



CENTER FOR COLLABORATIVE SYSTEMS CHANGE

INDIANA UNIVERSITY

Indiana Institute on Disability and Community

ANALYSIS REPORT: 2013-2017 STUDENT HEALTH AND ACADEMIC ACHIEVEMENT

Report prepared in collaboration with Paramount
School of Excellence and Community Health Network

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Introduction

Academic achievement of school-age children, as measured by the National Assessment of Educational Progress, has improved over time (Bohrnstedt et al., 2015). However, the persistent achievement gap between high and low performing children, particularly the disparate achievement of White students and their Black and Hispanic peers and between children from moderate to high income families and children of low-income families, suggests the importance of continuing to innovate coordinated education strategies. One component of an optimally coordinated education program is integrating learning and health for the purpose of promoting the cognitive, physical, social, and emotional development of every child (CDC, 2015). Children who are experiencing physical or emotional pain cannot fully engage in the classroom and miss class time due to absences and/or visits to the school nurse (Dunkle & Nash, 1991). Although health programs are heralded as an integral component of national educational reform essential to academic performance, program design and implementation barriers remain (Srabstein & Piazza, 2008). Innovative and collaborative strategies for coordinating learning and health could aid in enhancing school performance and could be shared and applied in a variety of educational contexts.

Research has established the link between student health and academic achievement; notably, as compared to healthy students, students with poor health perform worse in school (Forest et al., 2011; Lavin, Sapiro & Weill, 1992; Novello, Degraw & Kleinman, 1992; Swingle, 1997; Symons, Cinelli, James & Groff, 1997). In addition, poor health increases the frequency of visits to the school nurse and leads to increased student absences (Leaver, 2014; Weismuller et al., 2007). However, children with “unexplained recurrent [health] complaints” frequently visit the school nurse (Leaver, 2014). Frequency of school nurse visits is associated with both an increase in school absences and progressively lower academic ability (Joost et al., 1993; Leaver, 2014). Student academic performance is directly inhibited by missed instructional time and frequent school absences (Chan, 2002).

Beyond an established linkage, however, the extent of the impact of poor student health on academic performance is still uncertain because health is typically situated within a social-ecological context of which education is just one component and because it is often difficult to rule out the effects of other influences on academic achievement (Forrest et al., 2011; Thies, 1999). Therefore, because of the inherent challenges in evaluating the impact of the complex phenomena of student health, important education policy decisions and school-based interventions have relied on studies restricted primarily to measures of absenteeism and nurse report of student health (Maughan, 2003). However, for a complex problem such as student health, absenteeism and nurse report alone are not sufficient to predict student academic achievement. Instead, studies and supporting data have shown that student perceived health status, including parent and self-assessments of physical and mental health, and measures of missed instructional time are important predictors of academic achievement (Fredrick & Walberg, 1980; Mechanic & Hansell, 1987; Vingilis, Wade & Adlaf, 1998).

Project Description

This study addressed these important gaps by testing the impact of discrete categories of reported student health problems on academic achievement measured by longitudinally assessed student acuity. This represents a significant first step in understanding differences in how nurse visits for various health problems affect achievement.

This study reflects a collaborative design responsive to the needs and concerns of students, families and educators. In addition to enhancing the partnership between the school, community, and research partners, the findings have important implications for improving student education outcomes. Specifically, further exploration of nuances in differences in student health concerns motivating nurse visits as well as differences in the subsequent intervention actions will elucidate opportunities to enhance academic outcomes. Results from this project will benefit students, aid in school wide performance improvement and will provide important insights for other education agencies, policy makers and stakeholders.

Methods

The overarching goal of this study was to investigate the impact of student health problems on academic achievement outcomes. Specifically we examined the following research questions:

1. How are academic outcomes impacted by differences in the frequency of visits and across the health problem categories reported at each school nurse visit when controlling for demographics such as gender, race/ethnicity, and characteristics of the visit (time of day, day of week, month)?
2. To what extent do the frequency and category of school nurse visits, when controlling for demographics, affect student academic progress over time?

Data Source

This study uses data collected by the Community Health Network across multiple school years from 2013-14 to 2016-17. The data contain 622 third to eight graders who reported a total number of 8949 health visits.

Key Variables / Studies Factors

To examine the questions posted in the study, variables that indicated student academic performance and information about interactions with the school nurse were considered in addition to demographics and frequency of nurse visits.

Outcome variables: Student acuity scores as well as their class averages are collected as measures of student academic achievements. Specifically, student acuity is assessed longitudinally at three time points of the year (i.e., beginning, middle, and end of the year) in two subject areas: math and English language (ELA). In addition to the acuity scores, class averages were also calculated.

Visit reason: Students visit school nurses for different reasons. In this study, visit reasons are collected by 16 categories (excluding regular RX and OTC medication reasons): (1) Cardiovascular, (2) Dental, (3) Dermatological, (4) Eye/Ears/Nose/Throat, (5) Endocrine, (6) Gastrointestinal, (7) Genitourinary, (8) Gynecological/Obsterical, (9) Musculo/Skeletal, (10) Nutrition/Metabolic, (11) Neurological, (12) Parasites/Infections, (13) Disorder from Physical Agents, (14) Psychosocial, (15) Respiratory, (16) Other/Miscellaneous.

Referral information: Student referral information was collected using the following 12 categories: (1) Community/Outside Agency (Other), (2) Dental Care, (3) Guidance Counselor, (4) Domestic Violence, (5) Established Medical Provider, (6) Medical Care/Nursing Care, (7) New Medical Provider, (8) No Referral Needed, (9) Nursing Assessment, (10) Social Work Services, (11) School Administrator.

Treatment action: Treatment actions are coded into six categories: (1) Ambulance/911/Emergency Called, (2) Emergency Room, (3) Phone Guardian, (4) Returned to Class, (5) Sent Home, (6) Other.

Intervention: Intervention was collected using both primary and secondary intervention information. Primary intervention includes following information from different providers: (1) First Aid, (2) Nursing Assessment and Counseling, (3) Medication Dose Administered – RX, (4) Medication Dose Administered OTC, (5) Paraprofessional Encounter (Follow-Up), (6) Counseling, (7) Encounter, (8) Nursing Assessment, (9) Sport Physical examination.

Analysis

Analysis included standard descriptive statistics, correlation and multiple regressions. Descriptive statistics, including charts and figures, were utilized to examine the distribution of demographic variables, outcomes variables (e.g., student math and ELA acuity scores), and all studied factors, including number of visits, health problem categories, and visit actions/intervention. Relationship and interaction between studied variables were examined via descriptive statistics as well. Correlation and regression analyses were utilized to study the interaction between student achievement and school nurse visit information that are specified in research questions.

Results

Basic descriptive statistics were conducted to examine student demographics, distribution of nurse visits, and the distribution of visit frequency across multiple demographic groups for the school years 2014-15 through 2016-17 (See table 1 - 3).

Across the four school years (2013-14 to 2016-17), there were 622 students and 8949 total school nurse visits. Among the 622 students, 52.3% (N = 325) were male students, while the other 47.7% (N = 297) were female students. Among the 622 students, 28.0% (N = 174) were white students, 46.1% (N = 287) were Black students, 15.6% (N = 97) were Hispanic students, while another 10.3% (N = 64) were Multiracial. Table 1 shows student demographics across the multiple school years included in the study.

Table 1. Student Demographics by School Year

	2013-14		2014-15		2015-16		2016-17	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Gender								
Female	110	48.89	137	45.07	161	47.49	181	49.05
Male	115	51.11	167	54.93	178	52.51	188	50.95
Ethnicity								
White	72	32.00	88	28.95	95	28.02	105	28.46
Black	94	41.78	139	45.72	158	46.61	167	45.26
Hispanic	40	17.78	51	16.78	53	15.63	63	17.07
Multiracial	19	8.44	26	8.55	33	9.73	34	9.21
Grade								
Grade 3	56	24.89	65	21.38	66	19.47	74	20.05
Grade 4	55	24.44	58	19.08	71	20.94	75	20.33
Grade 5	40	17.78	62	20.39	65	19.17	66	17.89
Grade 6	32	14.22	46	15.13	56	16.52	59	15.99
Grade 7	28	12.44	41	13.49	47	13.86	57	15.45
Grade 8	14	6.22	32	10.53	34	10.03	38	10.30
Total	225	100.00	304	100.00	339	100.00	369	100.00

From the 2013-14 to 2016-17 school year, the number of times per school year students visited the nurse ranged from zero to 41 or more times. In the 2013-14, the majority of students had no school nurse visits (29%). In 2014-15, 2015-16, and 2016-17, the largest portion students had between five and 10 nurse visits (21%, 29%, and 30% respectively). Table 2 shows the distribution of students by the number times they visited the school nurse across the four school years.

Table 2. Distribution of Students by the Number of Medical Visits Across School Years

	2013-14		2014-15		2015-16		2016-17	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
No visit	66	29.33	45	14.8	64	18.90	38	10.3
1 visit	53	23.56	42	13.8	38	11.20	45	12.2
2 visits	29	12.89	28	9.2	29	8.60	34	9.2
3 visits	20	8.89	20	6.6	34	10.00	34	9.2
4 visits	10	4.44	21	6.9	24	7.10	19	5.1
5-10 visits	27	12.00	63	20.7	97	28.60	110	29.8
11-20 visits	9	4.00	48	15.8	41	12.10	51	13.8
21-40 visits	5	2.22	30	9.9	12	3.50	27	7.3
41 visits or above	6	2.67	7	2.3	/	/	11	3

Total	225	100.00	304	100	339	100.00	369	100
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Table 3 shows the number of school nurse visits per school year by student demographics.

Table 3. Number of Nurse Visits by Student Demographics Across School Years

	2013-14		2014-15		2015-16		2016-17	
	N	%	N	%	N	%	N	%
Gender								
Female	476	40.40	1142	42.20	930	49.70	1587	49.70
Male	701	59.60	1567	57.80	941	50.30	1605	50.30
Ethnicity								
White	685	58.20	765	28.20	593	31.70	1034	32.40
Black	259	22.00	1379	50.90	939	50.20	1620	50.80
Hispanic	115	9.80	366	13.50	180	9.60	330	10.30
Multiracial	118	10.00	199	7.30	159	8.50	208	6.50
Grade								
Grade 3	162	13.80	714	26.40	8	0.40	588	18.40
Grade 4	209	17.80	634	23.40	453	24.20	853	26.70
Grade 5	326	27.70	598	22.10	434	23.20	551	17.30
Grade 6	121	10.30	398	14.70	483	25.80	580	18.20
Grade 7	149	12.70	181	6.70	203	10.80	296	9.30
Grade 8	210	17.80	184	6.80	290	15.50	324	10.20
Total	1177	100.00	2709	100.00	1871	100.00	3192	100.00

Across the four school years, male students reported more yearly visits to the nurse (60% and 58%) in 2013-14 and 2014-15 compared to female students (40% and 42%) and male and female students had comparable numbers of school nurse visits in the 2015-16 and 2016-17 school years. Other background information, such as race/ethnic and grade, also show a significant diversity on frequency of visits. White students accounted for the majority of the 1177 total nurse visits (58%) in 2013-14. In 2014-15, 2015-16, and 2016-17, Black students reported the greatest number of nurse visits. Specifically, black students comprised 51% of the 2709 total nurse visits in 2014-15, 50% of 1871 total nurse visits in 2015-16, and 51% of 3192 total nurse visits in 2016-2017. Visit frequencies of students across grades also varied. In the 2013-14 school year, students in grade 5 accounted for the largest portion of nurse visits (28%). In 2014-15, third graders had the largest portion of school nurse visits (26%), while in 2015-16, the largest portion of school nurse visits was among 6th graders (26%) and in 2016-17 it was among 4th graders (27%).

Table 4 provides the distribution of reasons students visited the nurse across the four school years. Overall, from 2013-2017, the most common reasons for visiting the school nurse were for a gastrointestinal issue (16% of the total 8949 nurse visits), eye/ears/nose/throat issues (15%)

and dermatological issues (12%). Aside from nurse visits classified as null, in 2013-14 the most common visit reasons were for respiratory issues (13% of the total 1177 nurse visits), eye/ear/nose/throat issues (10%), and endocrine issues (9%). In the 2014-15 school year, not including null visits, the most common nurse visit reasons were eye/ear/nose/throat issues (17% of the total 2709 visits), eye/ears/nose/throat issues (14%), and muscular/skeletal issues (12%). In 2015-16, eye/ears/nose/throat issues (20% of the total 1871 nurse visits), gastrointestinal issues (17%), and dermatological issues (13%) were the most frequent visit reasons. In the 2016-17 school year, the most frequent reasons for nurse visits were gastrointestinal issues (18% of the total 3192 visits), dermatological issues (17%), and eye/ears/nose/throat issues (16%).

Table 4. Distribution of Nurse Visit Reasons

	2013-17		2013-14		2014-15		2015-16		2016-17	
	N	%	N	%	N	%	N	%	N	%
Cardiovascular	9	0.10			8	0.30			1	0.00
Communicable/ Reportable Diseases	35	0.39	33	2.80					2	0.10
Consult with MD/Other Provider	1	0.01					1	0.10		
Dental	278	3.11	8	0.70	48	1.80	71	3.80	151	4.70
Dermatological	1070	11.96	59	5.00	245	9.00	240	12.80	526	16.50
Disorder from Physical Agents	1	0.01			1	0.00				
Endocrine	223	2.49	108	9.20	76	2.80	20	1.10	19	0.60
Eye/Ears/Nose/Throat	1374	15.35	114	9.70	374	13.80	365	19.50	521	16.30
Gastrointestinal	1450	16.20	87	7.40	472	17.40	323	17.30	568	17.80
Gynecological/Obstetrical	248	2.77	9	0.80	4	0.10	87	4.60	148	4.60
Immune System (Allergies)	16	0.18	3	0.30			12	0.60	1	0.00
Muscular/Skeletal	974	10.88	63	5.40	336	12.40	219	11.70	356	11.20
Neurological	934	10.44	60	5.10	277	10.20	170	9.10	427	13.40
Nutrition/Metabolic	10	0.11	1	0.10	7	0.30	1	0.10	1	0.00
Parasites/ Infections	57	0.64	23	2.00	12	0.40	10	0.50	12	0.40
Psychosocial	12	0.13	3	0.30	4	0.10	4	0.20	1	0.00
Respiratory	716	8.00	150	12.70	288	10.60	108	5.80	170	5.30
Genitourinary	89	0.99	6	0.50	8	0.30	20	1.10	55	1.70
Consult with Parent/Caregiver	23	0.26					23	1.20		
School Physical	1	0.01					1	0.10		
Other	590	6.59	28	2.40	139	5.10	190	10.20	233	7.30
NULL	838	9.36	422	35.90	410	15.10	6	0.30		

Table 5 provides the distribution of primary intervention. We noticed that the top three intervention categories were Nursing Assessment and Counseling, RN-Nursing Assessment and

Counseling, and MA Encounter, which applied to 56% of the total visits (5031 out of 8949). Specifically, 23% of visit interventions were Nursing Assessment and Counseling (2085 out of 8949), while 23% and 10% of the interventions were RN- Nursing Assessment and Counseling and MA Encounter, respectively.

Table 5. Distribution of Type of Provider/Primary Intervention

	2013-17		2013-14		2014-15		2015-16		2016-17	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
ARNP - First Aid (5031)	2	0.00			2	0.10				
ARNP - Medication Dose Administered - Rx (5030)	5	0.10	5	0.40						
ARNP - Nursing Assessment and Counseling (5000)	1	0.00			1	0.00				
Carbohydrate Counting	1	0.00					1	0.1		
Cardiac Monitoring	1	0.00					1	0.1		
Counseling - Crisis	1	0.00					1	0.1		
Counseling - Student/Individual	47	0.50					47	2.5		
Encounter Follow-Up	276	3.10					249	13.3	27	0.8
First Aid	817	9.10					792	42.3	25	0.8
Glucose Monitoring	7	0.10					7	0.4		
HA - First Aid (5031)	1	0.00			1	0.00				
HA - Medication Dose Administered - OTC (5030)	2	0.00	2	0.20	1	0.00				
HA - Medication Dose Administered - Rx (5030)	1	0.00								
HA - Paraprofessional Encounter (Follow-up) (6500)	2	0.00			2	0.10				
LPN - Counseling	3	0.00			3	0.10				
LPN - Encounter (4050)	403	4.50	52	4.40	351	13.00			12	0.4
LPN - First Aid (5031)	53	0.60	3	0.30	50	1.80				
LPN - Medication Dose Administered - OTC (5030)	12	0.10	4	0.30	8	0.30				
LPN - Medication Dose Administered - Rx (5030)	440	4.90	36	3.10	404	14.90				
LPN - Nursing Assessment (5000)	3	0.00	1	0.10	2	0.10				
LPN Encounter	12	0.10								
MA Encounter	887	9.90							887	27.8
MD - Sport Physical examination (5500)	1	0.00			1	0.00				
Medication Dose Administered - OTC	46	0.50					38	2	8	0.3
Medication Dose Administered - Rx	64	0.70					42	2.2	22	0.7
Medication Prescribed/Admin-OTC	1	0.00					1	0.1		

Medication Prescribed/Admin-Rx	1	0.00				1	0.1		
Nebulizer Treatment	4	0.00				4	0.2		
Nursing Assessment	778	8.70				649	34.7	129	4
Nursing Assessment and Counseling	2085	23.30				6	0.3	2079	65.1
Obesity Intervention	1	0.00						1	0
Parent/Caregiver Consultation	8	0.10				6	0.3	2	0.1
RN - Complex Medical Procedure (5032)	88	1.00	88	7.50					
RN - Encounter (4050)	142	1.60	6	0.50	136	5.00			
RN - First Aid (5031)	71	0.80	53	4.50	18	0.70			
RN - Medication Dose Administered - OTC (5030)	54	0.60	48	4.10	6	0.20			
RN - Medication Dose Administered - Rx (5030)	543	6.10	524	44.50	19	0.70			
RN - Nursing Assessment and Counseling (5000)	2059	23.00	355	30.20	1704	62.90			

Table 6 shows the distribution of referrals following a school nurse visit. The majority of school nurse visits resulted in no referral as the nurse deemed it unnecessary.

Table 6. Distribution of Type of Referral Information

	2013-17		2013-14		2014-15		2015-16		2016-17	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Community/Outside Agency (Other)	2	0.00			2	0.1				
Dental Care	1	0.00					1	0.1		
Dental Care (2)	1	0.00			1	0				
Domestic Violence	1	0.00			1	0				
Established Medical Provider	7	0.10			7	0.3				
Guidance Counselor	18	0.20	9	0.80			15	0.8	3	0.1
Guidance Counselor (3)	10	0.10			1	0				
Medical Care/ Nursing care (6)	3	0.00			3	0.1				
Medical Care/Nursing Care	4	0.00					3	0.2	1	0
Medical Provider	6	0.10							6	0.2
New Medical Provider	39	0.40			3	0.1			36	1.1
No Referral Needed	4776	53.40					1766	94.4	3010	94.3
No Referral Needed (8)	3007	33.60	735	62.40	2272	83.9				
No Referral Needed, Other	1	0.00					1	0.1		
No Referral Needed, Primary Care Physician	1	0.00					1	0.1		

NULL	832	9.30	422	35.90	410	15.1		
Nursing Assessment	4	0.00					4	0.2
Nursing Assessment (9)	3	0.00			3	0.1		
Other	4	0.00					4	0.2
Other (12)	5	0.10	3	0.30	2	0.1		
Primary Care Physician	18	0.20					18	1
School Administration	2	0.00						
School Administrator	7	0.10	6	0.50	1	0		2 0.1
Social Work Services (10)	5	0.10	2	0.20	3	0.1		
Vision	1	0.00					1	0.1

To test the correlation between nurse visit frequency and student performance in Language Arts and math we calculated Pearson’s r statistic. In 2013-2014 and 2015-16, a negative correlation was observed between student achievement in language Arts and the number of visits to the school nurse ($r = -0.130, p = 0.05$ and $r = 0.123, p = 0.02$ respectively). No statistically significant correlation was observed between student achievement in Math and number of visits to the nurse across all four school years.

Table 5 shows the linear regression coefficients and associated standard error for student performance in Language Arts by demographics and number of nurse visits. Compared to White students, academic performance in Language Arts was lower among Black students in 2013-2014 ($\beta = -10.25, p = 0.001$), 2015-16 ($\beta = -8.88, p < 0.001$), and 2016-17 ($\beta = -5.20, p = 0.007$). In 2015-16, Language Arts academic performance was also lower among Hispanic students ($\beta = -9.15, p = 0.005$). In 2016-17, academic performance in Language Arts was lower among boys compared to girls ($\beta = -3.21, p = 0.05$). Academic performance in Language Arts was also lower among children with more frequent school nurse visits in 2013-14 ($\beta = -0.19, p = 0.01$) and 2015-16 ($\beta = -0.42, p = 0.01$). No significant difference in academic performance in Language Arts was observed for Multiracial students.

Table 5. Linear Regression of Language Arts by Number of Nurse Visits by Student Demographics Across School Years

	2013-14		2014-15		2015-16		2016-17	
	β	Std. Error	β	Std. Error	β	Std. Error	β	Std. Error
Gender								
Female	-	-	-	-	-	-	-	-
Male	-2.22	2.46	No data	No data	-3.97	2.04	-3.21*	1.62
Ethnicity								
White	-	-	-	-	-	-	-	-
Black	-10.25**	2.93	No data	No data	-8.88**	2.42	-5.20*	1.92
Hispanic	-6.86	3.62	No data	No data	-9.15*	3.24	-3.42	2.49
Multiracial	1.22	4.70	No data	No data	-2.69	3.82	2.77	3.06

Nurse Visits									
Visit frequency	-0.19*	0.072	No data	No data	-0.42*	0.16	-0.11	0.07	

Note: *p<0.05; **p<0.001

Table 6 shows the linear regression coefficients and associated standard error for student performance in Math by demographics and number of nurse visits. Compared to White students, academic performance in Math was lower among Black and Hispanic students in 2013-2014 ($\beta = -12.28$, $p < 0.001$; $\beta = -7.34$, $p = 0.03$, respectively) and in 2015-16 ($\beta = -9.60$, $p < 0.001$; $\beta = -11.74$, $p < 0.001$, respectively). Academic performance in Math was also lower among children with more frequent school nurse visits in 2013-14 ($\beta = -0.15$, $p = 0.03$). No significant difference in academic performance in Math was observed for student gender or among Multiracial students.

Table 6. Linear Regression of Math by Number of Nurse Visits by Student Demographics Across School Years

	2013-14		2014-15		2015-16		2016-17	
	β	Std. Error	β	Std. Error	β	Std. Error	β	Std. Error
Gender								
Female	-	-	-	-	-	-	-	-
Male	-0.66	2.21	No data	No data	1.82	1.88	2.32	1.75
Ethnicity								
White	-	-	-	-	-	-	-	-
Black	-12.28**	2.62	No data	No data	-9.60**	2.23	-3.96	2.07
Hispanic	-7.34*	3.27	No data	No data	-11.74**	2.97	0.49	2.68
Multiracial	-5.26	4.20	No data	No data	-4.40	3.46	5.68	3.31
Nurse Visits								
Visit frequency	-0.15*	0.06	No data	No data	-0.21	0.15	-0.03	0.08

Note: *p<0.05; **p<0.001

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