Subway Platform Screen Doors (PSDs) and Suicides in Korea*

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Abstract

Background: Subway suicide has emerged as a social problem in Korea, going well beyond a personal issue. Despite the Korean government's plan to install more platform screen doors (PSDs) to prevent suicide, there is still a significant number of stations across the nation left unequipped with the PSDs. Due to its high cost, the installation of the PSDs requires objective evidence that supports its cost-effectiveness. The subway stations in Seoul have begun featuring screen doors several years ago. However, so far, there is no research on the cost-effectiveness of installing screen doors.

Methods: Using the data on suicide cases that occurred at the Seoul Metro between 2003 and 2012, this study analyzes the impact of the installation of the PSDs on reducing subway suicide under the Poisson regression model. In addition, using the data on the installation cost of the PSDs installed between 2005 and 2009, this research estimates the average installation cost per suicide under limited assumptions.

Results: Findings suggest that the installation of the PSDs clearly reduces subway suicide and that it costs USD 10.21 Million to save a potential suicide victim as of 2010. It is estimated that the average cost needed to save a potential suicide would be USD 1.18 Million, USD 0.75 Million, USD 0.59 Million, and USD 0.51 Million in 2020, 2030, 2040, and 2050, respectively.

Limitation: The limitation of this research paper is that the analysis on the effectiveness of the PSDs installation in reducing suicide is carried out under an assumption that a potential suicide victim does not easily change his or her suicide method. In other words, this paper excludes any possibility that the potential suicide victim may change his or her mind to commit suicide at a station that is not equipped with screen doors. Also, due to limited access to available data, this study does not take into consideration a wide range of socio-economic factors including mental and pathological diseases that may have an impact on suicide.

Conclusion: The installation of the PSDs at the Seoul Metro contributes to reducing subway suicide and that the average installation cost per suicide is expected to decrease gradually. This research provides the grounds based on which the cost-effectiveness of subway platform screen doors in suicide prevention in Korea is tested. At a time when subway suicides are occurring frequently and when there remains a significant number of subway stations not equipped with platform screen doors, this paper offers important policy implications for policy-makers in charge of improving train and subway safety.

JEL: I18, I31

Key Words: Suicide, Subway, Platform Screen Door (PSD)

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1. Introduction

Among the OECD countries, Korea has the highest suicide rate of 29.1 per 100,000 as of 2012, far higher than the OECD average of 12.1 per OECD standard population (100,000 people) (Statistics Korea, 2014, p.17). Suicide is the fourth leading cause of death, following by cancer, cerebrovascular and cardiovascular diseases in Korea (Statistics Korea, 2014, p.6).

Depending on the social and cultural backgrounds, there are various suicide methods. For instance, the most common ones in Korea are hanging (50%) and jumping from tall heights (17%) (Ministry of Health and Welfare, 2014, p.6). Recently, the numbers of subway and railway suicides are increasing at an alarming rate. As of 2013, 73 out of 128 subway and railway accidents are estimated to be suicide related, accounting for more than half of the cases (Ministry of Land, Infrastructure and Transport, 2013, p.7).

In recognition of the severity of the issue, the Ministry of Land, Infrastructure and Transport established 'The National Transport Safety Basic Plan 2012-2016' in 2011, including strategies to set up a safe transport infrastructure to achieve a mid- and long-term goal of earning a place among the '10 best countries for safe transportation.' According to the plan, platform screen doors that are proven to be effective in preventing suicide would be additionally installed at 169 stations in order to prevent railway passenger accidents and suicide (Ministry of Land, Infrastructure and Transport, 2013, pp.3-5).

Seoul Metropolitan Subway (Seoul Metro), one of the public corporations that operate the Seoul subway lines, is no exception. According to accumulated data from 2003 to 2012, 135 suicide cases occurred. Against this backdrop, Seoul Metro spent about USD

194.06 million on installing platform screen doors in 121 stations between 2005 and 2009[1] as part of its efforts to prevent passenger accidents and enhance safety (Seoul Metro, 2014a).

Now after about five years, many people began questioning the quantitative effect of installing platform screen doors on suicide prevention. Though proven to be more effective than other institutions or technical devices, screen doors have not been readily installed due to high cost (Matsubayashi et al., 2012). Acknowledging that there are no empirical studies on the effect, this paper aims to examine whether platform screen doors (PSD) prevent subway suicides and save lives effectively.

Using data on suicides and PSD installation, this study focuses on the contribution of screen doors in reducing Korea's subway suicide rate. Also, under limited assumptions, it seeks to analyze the economic cost of preventing one suicide and provide policy implications to policy-makers in charge of improving transportation safety.

The study finds that the PSDs installed at the Seoul Metro contributed to the statistically significant prevention of suicides and on a "back-of-the-envelope" calculation, it costs USD 10.21 Million to save a potential suicide victim as of 2010. Given that suicide trends continue in the future, the average cost is estimated to be USD 1.18 Million, USD 0.75 Million, USD 0.59 Million, and USD 0.51 Million in 2020, 2030, 2040, and 2050, respectively. This is the only empirical research that analyzes the cost of installing PSDs at Seoul Metro stations and its impact on suicide prevention.

This paper consists of the following five chapters: Chapter 1. Introduction; Chapter 2. Data and Summary of Statistics; Chapter 3. Analytical methodologies; Chapter 4. Analytical Results; Chapter 5. Review and Conclusion.

[1] PSD is installed at Sindorim Station (branch line) on December 2011 and the installation cost is included in the calculation.

2. Data and Descriptive Analysis

In Seoul there are multiple public corporations responsible for operating the subway, including Seoul Metro (line numbers 1-4), Seoul Metropolitan Rapid Transit Corporation (line numbers 5-8), and others. Due to the limited access to personal data on individual suicides, this paper made an analysis using only data acquired from Seoul Metro that runs subway lines 1 to 4.[2]

Seoul Metro runs 121 subway stations: 10 on Line 1 (from Cheongnyangni to Seoul Station), 51 on Line 2 (Entire Section), 34 on Line 3 (from Jichuk to Ogeum), and 26 on Line 4 (from Danggogae to Namtaeryeong). Between 2005 and 2008, Seoul Metro installed PSDs across subway stations it manages. From 2003 to 2012, subway suicides occurred at 69[3] stations: 7 on Line 1, 31 on Line 2, 13 on Line 3, and 18 on Line 4, accounting for 57% of 121 stations equipped with screen doors (<Table 2.1>).

Among these, Guii Station on line 2 and Hansung University Station on line 4 recorded the most number of suicide cases with 5 (3.7% of a total of 135) each, followed by 4 (3.0%) at Jegidong, Bulgwang, Isu, and Suyu Station.

By line number, Line 2 recorded the most number of suicide cases with 58 (43.0%), followed by line 4 with 36 (26.7%) and line 3 with 26 (19.3%). line 1 recorded the least number of suicide cases with 15 (11.1%).

[2] From 2003 to 2012, the number of fatal accidents at the Seoul Metro is recorded at 163, among which suicide cases amount to 135, which is 83% of the total.

[3] Namyeong Station (Seoul Metro line 1) is included among the 69 stations because two subway suicide accidents occurred when a suicide at the Seoul Station jumped into an oncoming train bound for Namyeong Station, back then unequipped with screen doors.

<Table 2.1> Number of Suicides by Locations (2003-2012)

Line #	Station Name	Suicide #	Percent
1	Cheongnyangni	1	0.7%
1	Dongdaemun	2	1.5%
1	Jegidong	4	3.0%
1	Jongno5ga	3	2.2%
1	Namyeong	2	1.5%
1	Seoul Station	2	1.5%
1	Sinseoldong	1	0.7%
2	Ahyeon	2	1.5%
2	Bangbae	1	0.7%
2	Bongcheon	3	2.2%
2	Chungjeongno	3	2.2%
2	City Hall	2	1.5%
2	Daerim	2	1.5%
2	Dangsan	3	2.2%
2	Euljiro1ga	1	0.7%
2	Euljiro3ga	1	0.7%
2	Gangbyeon	3	2.2%
2	Gangnam	1	0.7%
2	Guro Digital Complex	2	1.5%
2	Guui	5	3.7%
2	Hanyang Univ.	2	1.5%
2	Hongik Univ.	1	0.7%
2	Jamsillaru	2	1.5%
2	Konkuk Univ.	1	0.7%
2	Mullae	1	0.7%
2	Sadang	1	0.7%
2	Sangwangsimni	2	1.5%
2	Seolleung	1	0.7%
2	Seoul Nat'l Univ.	2	1.5%
2	Sillim	1	0.7%
2	Sincheon	3	2.2%
2	Sinchon	2	1.5%
2	Sindaebang	3	2.2%
2	Sindang	2	1.5%
2	Sinjeongnegeori	2	1.5%
2	Sinseoldon	1	0.7%
2	Sports Complex	1	0.7%
2	Ttukseom	1	0.7%
3	Bulgwang	4	3.0%
3	Dogok	3	2.2%
3	Dongnimmun	2	1.5%
3	Express Bus Terminal	3	2.2%
3	Gupabal	1	0.7%
3	Hangnyeoul	1	0.7%
3	Hongje	3	2.2%
3	Irwon	2	1.5%
3	Jichuk	1	0.7%
3	Nokbeon	2	1.5%
3	Seoul Nat'l Univ. of Education	1	0.7%
3	Yaksu	1	0.7%
3	Yeonsinnae	2	1.5%
4	Changdong	1	0.7%
4	Chungmuro	2	1.5%
4	Dongdaemun History & Culture Park	1	0.7%
4	Dongjak	1	0.7%
4	Gireum	1	0.7%
4	Hansung Univ.	5	3.7%
4	Hyehwa	1	0.7%
4	Ichon	1	0.7%
4	Isu	4	3.0%
4	Miasageori	3	2.2%
4	Myeongdong	1	0.7%
4	Namtaeryeong	1	0.7%
4	Nowon	2	1.5%
4	Seoul Statation	1	0.7%
4	Sinyongsan	2	1.5%
4	Sookmyung Women's Univ.	3	2.2%
4	Ssangmun	2	1.5%
4	Suyu	4	3.0%
	Total	135	100.0%
	Subtotal (Line # 1)	15	11.1%
	Subtotal (Line # 2)	58	43.0%
	Subtotal (Line # 3)	26	19.3%
	Subtotal (Line # 4)	36	26.7%

The data on suicide cases that occurred between 2003 and 2012 includes the following: gender, age of a victim, and time of suicide. <Table 2.2> summarizes the above-mention data on suicide cases.

2.1. Gender

By gender, the number of suicides among men is 100, roughly three times higher than women whose number of suicide stands at 33. This is consistent with the nation's persisting trend of suicides in that men are more likely to commit suicide than women (<Figure 2.1>).

Korea's male-to-female ratio of suicide in general was 2.21 and 2.30 in 2003 and 2013, respectively (Statistics Korea, 2014, p.17), consistently lower than that of subway suicide. Such trend can be observed in other countries as well: the gender ratio of subway suicide was 4.26 for New York between 2003 and 2007 (Lin and Gill, 2009); it was 1.86 for the Lucknow Metro in India between 2007 and 2012 (Kumar et al., 2013).

2.2. Age

By age groups, people in their 20s have the highest number of suicide with 27, followed by 60s with 24, 30s and 40s with 23, 50s with 17, respectively. These figures do not exactly match the nation's overall pattern in the number of suicides shown across age groups: people in their 40s have the highest number of suicide, followed by 50s, 30s, 60s, and 70s, while those in their 20s have a comparably low number of suicides (Statistics Korea, 2013). This is attributable to different suicide methods across all age groups (<Figure 2.2>).

Different countries show different suicide trends by age. As for the Lucknow Metro in the city of Lucknow, India, a study on 297 suicide cases that took place between 2007 and 2012 suggest the following: people in their 20s ranked highest with 28%, followed by 30s (20%), teenagers (15%), and 50s (15%) (Kumar et al, 2013). In Sweden, a study on 145 suicide cases that took place between 2000 and 2002 showed the following: people in their 30s ranked first with 21%, followed by 40s (19%), 50s (19%), and 20s (18%) (Radbo et al., 2005).

2.3. Timing of Occurrences

2.3.1. Year

The number of suicide deaths recorded was 21 for year 2003 and it decreases from 20 in year 2004 to 18 in both years 2005 and 2006. Following a temporary increase to 24 in year 2007, the figure decreases once again to 19 in year 2008 and 14 in year 2009. Since the installation of PSDs in 2009, there have been hardly any suicides except for one in 2011 (<Figure 2.3>).

The number of suicides in Korea has been gradually increasing from 10,898 in 2003 to 14,427 in 2013, except for a temporary decrease in 2006 (10,653) and 2012 (14,160) (Statistics Korea, 2014). On the other hand, the number of subway suicides has been declining during the same period, mainly because of the installation of platform screen doors, except for a temporary increase in 2007.

2.3.2. Month

By month, suicide occurs most frequently in February with 17, followed by August

with 15, March with 13, January with 12, and December, recording lowest with 5 (<Figure 2.4>).[4]

As of 2013, general suicides occurred in March (9.6%) and May (9.4%), followed by June (8.9%), January (8.8%), April (8.7%), October (8.3%), February (8.1%), August (8.0%), September (8.0%), November (7.2%), and December (6.8%) (Statistics Korea, 2014, p.18). The result partly differed for subway suicides.

Different patterns were observed for different countries as well. Between 2003 and 2007, subway suicides occurred most in May (14%) and November (11%), and least in June (5%) and September (2%) in New York (Lin and Gill, 2009). Between 2007 and 2012, subway suicides occurred most in August (11%) and November (9%), and least in January (7%) and October (7%) in Lucknow (Kumar et al., 2013). Lastly, between 2000 and 2003, subway suicides occurred most in July (12%) and May (12%), and least in December (5%) and January (4%) in Sweden (Radbo et al., 2005).

2.3.3. Day of the Week

By day of the week, Sunday shows the highest number of suicides with 23, followed by Monday and Friday with 21 each, Thursday with 20, Tuesday with 18, Saturday with 17, and posting lowest was Wednesday with 15 (<Figure 2.5>).

Also consistent with the findings of this research, subway suicides occurred most on Tuesday (23%), Monday (16%) and Thursday (16%), and least on Wednesday (7%) in New York (Lin and Gill, 2009),. Meanwhile, in Sweden, subway suicides occurred most on Friday

[4] When categorized into seasons, the number of suicides is 34 (25.2%), 36 (26.7%), 31 (23%), and 34 (25.25%) for Spring (March ~ May), Summer (June ~ August), Autumn (September ~ November), and Winter (December ~ February), respectively. While Summer has the highest suicide frequency, Autumn has the lowest. No uniform categorization of seasons exists. Therefore, this study's statistical data classified into seasons is not compared with that of previous papers.

(18%) and Tuesday (17%), and least on Wednesday (12%), as the case on New York (Radbo et al., 2005).

Quite contrary to the outcome of this research in Germany, between 2002 and 2006, subway suicides occurred most on Tuesday (16%) and Thursday (16%), and least on Sunday (12%), (Dinkel et al., 2011).

2.3.4. Time of Day

By time of day, the number of suicides is highest from 10:00 to 11:00 with 13, followed by 12:00-13:00 and 20:00-21:00 with 10 each, 11:00-12:00 and 13:00-14:00 with 9, each, and 7:00-8:00 and 19:00-20:00 both with 8. Among the operating hours of subway, the number of suicides is the lowest with three for both 5:00-6:00 and 8:00-9:00. Meanwhile, there was no suicide occurrence when the subway closes from 1:00 to 5:00 (<Figure 2.6>).

As for the number of suicides by time of day, it is quite tough to make a comparison between existing studies and this research because the former is analyzed for every three or four hours, instead of every hour. Nevertheless, the distribution of suicides over time can be observed for both cases with a peak from 9am to 9pm when people are most active, and a subsequent decrease in the early morning hours (Lin and Gill, 2009; Radbo et al, 2005).

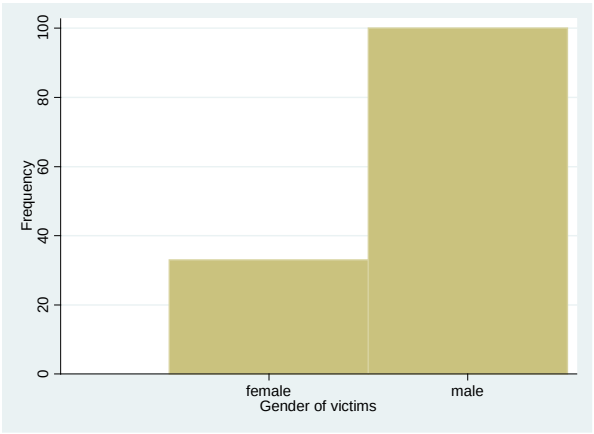
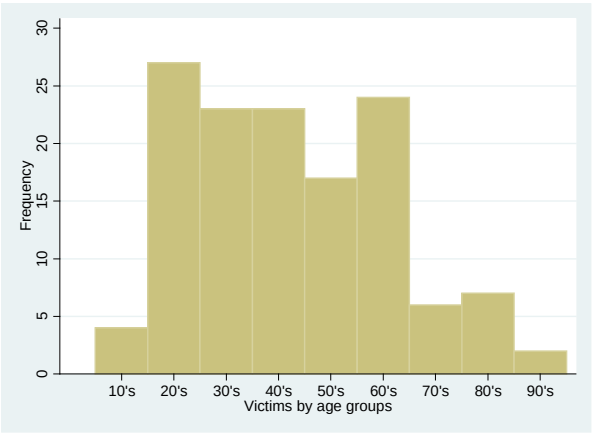
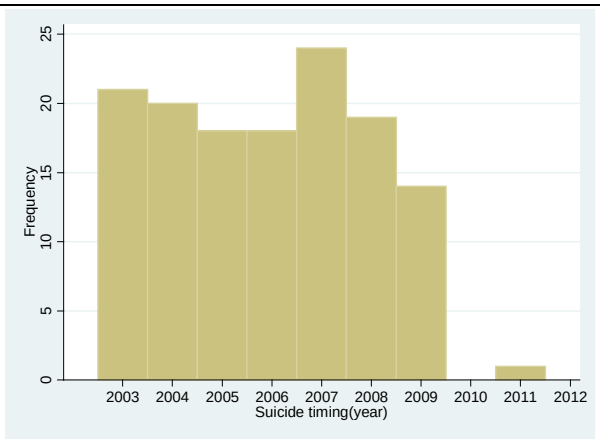
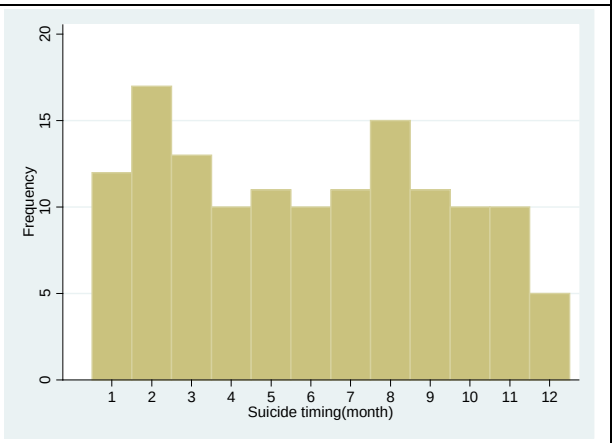
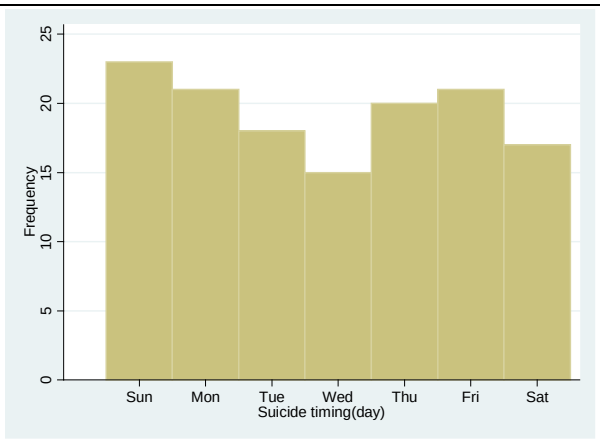
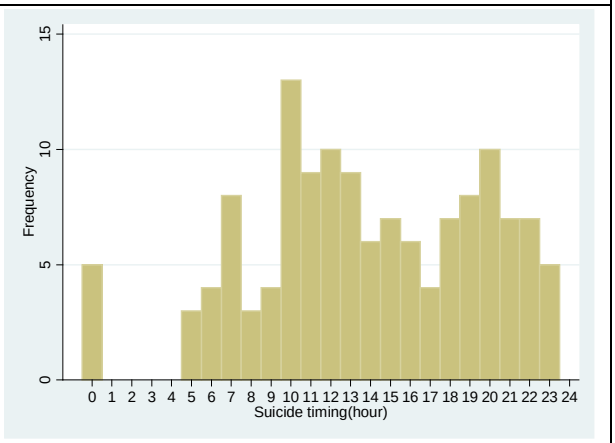
<Table 2.2> Number of Suicides by Gender, Age and Time (2003-2012)

Classification		N	%	Classification		N	%	Classification		N	%
Gender	Male	100	24.4	Month	January	12	8.9	Time	00:00-01:00	5	3.7
	Female	33	74.1		February	17	12.6		01:00-02:00	0	0.0
	Unknown	2	1.5		March	13	9.6		02:00-03:00	0	0.0
Age	10-19	4	3.0		April	10	7.4		03:00-04:00	0	0.0
	20-29	27	20.0		May	11	8.1		04:00-05:00	0	0.0
	30-39	23	17.0		June	10	7.4		05:00-06:00	3	2.2
	40-49	23	17.0		July	11	8.1		06:00-07:00	4	3.0
	50-59	17	12.6		August	15	11.1		07:00-08:00	8	5.9
	60-69	24	17.8		September	11	8.1		08:00-09:00	3	2.2
	70-79	6	4.4		October	10	7.4		09:00-10:00	4	3.0
	80-89	7	5.2		November	10	7.4		10:00-11:00	13	9.6
	90-99	2	1.5		December	5	3.7		11:00-12:00	9	6.7
	Unknown	2	1.5	Season	Spring	34	25.2		12:00-13:00	10	7.4
					Summer	36	26.7		13:00-14:00	9	6.7
Year	2003	21	15.6		Autumn	31	23		14:00-15:00	6	4.4
	2004	20	14.8		Winter	34	25.2		15:00-16:00	7	5.2
	2005	18	13.3						16:00-17:00	6	4.4
	2006	18	13.3	Day	Sunday	23	17.0		17:00-18:00	4	3.0
	2007	24	17.8		Monday	21	15.6		18:00-19:00	7	5.2
	2008	19	14.1		Tuesday	18	13.3		19:00-20:00	8	5.9
	2009	14	10.4		Wednesday	15	11.1		20:00-21:00	10	7.4
	2010	0	0.0		Thursday	20	14.8		21:00-22:00	7	5.2
	2011	1	0.7		Friday	21	15.6		22:00-23:00	7	5.2
	2012	0	0.0		Saturday	17	12.6		23:00-24:00	5	3.7
Total		135	100	Total		135	100	Total		135	100

Note: 1) The number inside the bracket is a percentage, rounded off to the nearest integer. Therefore, the percentages may not sum up to 100.

2) A year is divided into four seasons: Spring (March ~ May), Summer (June ~ August), Autumn (September ~ November) and Winter (December ~ February)

Source: Seoul Metro (2014b)

<Figure 2.1> Gender of Suicide Victims	<Figure 2.2> Age of Suicide Victims
	
<Figure 2.3> Suicide Timing (Year)	**<Figure 2.4> Suicide Timing (Month)**
	
<Figure 2.5> Suicide Timing (Day)	**<Figure 2.6> Suicide Timing (Hour)**
	

In addition, this paper used data on the status of installed screen doors, including the name of the station, the subway line number, and the time of installation. <Table 2.3> compares the suicide occurrence before and after the installation during the period from 2003 to 2012.

According to the table, the number of suicides which occurred before the installation was 132. The figure significantly dropped to three[5] after the installation, implying that the annual average was 19 from 2003 to 2009 when the installation was complete.

<Table 2.3> Number of Suicides (Before vs After Installation)

Year	Before Installation	After Installation	Total
2003	21	0	21
2004	20	0	20
2005	18	0	18
2006	18	0	18
2007	24	0	24
2008	18	1	19
2009	13	1	14
2010	0	0	0
2011	0	1	1
2012	0	0	0
Total	132	3	135

Source: Seoul Metro (2014a; 2014b)

[5] After the installation, a total of three suicide cases occurred at Gangbyeon and Konkuk University Station that feature half-height platform gates or chest-height sliding doors. While there are two types of screen doors, Home Door (half-height platform screen doors) and Screen Door (full-height platform screen doors), this study examines the effect of both. Full-height platform screen doors are more effective than half-height doors in preventing suicide, as evidenced by research findings which suggest that all the subway suicides have taken place at stations with half-height platform screen doors since the installation of subway platform screen doors in Korea.

3. Estimation Method

To analyze the impact of installing platform screen doors at Seoul Metro on the frequency of suicide, this study uses Poisson regression whose equation is shown in (1).

$$s_{it} = \alpha_0 + \alpha_1 * d_{i,t} + \beta X + u \quad (1)$$

s_{it}, a dependent variable, denotes the number of suicides that occurred at the station i in the year t. $d_{i,t}$, a dummy variable, denotes whether the station is equipped with platform screen doors in the year t when suicide occurred. The dummy variable appears 0 if the time of suicide (YY/MM/DD) comes before the installation and 1 if the time of suicide (YY/MM/DD) comes after the installation. Therefore, α_1 represents the treatment effect of PSDs, while X shows the year dummy and station fixed effect.

4. Estimation Results

4.1. Poisson Estimation

When suicide comes after the installation, the analysis outcome of Poisson regression suggests the following: when the year dummy is not taken into consideration, the coefficient of the dummy variable is -3.5966; the coefficient of the dummy variable is -4.2808 when the year dummy is taken into consideration; the coefficient of the dummy variable is -4.0824 when both the year dummy and station dummy are taken into consideration. Note that the

negative sign of the coefficient means that the installation of platform screen doors contributes to the reduction of suicides.

Under the first model, the incidence relative ratio (IRR) is 0.0274, while 95% confidence interval (CI) is 0.0064 ~ 0.1179. This means that the installed PSDs resulted in the reduction of suicide rate by 97% (CI: 88~99%). Under the second and third model, the IRR is 0.0138 (CI: 0.0031 ~ 0.0605) and 0.8827 (CI: 0.0036 ~ 0.0798) respectively, which means that the PSDs led to the reduction of suicide rate by 99% (CI: 94~100%) and 98% (CI: 92~100%), respectively.

<Table 4.1> Regression Results

	(1)			(2)			(3)		
	Effect	95% CI		Effect	95% CI		Effect	95% CI	
Dummy for PSDs	-3.5966***	-5.0556	-2.1376	-4.2808***	-5.7572	-2.8043	-4.0824***	-5.6371	-2.5278
	(0.744)			(0.753)			(0.793)		
Year Dummy	NO			YES			YES		
Station Dummy	NO			NO			YES		
Constant	-1.6201***	-1.8177	-1.4226	-14.9964***	-16.4773	-13.5154	-16.9574***	-18.8671	-15.0478
	(0.101)			(0.756)			(0.974)		
Observations	1,210			1,210			1,210		
IRR	0.0274	0.0064	0.1179	0.0138	0.0031	0.0605	0.0169	0.0036	0.0798

Note: Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

4.2. Average Unit Cost of Preventing Suicides

In this section, the PSD installation cost at Seoul Metro is used to calculate the average cost of preventing a suicide. As shown below (<Table 4.2>), PSDs were installed at 121 stations between the 2005 and 2009 period. Private investment, the Seoul Metropolitan Government's budget, and the Seoul Metro's own capital were used to cover the total installation cost of USD 194.06 million.

For reference, Seoul Metro spent USD 216.71 million on installing the doors. However, this study excludes the maintenance cost of USD 22.65 million (incidental expenses) and considers USD 194.06 million as the true installation cost.

<Table 4.2> Number of Stations with PSD and Amount of Expense of Installation

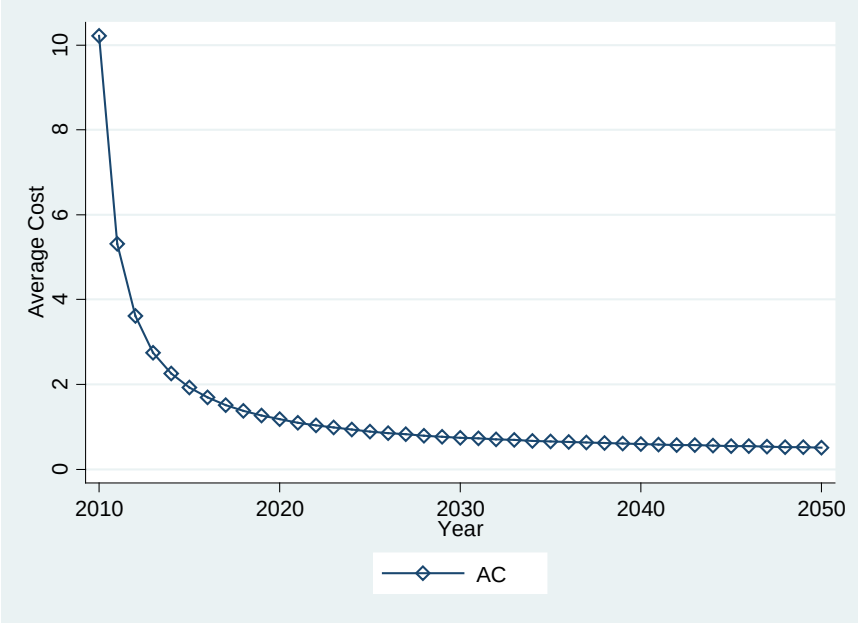
Classification	Total Number of Stations	2005	2006	2007	2008	2009	2011	Amount (USD Million)
Total	122	1	16	10	10	84	1	194.1
Private Investment	24	1	11	8	4			137.5
Own Capital (Seoul Metro)	95		5	2	6	81	1	53.6
Seoul City	3					3		2.9

Note: 1) Since Own Capital (Seoul Metro) installed screen doors at the branch line of the Sindorim Station on December 31, 2011, the installation cost is included in the calculation. 2) The budget for PSD installation is denominated in U.S. dollars using the exchange rate (USD 1 = KRW 1,153) as of January 4, 2010.
Source: Seoul Metro (2014a)

Under a limited assumption that the number of subway suicides is consistent every

year and that suicidal behavior is uniform, 19 potential suicides[6] have been prevented every year since the installation completion. Figure 2.7 outlines the average cost calculated by dividing each future value of the installation cost (USD 10.21 Million as of 2010 according to <Table 4.2>) after 10, 20, 30, and 40 years by the annual number of suicides under an assumption that the above-mentioned trends persist even when subway stations are not equipped with Platform Screen Doors (PSDs).[7] It is illustrated that the cost continues to decrease to USD 1.18 Million, USD 0.75 Million, USD 0.59 Million, and USD 0.51 Million (5% of the initial cost) in 2020, 2030, 2040, and 2050, respectively.

<Figure 3.1> Average Cost of Preventing Suicides



[6] This estimate is approximately 19, the average number of suicides per year before complete installation of PSDs in 2009.

[7] To calculate the future value of the installation cost of screen doors, the CPI trend over 13 years (2000-2013), provided by the Bank of Korea, is reviewed. With 2010=100 as reference year, an assumption is made that the index will continue to increase by 2.66 annually. The future value of the installation cost is then divided by the accumulated number of potential suicides to calculate the average cost needed to save one potential suicide.

5. Conclusion

Korea's suicide rate is the highest in the world and has emerged as a social problem, going well beyond a personal pathologic issue that was viewed in the past. Furthermore, subway suicide has been causing negative socio-economic spillover effects in Korea, becoming a new issue. In recognition of the severity of subway suicide, the Korean government plans to install more platform screen doors (PSDs) at subway stations.

Seoul Metro which serves the Seoul Metropolitan Area spent USD 194.06 million on installing PSDs at 121 stations between 2005 and 2009. Many people state that the installation contributed to enhancing subway safety and reducing suicide rate. However, currently, there is no research on the cost-effectiveness of installing screen doors.

This study uses data on PSDs installed and suicide cases that occurred at the Seoul Metro stations to conduct an empirical analysis on how much PSDs contribute to reducing subway suicide. To that end, the Poisson model is used to examine the relationship between the installation of PSDs and suicide. Findings suggest that the installation of PSDs reduces suicide. Using the data on the cost of installing PSDs, this research also observes how much is spent to save a potential suicide victim.

Given that subway suicide trends continue in the future, the average cost needed to prevent suicide gradually drops after 10, 20, 30, and 40 years. These research outcomes may be useful to policy makers in charge of subway safety at a time when there are a growing number of subway suicide deaths occurring in many countries including Korea.

Also, equipping stations with PSDs on a large scale requires objective and persuasive base data needed to examine the cost-effectiveness of the installation. As the findings suggest,

the installation of screen doors is more cost-effective in preventing suicide in the long-term than in the short-term.

The shortcoming of this research paper is that the analysis on the effectiveness of PSDs in reducing suicide is carried out under an assumption that a potential suicide victim does not easily change his or her suicidal behavior. In other words, this paper excludes the possibility that the potential suicide victim changes his or her mind to commit suicide at a station that is not equipped with PSDs or choose a different suicide method.

Also, this study does not take into consideration unobservable personal data on pathologic and mental health or socio-economic characteristics. These would make a good topic for a more comprehensive future study.

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