

**Attrition of school principals:
A survival analysis using seven years of administrative data
from Pennsylvania**

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Background

Principals play an important role in the success of schools by hiring and evaluating teachers, managing budgets and resources, and influencing school culture and staff cohesion. Some researchers have found that principal attrition is associated with a decrease in students' achievement as well as an increase in teacher turnover, with particularly harmful effects in schools with high rates of poverty (Béteille, Kalogrides, & Loeb, 2012; Miller, 2013). Therefore, it is important to understand factors associated with an increase in the risk of attrition among school principals and design policies to strategically retain school leaders at risk of leaving their jobs.

Objectives

This study uses survival analysis and administrative records on all principals in K-12 public and charter schools in the state of Pennsylvania over a seven-year period to analyze the proportion of principals that leave their school each year and also to identify factors associated with the risk of principal attrition. The results shed light on potential policies to retain school leaders at greater rates.

Data

The Pennsylvania Department of Education provided administrative records on all principals in K-12 public and charter schools in the state from academic years 2011-2012 to 2017-2018. The datasets included individual-level information, such as the principal's date of hire and termination, background characteristics (gender, ethnicity, age, years of work experience, education level), salary, and hours of professional development. School-level characteristics, including urbanicity, school size, Title 1 eligibility, public vs. charter school status, and percent of minority students, were obtained from publicly available state and federal datasets and merged with the administrative records of the principals. 278 principals that were newly hired into a principal role by a K-12 public or charter school in Pennsylvania during the 2011-2012 academic year were included in the study's base cohort. Tables 1 to 4 report the descriptive statistics of the principals in the base cohort.

Methodology

This study employed survival analysis, a statistical method used to analyze factors associated with the risk of an “event” happening, defined here as a principal leaving the school where he/she was hired (Allison, 2010). For each principal in the base cohort, we calculated the survival time in days (i.e, the number of days during which a principal remained in the school where he/she was hired). Due to methodological constraints, principals hired before the study period were excluded from the analysis, as their inclusion would have over-estimated the overall survival times of principals by not taking into account the survival times of principals who left their position before the beginning of the 2011-2012 academic year.

Survival curves were plotted to visually represent the percent of principals in the base cohort who remained in their position across the seven-year period. These survival curves were also disaggregated by individual-level and school-level variables to show the percent of principals in each sub-group that were still in his/her position at each point in time.

We then used the Cox proportional hazards model to identify factors associated with the risk of attrition among principals, controlling for all other variables in the model (Allison, 2010). The seven individual-level variables and five school-level variables listed above were included in the model.

Results

Figure 1 presents the survival curve of the entire base cohort. The zero on the x-axis represents the day on which a principal started his/her position, and each number on the x-axis represents one full year since that date. The values on the y-axis indicate the percentage of principals in the base cohort that were still in his/her position at the corresponding point in time on the x-axis. At the end of the first year, 80% of the principals remained in his/her position. This drops to 50% by the end of the third year, and it drops further to 25% by the end of the seventh year.

Figures 2 to 10 present the survival curves of the base cohort disaggregated by individual-level and school-level variables. In terms of individual characteristics, attrition was greater among female principals, Black principals, principals who were over 50 years old or under 30 years old when they were hired, principals with 25 or more years of work experience when they were hired, and principals with a bachelor’s degree as the highest education level. At the school level, attrition was greater among principals in schools in urban areas, schools with less than 1,000 students, schools eligible for Title 1 status, and charter schools.

The results of the Cox proportional hazards model are presented in Table 5. These results may be more informative than the results presented above in informing policies to reduce principal attrition, since it controls for the effect of all other variables in the model when identifying risk factors and protective factors associated with principal attrition. The only variables that were statistically significant were annual salary and cumulative hours of professional development. Specifically, a \$6,000 increase in annual salary was associated with a 14% decrease in the risk of principal

attrition, while a 10-hour increase in cumulative professional development hours was associated with a 6% decrease in the risk of principal attrition, controlling for all other variables in the model.

Conclusion

Since principal attrition has been linked with detrimental school outcomes, such as lower student achievement and higher teacher attrition, it is important for policy makers to formulate policies that can effectively increase the retention of school leaders. This study is significant in that it identified risk factors and protective factors associated with principal attrition in K-12 public and charter schools in Pennsylvania by using administrative data from a recent seven-year period, and it also precisely quantified the extent of attrition among various sub-groups of principals. These results provide valuable insights to policy makers as well as to researchers who are interested in conducting further research on the effectiveness of interventions that may increase the retention of principals in K-12 public and charter schools.

TABLES

Table 1
Characteristics of Principals in the Base Cohort – Categorical Variables (N = 278)

Variable	%	Frequency
Gender		
Male	54	149
Female	46	129
Ethnicity		
White	74	206
Black	21	59
Hispanic	2	6
Asian	1	3
Multi-Racial	1	4
Age (when hired)		
Age < 30	4	12
30 ≤ Age < 40	51	142
40 ≤ Age < 50	31	85
50 ≤ Age	14	39
Years of work experience (when hired)		
Experience < 3	27	74
3 ≤ Experience < 25	66	184
25 ≤ Experience	7	20
Highest education level (at the end of the 2011-2012 academic year)		
BA degree	25	69
MA degree	71	197
Doctoral / Specialist Degree ^a	4	12

^a An educational specialist degree (e.g., Ed.S.) is a terminal professional degree for individuals who have already completed a master's degree in education.

Table 2
Characteristics of Principals in the Base Cohort – Continuous Variables

Variable	Mean	SD	N
Annual salary (before deductions, in the 2011-2012 academic year)	93,540	21,953	278
Hours of professional development (in the 2011-2012 academic year) ^a	30	20	239

^a Only ACT 48 professional development courses were included.

Table 3

Characteristics of Schools in which the Base Cohort Principals Taught – Categorical Variables (N = 229)

Variable	%	Frequency
Urbanicity		
Rural	19	43
Town	6	13
Suburb	45	104
City	30	69
School size ^a		
Less than 1,000 students	82	187
1,000 or more students	18	42
Title 1 eligibility ^b		
Eligible	74	163
Not eligible	26	57
School type		
Public school	86	197
Charter school	14	32
School level		
Primary school (pre K to grades8)	45	104
Middle school (grades 4 to 9)	16	37
High school (grades 7 to 12)	32	73
Other (other configurations not falling into the categories above)	7	15

Note. Unless otherwise noted, information is from the 2011-2012 academic year.

^a School size was calculated by averaging number of students enrolled from the 2011-2012 academic year to the 2016-2017 academic year.

^b Information was available for only 220 schools (out of 229 schools)

Table 4

Characteristics of Schools in which the Base Cohort Teachers Taught – Continuous Variables

Variable	Mean	SD	N
Ethnicity			
% of white students	55	37	220
% of black students	29	35	220
% of Hispanic students	9	14	220
% of other students ^a	7	6	220
Student-teacher ratio	15	3	220
% of male students	51	5	220
% of students below basic level for PSSA ^b	22	17	145
% of students below basic level for Keystone ^c	15	15	78

Note. Unless otherwise noted, school characteristics were calculated by averaging information from the 2011-2012 academic year to the 2016-2017 academic year.

^a This category includes Asian, native Hawaiian or Pacific Islanders, American Indian, and multi-racial students.

^b Schools with grades 3 to 8 had data on the PSSA assessment. Results were obtained from the 2014-2015 academic year to the 2017-2018 academic year.

^c Schools with grade 11 had data on the Keystone assessment. Results were obtained from the 2014-2015 academic year to the 2017-2018 academic year.

Table 5
Cox Proportional Hazards Models (N = 249)

Variable	Hazard Ratios
Individual-level variables	
Gender (Reference: Female)	
Male	0.862
Ethnicity (Reference: White)	
Black ^a	1.452
Other (Hispanic, Asian, Multi-racial) ^a	0.933
Age when hired (Reference: Age < 30)	
30 ≤ Age < 40	0.584
40 ≤ Age < 50	0.631
50 ≤ Age ^a	1.096
Years of work experience ^b	1.000
Highest educational level (Reference: BA) ^c	
MA	0.856
Doctoral / Specialist ^{a, d}	1.462
Annual salary ^e	0.860***
Cumulative hours of professional development ^f	0.942***
School-level variables	
Urbanicity (Reference: Rural) ^g	
Town	1.457
Suburb	1.091
City	1.815
School size (Reference: Under 1,000 students) ^h	
1,000 or more students	0.963
Title 1 eligibility (Reference: Not eligible) ^g	
Eligible	1.189
School type (Reference: Public school) ^g	
Charter school	0.723
% of minority students ^h	1.008

Note. The hazard ratios and significance may not be accurate due to the small sample size (N=249).

^a These groups have a small sample size (<50).

^b Years of work experience when hired.

^c Highest educational degree when the event occurred.

^d An educational specialist degree (e.g., Ed.S.) is a terminal professional degree for individuals who have already completed a master's degree in education.

^e Salary (before deductions) when the event occurred, in units of \$6,000 annually (or \$500 monthly).

^f Cumulative hours of professional development when the event occurred, in units of 10 hours. Only ACT 48 professional development courses were included in the analysis.

^g During the 2011-2012 academic year.

^h Calculated by averaging information from the 2011-2012 academic year to the 2016-2017 academic year.

*p<.05. **p<.01. *** p<.001

FIGURES

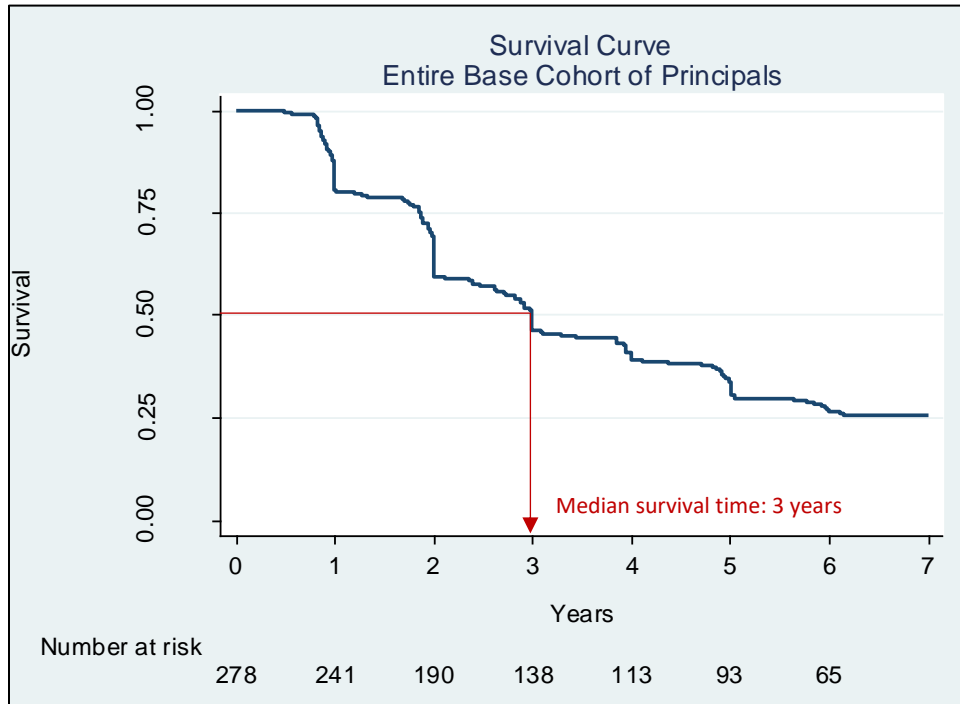


Figure 1. Survival curve of the entire base cohort. N = 278

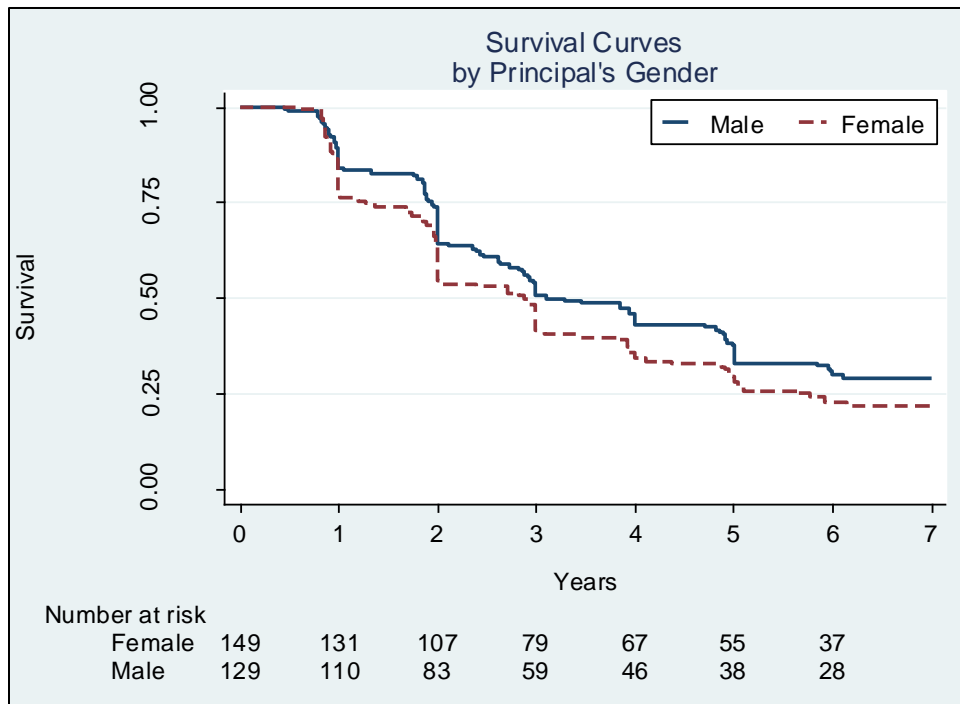


Figure 2. Survival curves disaggregated by principals' gender. N = 278

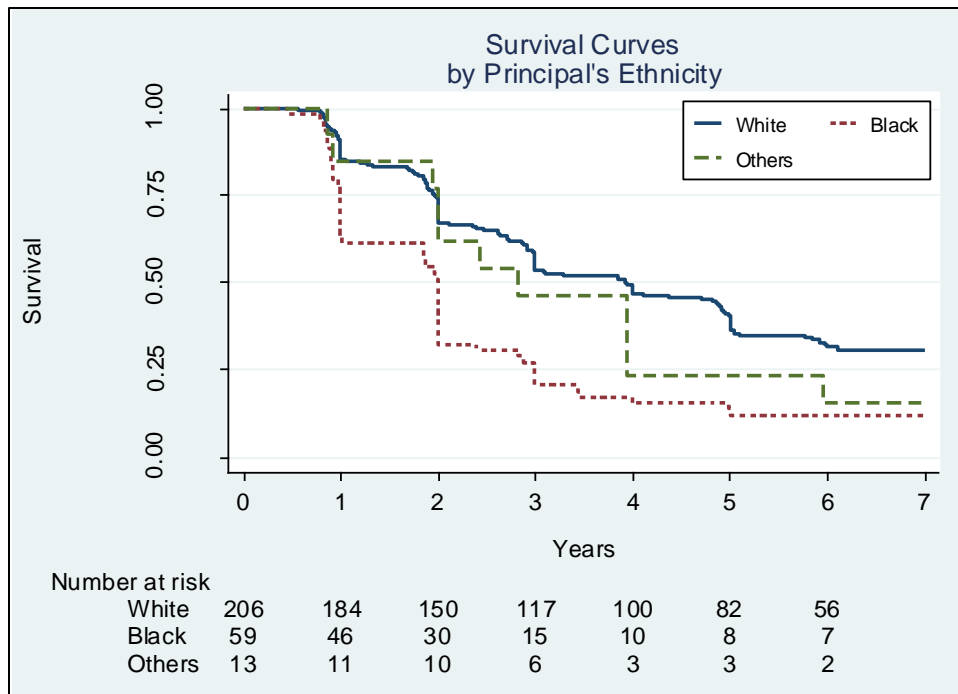


Figure 3. Survival curves disaggregated principals' ethnicity. N = 278

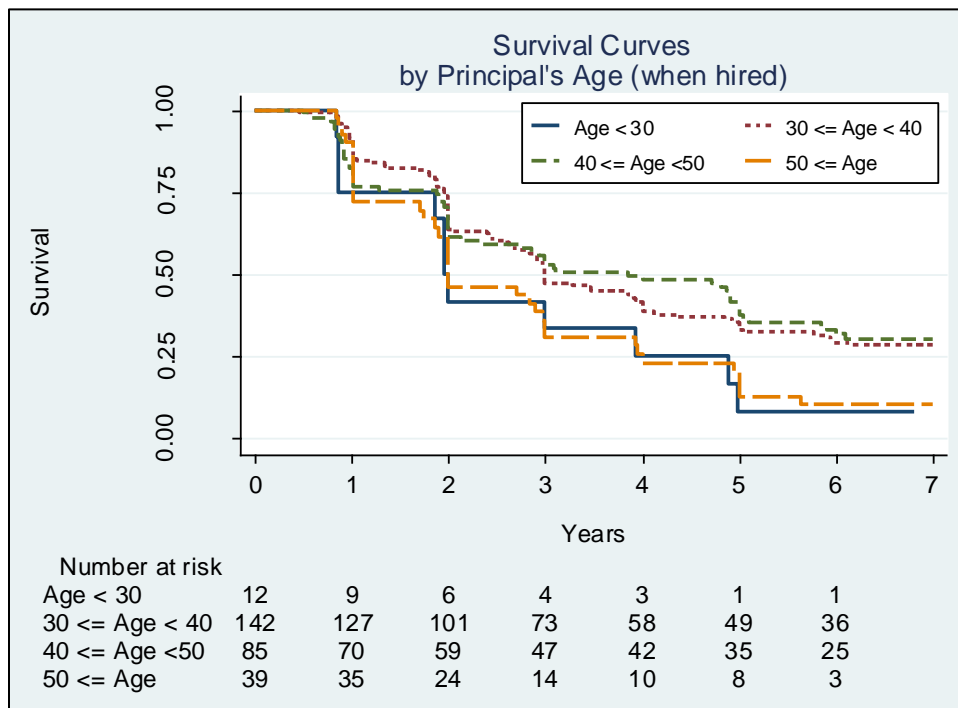


Figure 4. Survival curves disaggregated by principals' age (when hired). N = 278

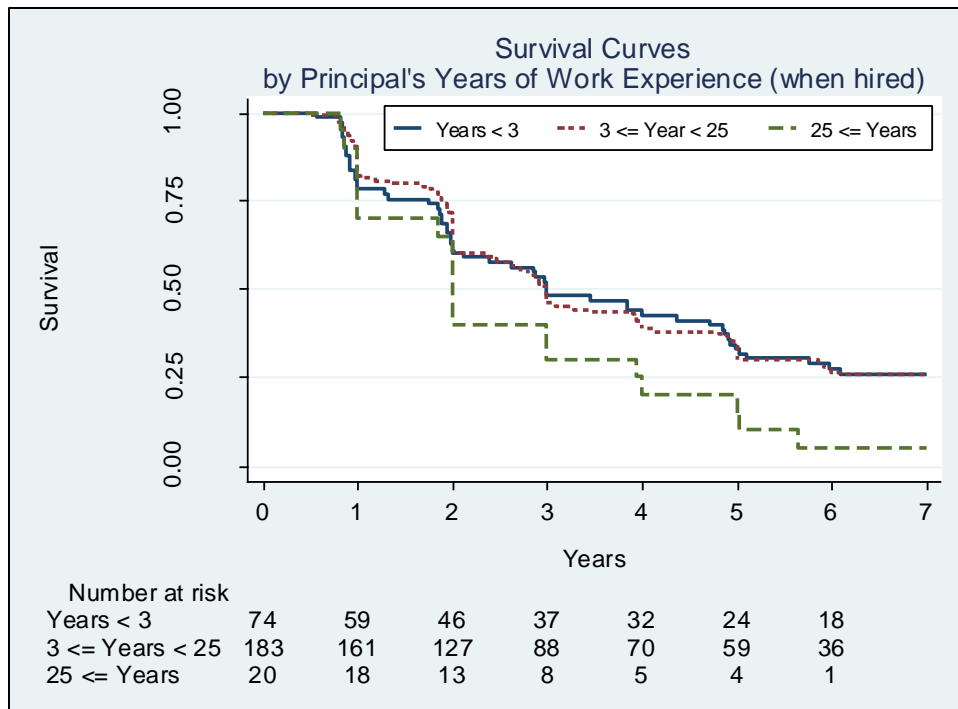


Figure 5. Survival curves disaggregated by principals' years of work experience (when hired). N = 277

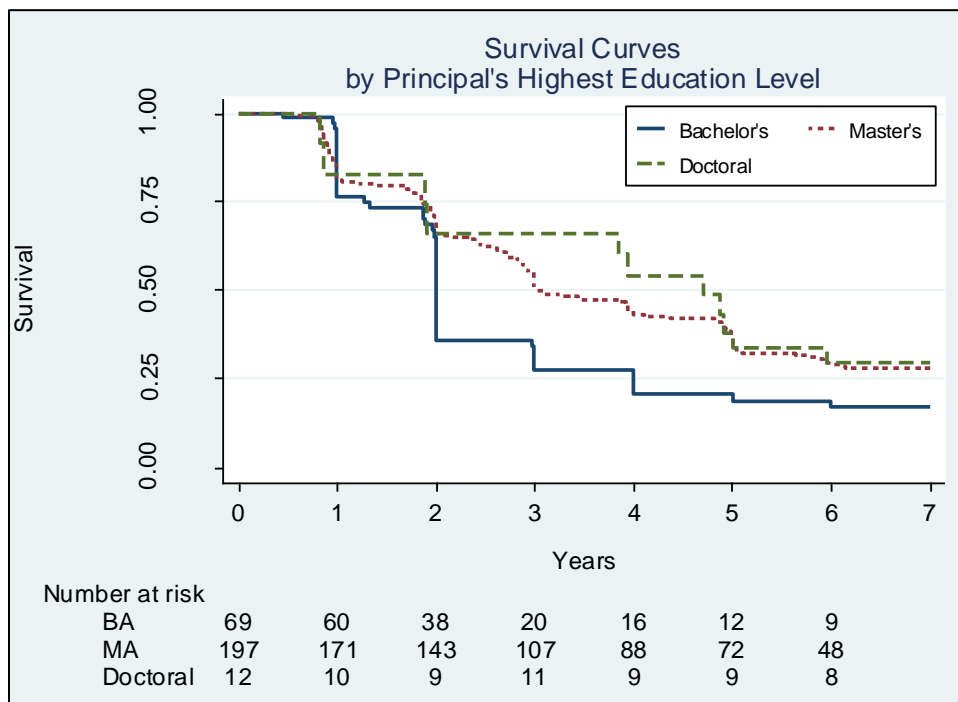


Figure 6. Survival curves disaggregated by principals' highest education level (taking into account the changes in principals' educational attainment across time). N = 278

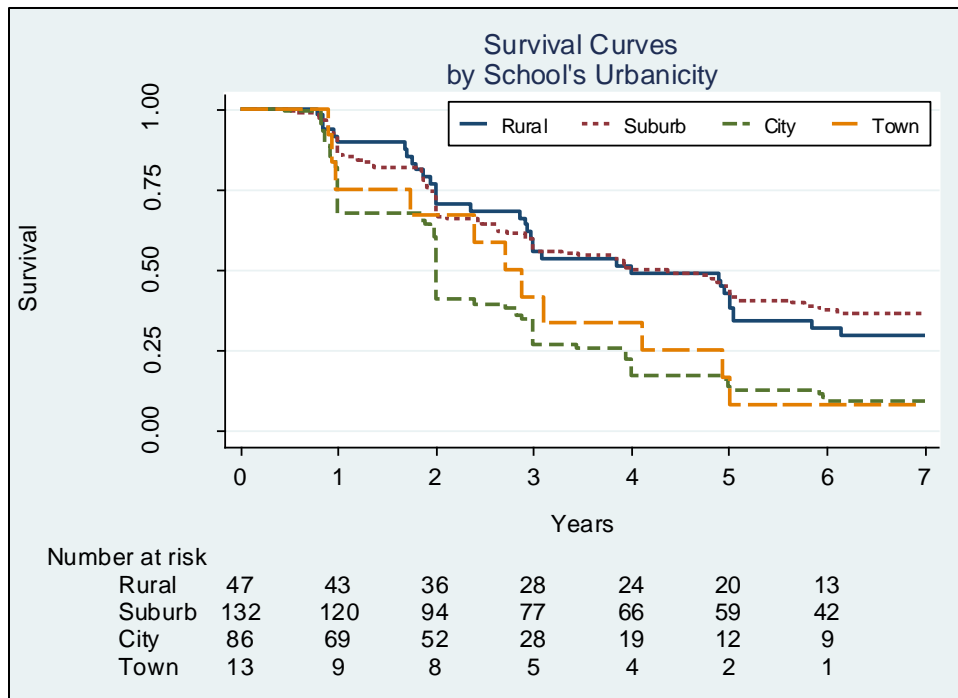


Figure 7. Survival curves disaggregated by school's urbanicity (during the 2011-2012 academic year). N = 278

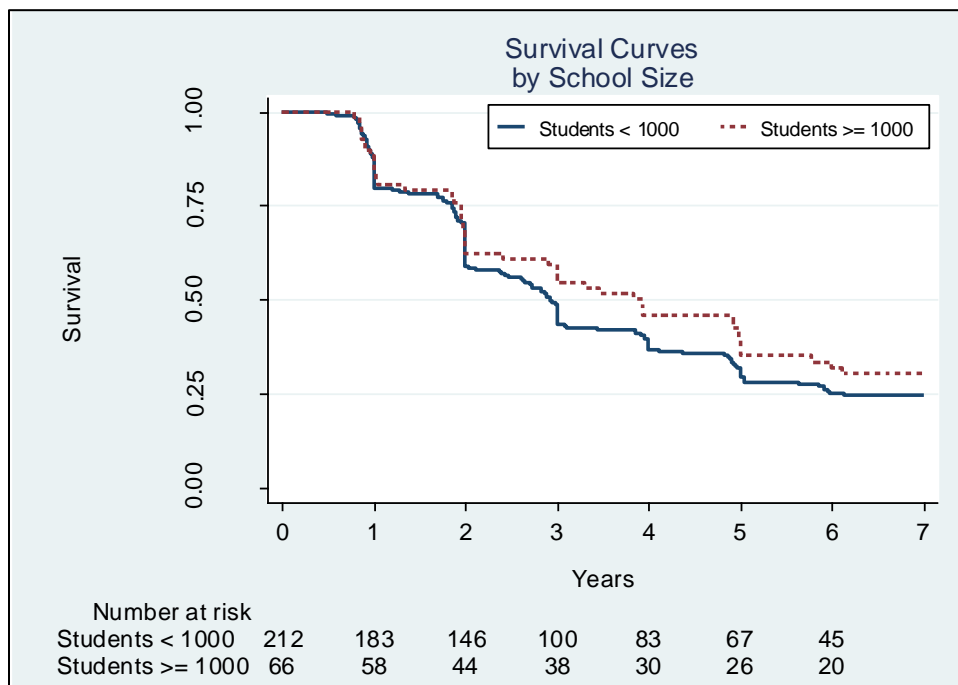


Figure 8. Survival curves disaggregated by school size (averaged across the 2011-2012 academic year to the 2016-2017 academic year). N = 278

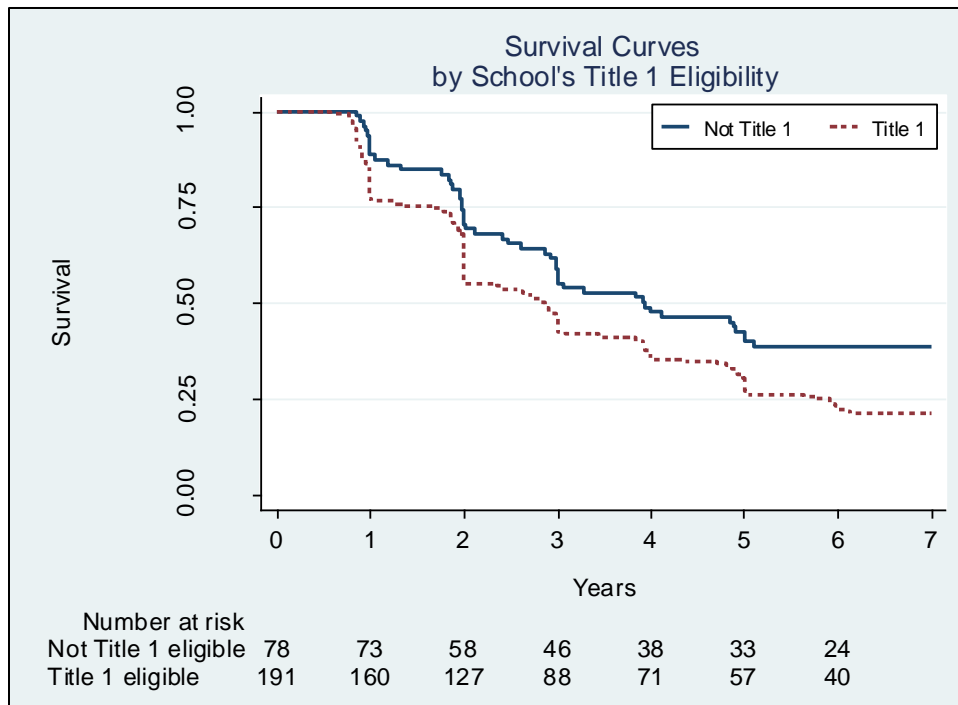


Figure 9. Survival curves disaggregated by school's Title 1 eligibility (during the 2011-2012 academic year). N = 269

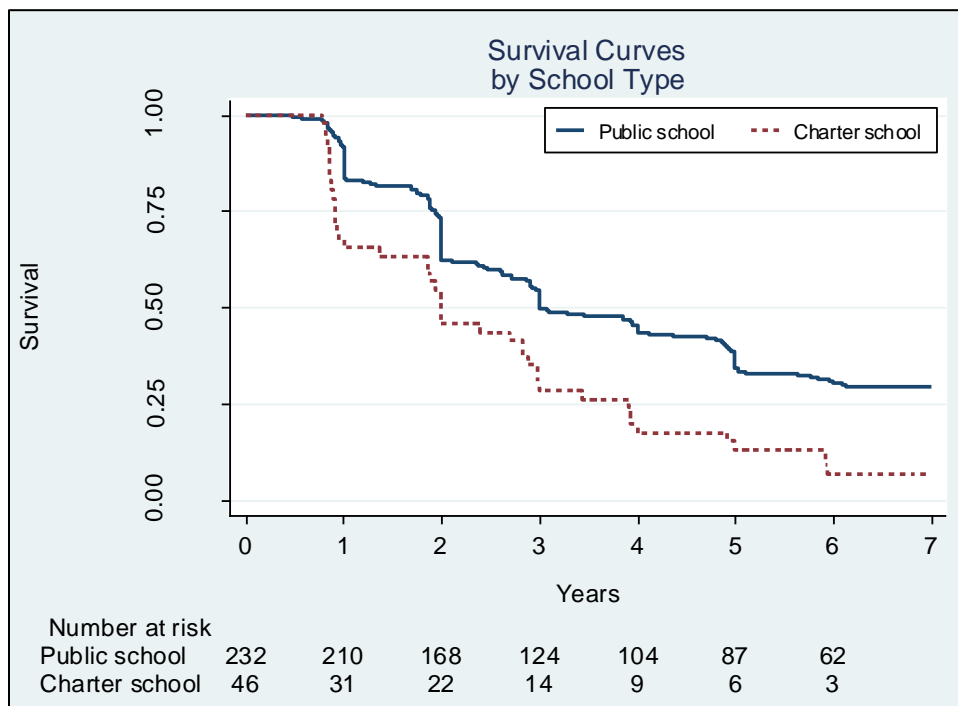


Figure 10. Survival curves disaggregated by school type (during the 2011-2012 academic year). N = 278

REFERENCES

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