.6	-1.6%	100.0	0.3%	2007	2008
School enrollment, tertiary (% gross)	66.1	6.2%	103.1	2.3%		
CO2 emissions (kg per 2005 PPP $ of GDP)	0.28	-0.6%	0.41	-2.0%	2009	2009
CO2 emissions (metric tons per capita)	3.94	2.2%	10.36	1.0%	2009	2009
Transport CO2 emissions (mn tonnes)	21.22	3.9%	86.76	-0.2%	2010	2010
Motor vehicles (per 1,000 people)	184.4	4.5%	363.1	2.6%	2010	2010
Passenger cars (per 1,000 people)	126.9	5.2%	275.9	3.6%	2010	2010
Pump price for diesel fuel (US$ per liter)	1.24	8.3%	1.63	6.7%	2012	2012
Pump price for gasoline (US$ per liter)	1.56	7.6%	1.80	3.6%	2012	2012
Road sector energy consumption (% of total)	20.3	0.9%	11.4	-1.6%	2010	2010
Vehicles (per km of road)	40.6	6.2%	161.0	1.5%	2010	2008

Values are for 2011, unless otherwise indicated in last column which represents last available year for the respect country; AAGR is average annual growth rate over period 2005-2011, or closest available years for which data are available. PPP values are in constant 2005 international $. Source: World Bank, 2013.

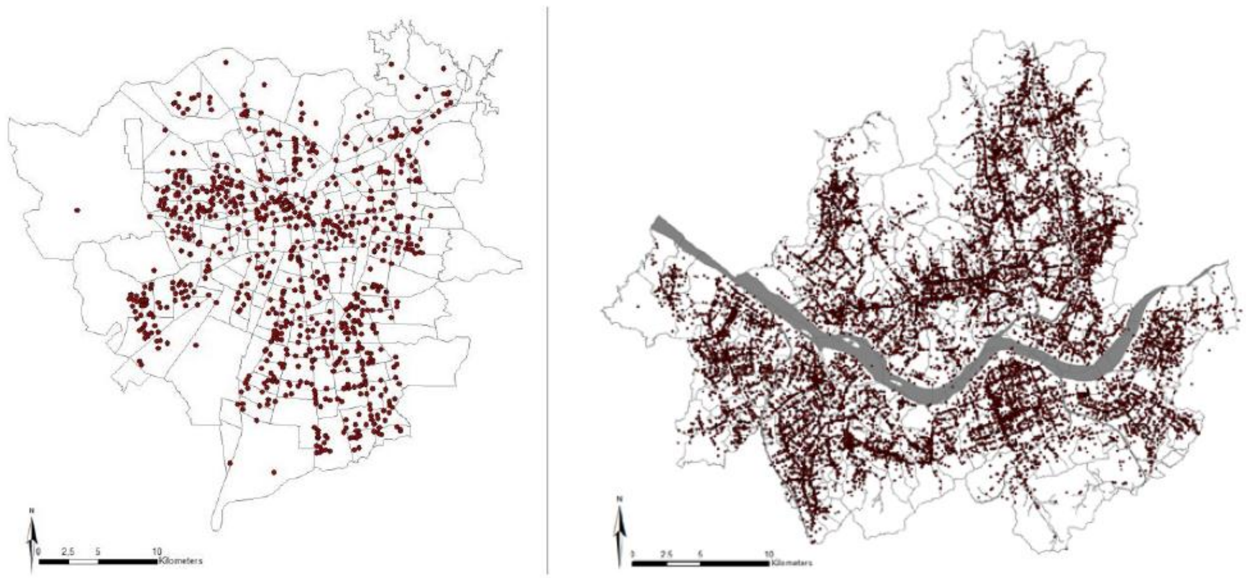
Table 2: Summary of Traffic Fatality Trends

	Chile			Korea		
	2000	**2010**	**AAGR**	**2000**	**2010**	**AAGR**
Total Deaths	1,698	1,595	-0.6%	10,236	5,505	-6.2%
Deaths per 10,000 Vehicles	8.0	4.7	-5.2%	6.9	2.6	-9.8%
Deaths per 100,000 Persons	11.0	9.3	-1.7%	21.8	11.3	-6.6%
Pedestrian Deaths	743	627	-1.7%	3764	2082	-5.9%
Pedestrian % All Deaths	44%	39%	-1.1%	37%	38%	0.3%
% Deaths <18 years old	10%	7.0%	-3.8%	8.3%	5.4%	-4.3%

Sources: CONASET, 2013; IFT, 2012.

3 CHILD PEDESTRIAN CRASH DATA AND DESCRIPTIVE ANALYSIS

We examine school-age children (5 to 18 years old) pedestrian crashes between 2010 and 2011. For Santiago, the data come from the Integrated Statistical System of the Chilean Police (SIEC 2) through CONASET, which maintains a database with all road traffic accidents that occur in Chile. For Seoul, the data, collected by the police, come from the Traffic Accident Analysis System (TAAS). For Santiago, 975 collisions involving child pedestrians were obtained, of which 904 (92.7% were successfully geocoded in a GIS environment. For Seoul, the dataset included 3,532 records of child pedestrian crashes, of which 3,505 (99.2%) were successfully geocoded (See Figure 1).



a) Santiago b) Seoul

Figure 1: Child pedestrian crashes in Santiago and in Seoul between 2010 and 2011

3.1 Child Pedestrian Crash Rate

The cities have somewhat comparable child populations, 1,430,000 and 1,513,125 for Santiago and Seoul, respectively; consistent with Korea's relatively older overall demographics (Table 1). Considering the number of child pedestrians involved in collisions in the two cities (Santiago's 939 and Seoul's 3505), the overall crash risk rate for youth pedestrians in Seoul is up to 3.5 times higher: 66 per 100,000 children in Santiago versus 232 for Seoul. Even accounting for likely differences in reporting levels and some inconsistencies in population boundaries,[2] it seems evident that children in Seoul have a higher risk of being involved in accidents. This may be due to higher pedestrian activity levels, more dangerous traffic conditions or a combination of these and other factors.

[2] The Santiago rate is likely an under-estimate, as the children population is estimated for the entire Metropolitan Region, while the accidents are only for 34 comunas.

3.2 Type of Injury

Korea classifies accidents into four injury types, as shown in Table 3. Chile has five types of injuries, including "less seriously injured." For comparison purposes, the latter injury type was included with type "seriously injured." Overall, 96.8% and 93.5% of all child pedestrian crashes yielded some degree of physical injury in Santiago and Seoul, respectively. In both cities the majority of children pedestrians involved collisions were "slightly injured." More children were left unharmed in Seoul while more were killed in Santiago.

Table 3: Child Pedestrian Injuries in Santiago and Seoul during the period 2010-2011

Type of Injury	Santiago		Seoul	
	Total Number	Percentage	Total Number	Percentage
Unharmed	30	3.2%	229	6.5%
Slightly Injured	581	61.9%	1,914	54.6%
Seriously Injured	316	33.6%	1,345	38.4%
Fatalities	12	1.3%	17	0.5%
Total	**939**	**100.0%**	**3,505**	**100.0%**

3.3 Age

In Santiago, older children tend to be involved in a greater share of the accidents (57% of all child pedestrian crashes involved children between 13 and 18 years of age), while in Seoul, after the age of 6 a somewhat more consistent share of involvement emerges (in Seoul children between 7 and 9 years of age and between 15 and 18 years of age are somewhat more likely to be involved in a pedestrian accident). These tendencies may reflect cultural distinctions; perhaps in Seoul children are granted more independence to venture into public spaces at an earlier age; or perhaps those public spaces where children gather in Seoul are subject to more traffic risk. This may also reflect a "learning" process: in Seoul children learn early and hard (with younger children comprising a higher share than in Santiago); for older kids the rates reverse, as older kids in Santiago represent a greater share than their counterparts in Seoul.

3.4 Gender and Type of Injury

Figure 3 presents the variation of child pedestrian crashes by gender and type of injury. Overall, female children are less likely to be involved as pedestrians in collisions, roughly comparably so in both places: 44% in Santiago and 43% in Seoul. This result is consistent with findings elsewhere (WHO, 2013; Obeng, 2011), suggesting males are more likely to be involved in road traffic crashes.

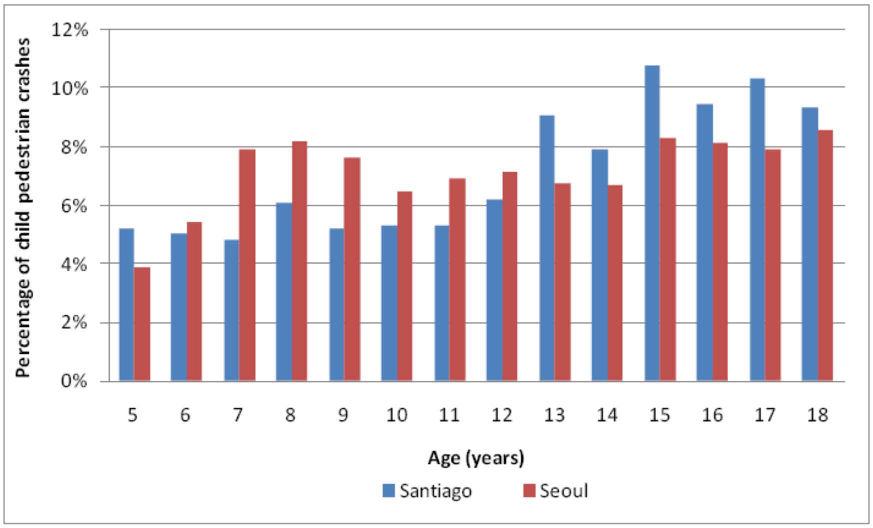


Figure 2: Percentage of child pedestrian crashes by Age in Santiago and Seoul between 2010 and 2011

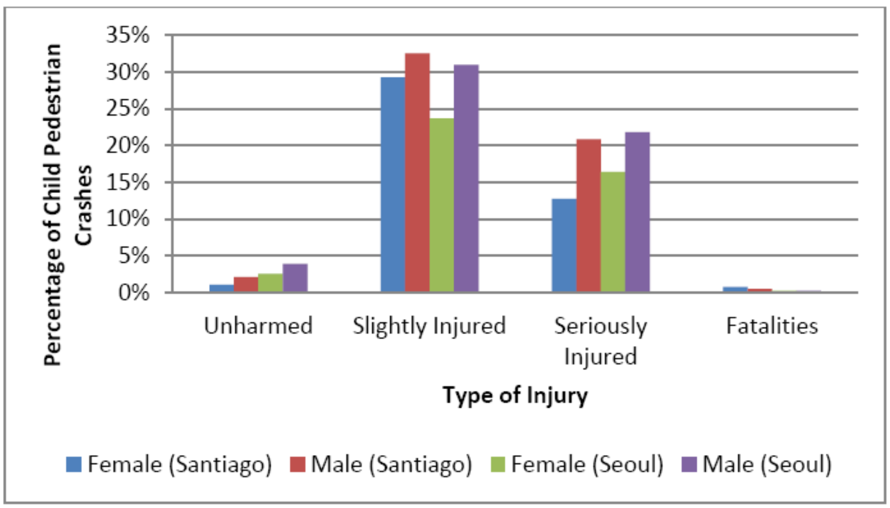


Figure 3: Percentage of child pedestrian crashes segregated by gender and type of injury in Santiago and Seoul

3.5 Time of Day

Santiago and Seoul present similar patterns for child pedestrian crashes throughout the day, with a morning and evening peak consistent with school travel (Figure 4). The only major break to this pattern is at 13:00 and 15:00, when Santiago and then Seoul have different peaks: perhaps reflecting school schedule differences for certain age groups. Overall, the great largest single share of child pedestrian accidents in both places accumulates in the afternoon and evening.

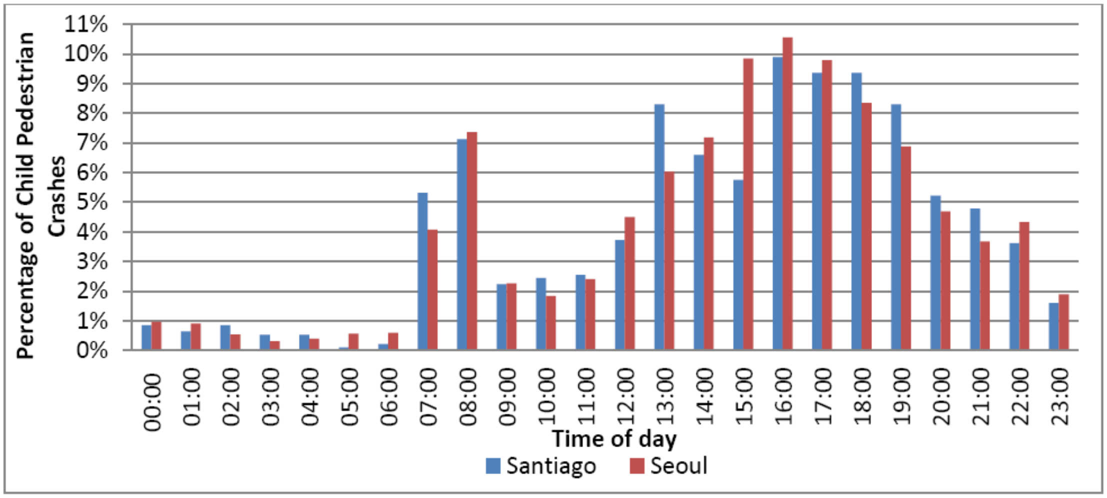


Figure 4: Average percentage of child pedestrian crashes per hour between 2010 and 2011 in Santiago and Seoul

3.6 Day of the Week

Most of the child pedestrian crashes in both cities occurred on weekdays, particularly Wednesdays and Fridays, which accounted for 34.3% and 31.6% of the crashes during the period studied period in Santiago and Seoul, respectively (Figure 5).

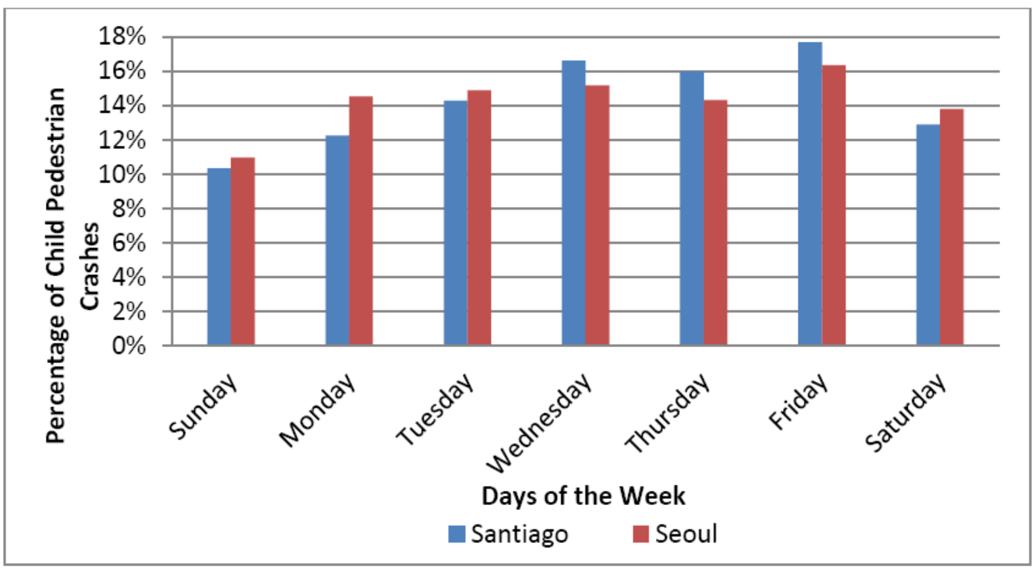


Figure 5: Average percentage of child pedestrian crashes per day of the week for the 2010-2011 period in Santiago and Seoul

3.7 Month of the Year

In Santiago, more child pedestrian crashes occur during the academic year between March and December, with a lower number recorded during the summer time (i.e., January and February), as presented in Figure 6. Note that the month of July also presents a low percentage of child pedestrian crashes with a value of 5.8%, which coincides with the winter break. Another related study with crash data between 2000 and 2008 revealed that the number of child pedestrian crashes increased towards the end of the year coinciding with spring time (Blazquez and Celis, 2013). Our data do not repeat that trend, perhaps due to the number of student protests with massive non-violent marches and school occupations that tarted in August 2011.

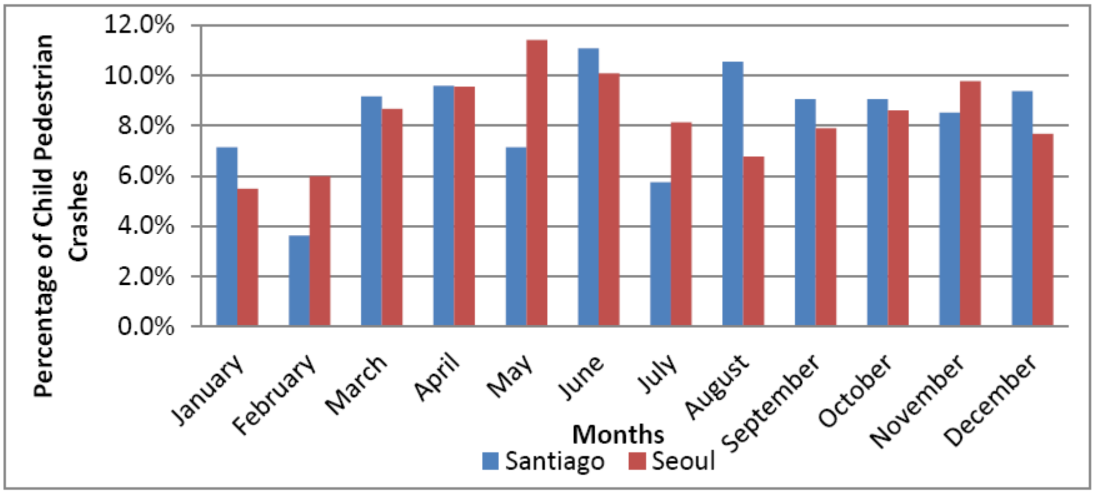


Figure 6: Average Number of Child Pedestrian Crashes per Month for the 2010-2011period

Seoul's accidents also reflects a summer break effect, with lower rates in July and August (school begins late August and ends in mid-July); Seoul also, however, has notably lower winter rates (January-February) perhaps reflecting lower child outdoor street activities in the relatively colder Seoul winter.

3.8 Intersections versus midblock

Over 70% of the child pedestrian crashes in Santiago occurred at intersections, whereas in Seoul only 47.5% occurred at intersections and crossings. This may be due to at least two causes. Perhaps in Santiago, children cross roads surprisingly or carelessly particularly at intersections when there is a red light. Alternatively, and/or additionally, Korean children may obey traffic signals at intersections, but cross roads more often at midblock, yielding higher accident rates at these locations.

4 SPATIAL ANALYSIS

We now present initial models of child pedestrian accidents in both cities, specified and estimated in a consistent manner, with as consistent data as possible. For this analysis, we aggregate the accident data spatially, utilizing the *dong* in Seoul, an administrative unite roughly corresponding to a neighborhood and utilizing police districts in Santiago. As can be seen in Table 3, these spatial units are not consistent in size, which might produce some biases in the results.

Table 1: Statistics for the Dongs in Seoul and Police Districts in Santiago

City	Count	Minimum (km2)	Maximum (km2)	Mean (km2)
Santiago	226	0.45	113.9	4.66
Seoul	424	0.21	12.7	1.43

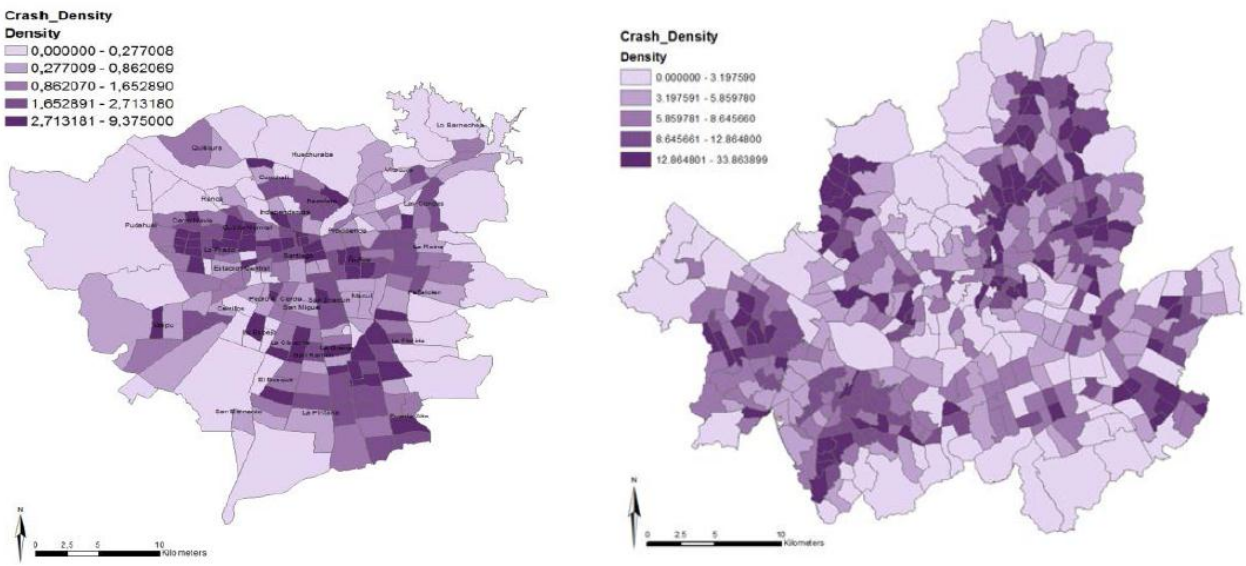
We specify and estimate three different regression models: ordinary least squares (OLS) and two forms of spatial regression models, a spatial lag model (SLM) and a spatial error model (SEM). The latter two models attempt to correct for potential spatial dependence – essentially the prospect that a value associated with any one location may depend on values at other locations. Two basic causes exist: spatial lag, whereby, for example, a poorly maintained house may negatively influence the value of neighboring houses; and spatial error, whereby, for example, the measurement for a particular variable, like crime rates, is influenced by the spatial approach to measurement. Spatial dependence will violate the assumptions (e.g., errors are uncorrelated with each other and with the independent variables, and have equal variance) of OLS regression, producing results that will be biased and/or inconsistent (Anselin, 2001). Practically, spatial dependence can be accounted for in spatial autocorrelation regression models. An SLM assumes that the dependent variable in location *i* is influenced by the values of the dependent and independent variables in the surrounding locations *j* and SEM allows the correlation of error terms across different spatial units (Vandenbulcke-Plasschaert, 2011).

Table 3 presents the key variables and the descriptive statistics employed in the spatial regression models for Santiago and Seoul. The first two variables (ACCDEN and ACCRATE) are the dependent variables and the remainder are explanatory variables of the regression models.

Table 3: Key Variables and Descriptive Statistics

Variables	Description	Santiago (n=226)		Seoul (n=424)	
		Mean	SD	Mean	SD
ACCDEN	Child Pedestrian Accidents / Area (km^2)	1.65	1.59	8.41	5.92
ACCRATE	Child Pedestrian Accidents / 1,000 Children	0.80	1.00	2.88	4.18
POPDEN	Total Population/Area (km^2)	9,574.3	5,573.9	23,818.7	11,902.7
CHILDDEN	Child Population/Area (km^2)	2,684.9	1,896.1	3,524.6	2,025.8
SCHDEN	Number of Schools/Area (km^2)	3.76	2.92	2.31	1.70
BUSDEN	Number of Bus Stops/Area (km^2)	18.43	9.10	13.54	8.13
SUBDEN	Number of Stations/Area (km^2)	0.23	0.48	0.71	1.01
INTDEN	Number of intersections/Area (km^2)	132.54	73.34		
LUDI	Land Use Diversity Index	0.39	0.18	0.21	0.17
ROADDEN	Road Length (km)/Area (km^2)	19.26	7.70	19.99	10.54
P_ARTERIAL	Percentage of Arterial Roads	10.08	7.73	41.45	25.66
P_COLLECTOR	Percentage of Collector Roads	10.64	7.45	15.46	16.93
P_LOCAL	Percentage of Local Roads	79.28	10.50	43.09	37.22
SLOPE	% Rise	2.41	3.73	7.81	6.46

Figure 10 displays the child pedestrian accident density (i.e., number of child pedestrian accidents / area) for Santiago and Seoul. Note that Seoul child pedestrian accidents are more dispersed (with noticeably low rates in the city center) and indicate a higher density than in Santiago.



a) Santiago b) Seoul

Figure 10: Child Accident Density for Santiago and Seoul

Tables 4 and 5 show the results of the regression models for both cities with child pedestrian accident density and rate of child pedestrian accidents as dependent variables, respectively. Note that prior exploratory analysis (examining the correlation matrix) indicated that multicollinearity exists between the independent variables total population and child population. Thus, we excluded the former variable from the models. Similarly, the variables related to road density, intersection density, and percentage of local roads were also omitted from the models.

The accident density model (Table 4) indicates a consistently positive effect of school density in Santiago and a consistently positive effect of density of children in Seoul. Seoul also displays a consistently positively effect of the share of collector type roads. These differences across places warrant further investigation. In both cities, bus stop density is significantly positive, consistent with children congregating at bus stops for travel. Somewhat counterintuitively, land use mix is negatively associated with children accident density across all models in both cities. Perhaps these places have more congestion and slower traffic and/or generate more pedestrian traffic increasing the "safety in numbers" effect. The models suggest evidence of both spatial lag and error. For both cities, 35 to 45% of the variation in child pedestrian accident density can be explained by the variables included.

In terms of accident rate (child pedestrian accidents per child in the zone), we see countering effects regarding the role of population density (positive in Santiago and negative in Seoul), but again the positive effect for bus stop density. Subway station density in Santiago also emerges consistently significant across all models in Santiago. In this case, the spatial models do not seem necessary in Santiago, but both are still appropriate in Seoul. These results warrant future analysis.

Table 4: Results of Regression Models Estimating Child Pedestrian Accident Density

	Santiago (n=226)			Seoul (n=424)		
	OLS Coeff. (S.E.)	**SLM** Coeff. (S.E.)	**SEM** Coeff. (S.E.)	**OLS** Coeff. (S.E.)	**SLM** Coeff. (S.E.)	**SEM** Coeff. (S.E.)
CHILDDEN	0.000	0.000	0.000	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SCHDEN	0.096**	0.095**	0.094**	0.134	0.144	0.206
	(0.035)	(0.034)	(0.034)	(0.147)	(0.140)	(0.137)
BUSDEN	0.060***	0.056***	0.058***	0.128***	0.116***	0.140***
	(0.015)	(0.015)	(0.014)	(0.033)	(0.031)	(0.034)
SUBDEN	0.650**	0.618**	0.628	0.246	0.348	0.384
	(0.207)	(0.201)	(0.205)	(0.236)	(0.225)	(0.233)
LUDI	-1.420*	-1.519**	-1.446**	-5.151***	-4.408**	-4.642**
	(0.560)	(0.544)	(0.551)	(1.469)	(1.401)	(1.547)
P_ARTERIAL	-0.021	-0.019	-0.018	-0.025*	-0.024*	-0.026*
	(0.012)	(0.012)	(0.012)	(0.011)	(0.010)	(0.012)
P_COLLECTOR	-0.024*	-0.023	-0.021	0.064***	0.055***	0.062***
	(0.012)	(0,012)	(0,012)	(0.016)	(0.015)	(0.017)
SLOPE	-0.025	-0.027	-0.032	-0.053	-0.059	-0.093*
	(0.028)	(0.028)	(0.028)	(0.040)	(0.038)	(0.046)
CONSTANT	1.083*	0.896*	1.104**	3.800***	1.913	4.473***
	0.421	(0.420)	(0.420)	(1.036)	(1.055)	(1.156)
W_ ACCDEN		0.178*		-	0.319***	-
		(0.090)			(0.059)	
LAMDA			0.159	-	-	0.356***
			(0.111)			(0.067)
R-SQUARED	0.353	0.337	0.361	0.394	0.440	0.436
LL	-375.6	-373.8	-374.8	-1248.9	-1236.0	-1239.0
AIC	769.3	767.7	767.6	2515.8	2491.9	2496.1

Note: *: p < .05; **: p < .01; ***: p < .001

Table 5: Results of Regression Models Estimating Rate of Child Pedestrian Accidents

	Santiago (n=226)			Seoul (n=424)		
	OLS Coeff. (S.E.)	**SLM** Coeff. (S.E.)	**SEM** Coeff. (S.E.)	**OLS** Coeff. (S.E.)	**SLM** Coeff. (S.E.)	**SEM** Coeff. (S.E.)
POPDEN	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	-0.000*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
SCHDEN	-0.015 (0.024)	-0.017 (0.023)	-0.018 (0.023)	0.046 (0.112)	0.038 (0.114)	0.032 (0.112)
BUSDEN	0.037*** (0.011)	0.037*** (0.011)	0.038*** (0.011)	0.105*** (0.028)	0.090*** (0.027)	0.089** (0.029)
SUBDEN	0.963*** (0.136)	0.942*** (0.134)	0.959*** (0.134)	0.531** (0.199)	0.370 (0.190)	0.275 (0.196)
LUDI	-0.468 (0.383)*	-0.490 (0.376)	-0.466 (0.377)	-1.910 (1.305)	-1.173 (1.243)	-0.919 (1.347)
P_ARTERIAL	-0.005 (0.008)	-0.004 (0.008)	-0.005 (0.008)	0.001 (0.009)	0.002 (0.009)	0.003 (0.010)
P_COLLECTOR	-0.011 (0.008)	-0.011 (0.008)	-0.010 (0.008)	0.016 (0.014)	0.011 (0.013)	0.013 (0.015)
SLOPE	-0.016 (0.019)	-0.016 (0.019)	-0.016 (0.019)	-0.046 (0.034)	-0.050 (0.033)	-0.084 (0.039)
CONSTANT	1.000*** (0.286)	0.960*** (0.282)	1.004*** (0.283)	4.353*** (0.968)	3.028** (0.956)	4.346*** (1.059)
W_ ACCDEN		0.089 (0.097)		-	0.324*** (0.066)	-
LAMDA			0.050 (0.114)	-	-	0.345*** (0.068)
R-SQUARED	0.333	0.337	0.334	0.118	0.183	0.182
LL	-287.463	-287.057	-287.388	-1181.3	-1169.2	-1169.9
AIC	592.927	594.114	592.775	2380.5	2358.3	2357.9

Note: *: p < .05; **: p < .01; ***: p < .001

5 CONCLUSIONS

The global traffic mortality and morbidity epidemic will likely continue to get worse before it gets better, as engineering, cultures, and institutions adapt to a world of more motorized travel. We have examined cities in two countries apparently improving their traffic safety conditions. Specifically, we examine pedestrian traffic collisions involving children in Santiago de Chile and Seoul, Korea, using data from 2010-2011 collected by the relevant authorities. The data suggest that children in Seoul have a higher risk of being involved in accidents than their counterparts in Santiago; possibly due to higher pedestrian activity levels, more dangerous traffic conditions or a combination of these and other factors. However, in Seoul a higher share of children escape without injury than in Santiago, where a higher share are killed than in Seoul. Younger pedestrians in Seoul make up a larger share of crash victims than their counterparts in Santiago; a trend that is reversed for older children. Male children are more likely to be involved in pedestrian accidents in both places. Both cities have temporal patterns unsurprisingly consistent with the school day and school years; although Seoul has slightly lower winter rates, perhaps due to the weather. In terms of relative location, more child pedestrian collisions in Santiago happen at intersections.

Our initial spatial models find consistent relationships between bus stop density in Santiago and land use mix in Santiago and Seoul and the density of child pedestrian crashes in both cities; but examining another measure of risk (accidents per children) reveals different results. Any conclusions drawn from this work, however, should be tentative, at best, as the research is still exploratory. For one, there appears to be differences in reporting quality across the two places, which requires further investigation. Furthermore, numerous explanatory factors remain outside of the current models, such as motorized travel volumes and speeds (by vehicle types), social conditions and income levels, better knowledge of the type of collision (e.g., darting into the street), the characteristics of the actual street where the collision occurred, among others. The models may suffer from the modifiable areal unit problem, due to the aggregation to the zones (not to mention the comparability of the results possibly being affected by the different zone sizes). Additional improvements could entail testing event count model approaches, accounting for potential heteroscedasticity and/or other violations of model assumption, moving away from the crude zone measures, accounting for weather effects, and including roadway geometric design features. Value might also be gained by extending beyond pedestrian risks alone; or comparing pedestrian risks for children with the other modes by which they travel in the city. Clearly work remains to be done to better understand the comparative traffic safety risks in rapidly motorizing urban settings.

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