Research Article

Hygiene-related Conditions That Impact Academic Performance: An Analytical Cross-sectional Study

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Background: Pediculosis capitis (PC), impacted cerumen (IC), and dental caries (DC) are conditions common in children, and may potentially affect academic performance.

Aims: To determine their correlation, particularly during critical stages of learning in early school years, 65 grades 1-3 students of West Fairview Elementary School of ages 6-9 underwent screening for these conditions. The test was also performed to determine the association with concomitant exposures, that is, the presence of two conditions in any combination, and all three of the conditions.

Methods: Academic performance was measured by General Weighted Averages (GWA), classified to Poor (PAP, GWA below 80), Good (GAP, GWA of 80-84), and Excellent (EAP, GWA of ≥85). To determine whether there is a significant association between academic performance and these conditions, chi-square test for association was done.

Results: Only PC was significantly correlated (p=0.012) with academic performance; however, in grade 3 alone, there was no significance (p=0.770). The number of conditions also showed significant correlation with academic performance. Interestingly, students without the conditions had no PAP, while those with two conditions had the highest prevalence of PAP (62.5%). All affected groups showed a significant correlation. PC, even alone, increased the odds of PAP, particularly in the lower grades 1-2, while IC and DC may also increase the odds, but only when present simultaneously with 1 or 2 other conditions.

Conclusion: Prevention and treatment of these conditions particularly, may help in improving academic performance of grades 1-3 children, and should receive special attention.

INTRODUCTION

Several diseases that inflict children bring challenges to their daily activities and affect their quality of life. Common to children are head lice infestation, dental caries, and impacted cerumen which are found to be hindrances to children's learning.[1,2]

The head louse or *Pediculosis humanus capitis* is a highly specialized parasite that only propagates on human scalp to feed on the host's blood, leading to intense itchiness.[3] Transmission is mainly through direct contact of two heads.[3] The Department of Education in the Philippines reported that pediculosis is the second most common problem among students after tooth decay.[4] Children are more prone to head lice as they share more play objects and play together closely.[5] Intense itching can lead to sleep disturbance, poor concentration, and social stigma, which may cause them to skip school, leading to decline in school performance.[5]

In the Philippines, the National Oral Health Survey reported that 97.1% of 6-year-olds have dental caries.[6] Oral health might play a significant role in children's normal growth and neural development.[7,8] Dental caries are likely to lead to nutritional deficiency, pain, and sleep disturbance. This may affect a child´s daily activities, including school performance.[7,8]

Cerumen impaction can occlude the external auditory canal, causing hearing loss, itching, pain, tinnitus, and dizziness.[9] Hearing impairment negatively impacts a student's development of academic, language, and social skills.[10] In the Philippines, 12.12% of hearing loss cases were due to ear wax occlusion.[11]

Studies have shown that there is a relationship between academic performance and the prevalence of dental caries, pediculosis capitis, and impacted cerumen. Alas, the strength and directness of association were not mentioned. Data is still scarce in the Philippine setting in terms of studies that correlate academic performance of children and the said diseases. Variations across grade levels are also rarely correlated.

Data have shown that pediculosis capitis, dental caries, and impacted cerumen are the top prevalent diseases among grades 1 to 3 students of West Fairview Elementary School. Since this is taking place during critical stages of development and learning, it may negatively impact their academic foundation, which could adversely influence their educational attainment for the succeeding years.

In line with this, the study aimed to 1) determine the presence of an association between these three diseases and the academic performance of grades 1-3 students of West Fairview Elementary School; 2) compare the effects of each condition on the academic performance individually to determine which of the three conditions had the most significant association with the academic performance; 3) correlate academic performance and all three or any combination of two of the conditions; 4) determine which grade level had the most significant association with the three most prevalent health conditions.

METHODS

After being approved by the Research Ethics Board and prior to screening and data collection, an assent was obtained from the subjects with a corresponding informed consent and signed consent form from their parents or guardians. It also ensured all data collected will remain confidential while the safety of the students will be given the utmost importance with the researchers only conducting procedures approved by the Ethical Board Committee, and that treatment shall be provided to the children who have health problems detected in them. Also, a Memorandum of Agreement was signed between the researchers and the school allowing the researchers to collect data, conduct physical examination at school premises, and have a copy of the official grades while abiding to the school's rules and regulations, and informing the institution regarding the results of the study. The parents and guardians were asked for the child's General Weighted Average (GWA) for the previous school year. This analytic cross-sectional study aimed to determine the possible relationship between the presence or absence of pediculosis capitis (PC), impacted cerumen (IC), and dental caries (DC) with the academic performance among grades 1 to 3 students. The study included students of school year 2017-2018, ages 6 to 9

years old of West Fairview Elementary School who attended the Brigada Eskwela program from May 16 to 18, 2017. Chronic absentees (≥ 10% absences), and those with deafness secondary to causes other than impacted cerumen was excluded. To standardize the screening, only one clinical clerk assessed for head lice, and another clinical clerk assessed for dental caries. The screening was under the supervision of a Family Physician who was present throughout the examination. The physician performed the otoscopic examination. Finally, treatment was provided to those who had health problems detected in them.

Grades 1, 2, and 3 students had total populations of 396, 548, and 490 respectively. The study was comprised of 3 groups per grade: (1) with only 1 health problem (IC/PC/DC), (2) with 2 health problems of any combination (IC+PC/IC+DC/PC+DC), and (3) with all health problems (IC+PC+DC). Sample size estimation that was computed using the formula for the test of hypothesis for the difference between proportions yielded a total sample size of 288 students. Stratified random sampling was also utilized to determine the number of subjects needed for each grade which are 80, 110, and 98 respectively. The power of the test is 80% with z value = 1.28 and an α error of 5% with z value of 1.96.

The independent variables of the study are the presence of the 3 health conditions. For this study, PC was defined as infection of the head hair and scalp by head lice confirmed by the presence of eggs, nymph, and/or adult stages upon inspection. IC was defined as the presence of built-up layers of earwax blocking the ear canal as observed through otoscopy. DC was defined as structural damages to the teeth as determined through inspection of the teeth. The outcome of the presence of these health conditions were assessed through the academic performance (AP), which was categorized into Poor (PAP), Good (GAP), and Excellent (EAP). K-12's grading scale system was used as a reference (DepEd Order No. 8, 2015) in grouping the GWAs. GWAs of below 80 were considered as PAP, GWAs of 80 to 84 were considered as GAP, and GWAs of above 85 were considered as EAP.

For statistical analysis, IBM SPSS Statistics 20 was utilized. Pearson's Chi-squared test with level of significance of 0.05 was used to 1) determine the correlation between the presence or absence of head lice, impacted cerumen, or dental caries and academic performance; 2) determine the correlation between the number of health problems present and academic performance (i.e., a single health problem, 2 health problems of any combination, or all three); 3) determine the relationship of the three health problems among different grade levels and their academic performance.

RESULTS AND FINDINGS

Among all elementary students who attended days 2-4 of Brigada Eskwela 2017-2018, 124 students were examined for eligibility. Seventy-five (75) students met the inclusion criteria and completed the screening for the presence of head lice, impacted cerumen, and dental caries. Meanwhile, as some parents and guardians (n=10) were unable to provide the GWA, only 65 students were included in the analysis of data. (See figure 1)

Due to time restrictions relating to tight schedules and the small time-window of the physicians' and the students' availability, the authors at the time could not contact and coordinate with more schools in the vicinity to recruit more students to achieve the computed total sample size. Despite of that, the authors still decided to go on with the study with the available students as a small-scale localized type of study.

We do acknowledge that the small number of participants may reduce the statistical power of the study; however, the study shall still be significant looking at the contribution it will provide to a relatively less explored area, in addition to serving as a guide to similar future research as well as to policymakers and stakeholders.

It also tackles a potentially serious issue taking place in the early developmental and educational stages of childhood which can severely affect a child's future, which is a common problem in developing countries.

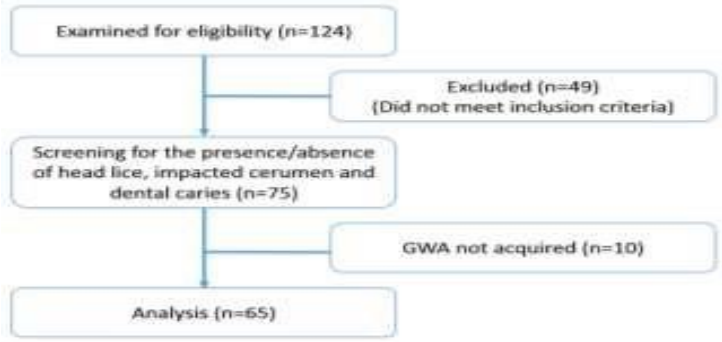

Figure 1. Number of subjects in each stage of the study

The subjects were composed of 23 grade 1 students (35.3%), 20 grade 2 students (32.3%), and 22 grade 3 students (33.8%), in which 70.7% were females. Also, there were no significant differences in the number of subjects based on age (6 years old= 18, 7 years old=15, 8 years old=16, 9 years old = 16).

		Grade 1		Grade 2		Grade 3		Total	
		%	n	%	n	%	n	%	n
Sex	M	10.8	7	6.2	4	12.3	8	29.3	19
	F	24.6	16	24.6	16	21.5	14	70.7	46
Total		35.4	23	30.8	20	33.8	22	100	65
Age	6	24.6	16	3.1	2	0	0	27.7	18
	7	9.2	6	12.3	8	1.5	1	23	15
	8	1.5	1	13.8	9	9.2	6	23.1	16
	9	0	0	3.1	2	23.1	15	26.2	16
Total		35.3	23	32.3	20	33.8	22	100	65

Table 1. Sex, Age, and Grade Level of the Recruited Subjects

Chi-square test showed that there was a significant association between PC (p=0.012) and academic performance within the entire population of students. There was a >2-fold decrease in the number of students with GAP (62.2% vs 32.1%) and a >2- fold increase in the number students with PAP (18.9% vs 53.6%) in those with PC as compared to those without PC (Table 2). However, there was no observed statistical

significance (p=0.770) in grade 3 students (Table 3).

Within the entire population, PAP was most prevalent (62.5%) in subjects with IC in 2 ears. Subjects with DC (36.4%) have higher prevalence of PAP than those without DC (20%). Meanwhile, there was no significant correlation between IC (p=0.380), DC (p=0.394), and the academic performance (Table 2). For each individual grade level, there was also no significant association observed.

		PAP		GAP		EAP		P Value
		%	n	%	n	%	n	
PC	Absent	18.9	7	62.2	23	18.9	7	0.012
	Present	53.6	15	32.1	9	14.3	4	
IC	No IC	28.2	11	56.4	22	15.4	66	0.38
	1 ear	33.3	6	44.4	8	22.2	4	
	2 ears	62.5	5	25	2	12.5	1	
DC	Absent	20	2	50	5	30	3	0.394
	Present	36.4	20	49.1	27	14.5	8	

Table 2. Academic Performance of Grades 1-3 Students With and Without Health Problems

		PAP		GAP		EAP		P Value
		%	n	%	n	%	n	
G1	Absent	13.3	2	73.3	11	13.3	2	0.042
	Present	62.5	5	25	2	12.5	1	
G2	Absent	11.1	1	66.7	6	22.2	2	0.042
	Present	63.6	7	18.2	2	18.2	2	
G3	Absent	30.8	4	46.2	6	23.1	3	0.77
	Present	33.3	3	55.6	5	11.1	1	

Table 3. Academic Performance of Students With and Without Pediculosis capitis (PC) in Each Grade Level

The number of health problems in each individual was also significantly correlated with academic performance (Table 4). Among those without any of the 3 health problems, there was no subject with PAP. In particular, students with any 2 health conditions were observed to have the highest prevalence of PAP (62.5%) compared to any other group.

	PAP		GAP		EAP		P Value
	%	n	%	n	%	n	
No Health Problems	0	0	50	2	50	2	
1 Health Problem (PC/IC/DC)	4.3	1	73.9	17	21.7	5	
2 Health Problems (PC+IC/PC+DC/IC+DC)	62.5	18	25	7	12.5	3	0
3 Health Problems (PC+IC+ DC)	33.8	3	47.7	5	18.5	2	

Table 4. Academic Performance of Grades 1-3 Students & Health Status

DISCUSSION

Due to the irritating and sometimes debilitating nature of some childhood health problems, these conditions can impact the child's quality of life in various aspects, including their ability to learn, thereby negatively affecting their educational attainment as a result. In developing countries, conditions related to poor hygiene are common to children of school-age years. These include head lice infestation, dental caries, and impacted cerumen. It also happens that they are found to be an impediment to children's learning.

The study was aimed to determine the association between these three diseases and the academic performance of the students. This is in response to the fact that the few existing studies have shown a relationship between academic performance and the prevalence of the three conditions, but did not mention the strength and directness of such association. Likewise, data is scarce in the Philippine setting, particularly the kind of data that correlate academic performance and all the three said conditions among children, whether present alone or in combination. This study described whether impacted cerumen, pediculosis capitis, and dental caries had a significant effect on the academic performance of grades 1-3 students of West Fairview Elementary School by comparing the effects of each health condition on the academic performance of the students in order to determine which of the three health conditions had the most significant association with the academic performance of the students, and to determine which grade school level had the most significant association with the three most prevalent health conditions through an analytic cross-sectional study that involved children of ages 6-9 years old divided into 3 groups per grade level.

It was observed that there was no significant correlation between impacted cerumen and dental caries individually on the academic performance of the participants within the entire population. There was also no association observed for each individual grade level.

For dental caries, the observation was inconsistent with some of the previous studies, including a cross sectional analysis by Pourhashemi in Iran on 300 elementary school students, which revealed that oral health indices were statistically associated with school performance and the study by Seirawan from Los Angeles County public schools which concluded that oral health affects students' academic performance. A possible reason for this inconsistency is the fact that unlike the present study, the previous studies did not exclude chronic absentees. It is well-known that dental caries can be devastating for children, leading to absences, and consequently to lower grades. Correlating the present study with the aforementioned studies suggests that poor academic performance is actually a result of absences due to dental caries rather than the condition itself. This was confirmed by Pourat and Nicholson wherein absenteeism from school due to dental caries have implications on the school performance of children, since the absences reflect missed opportunities for learning and academic advancement. It has also been observed that there was a lack of exploration of the specific oral problems related to the absenteeism, which can be the possible factors that are directly associated to the school performance of children.

Prior to the present study, authors have reported impacted cerumen as one of the most common disorders among school-aged children in Nigeria, Nepal, and Tanzania – all developing countries alike. It is also well known that one prevalent cause of hearing loss, particularly in developing countries, is cerumen impaction. Furthermore, it is understood that communication is vital to learning, and if a child's ability to interact is affected, it is within the realm of possibility that their ability to learn may be affected as well. Literature suggests that this relationship may be secondary to social detriment. Moreover, the present study excluded children with hearing loss; hence, the absence of the implications and social effects, which are the most probable reasons why the present study is inconsistent with the available literature, particularly with the exploratory analyses performed by Bess et al in 2020, that reported that children with unilateral hearing loss demonstrated a decrease in self-esteem and increased exhaustion, suggesting social implications of hearing loss among children that can affect academic performance.

On the other hand, there was a significant association between head lice and academic performance within the entire population represented by the greater than 2-fold decrease in the number of students with Good Academic Performance and the greater than 2-fold increase in the number students with Poor Academic Performance in those with hair lice as compared to those without it. This goes hand in hand with a previous study by Madeira et al in 2015 that states that pediculosis capitis is said to affect the academic performance because children even as early as kindergarten associate lice with sadness, fear, and anxiety. It can also result to discrimination, with the infested children facing ridicule and jokes that damage their self-esteem.

It should be noted that for the Grade 3 participants, there was no observed statistical significance. The possible reasons behind this are probably subjective in nature, such as the ones stated by Gboeloh and Elele, where teachers reported that the major effects of the head lice infestation were the lack of concentration and discomfort, which can only be subjective in nature, indicating that older children might be able to tolerate the head lice better than those of younger age. Whilst older children might be less susceptible to developing the major effects of head lice infestations, there are no data that can support such claim. There are also no local data stating the most common major effects of head lice infestation. In fact, subjective data such as concentration and discomfort weren't collected in this study, which can be qualified as a limitation alongside the small sample size. Finally, we recommend that this study be utilized in conjunction with other studies, in meta-analyses or systemic reviews, to increase its statistical power, as it has a relatively small sample size.

CONCLUSION

The present study reinforces the fact that head lice infestation is a problem, especially among school-aged children. It also reinforces the fact that head lice infestation affects the academic performance of children, which calls for the need for preventive and curative measures. Since transmitting head lice is mainly associated with the children's activities and habits, children can be taught to avoid activities that may spread head lice; henceforth, the need to educate and spread awareness to families and teachers. A survey in the Philippine setting testing the

knowledge of teachers and guardians regarding the three conditions can prove to be beneficial. For individuals diagnosed with an active infestation, pharmacologic treatment is the routine measure.

Knowledge of the relationship between academic performance and the health conditions in question will guide the professionals in providing appropriate interventions to the patients and other at-risk individuals. This study, along with similar others, can serve as evidence and guide for policymakers and stakeholders in conducting local, regional, and national programs, and implement guidelines and policies that would address these conditions, from prevention, to screening and treatment. There is a need for collaboration efforts between families, schools, communities, and the media to create an environment that establishes healthy behaviors through health promotion.

On a local level, this study will raise awareness in the school communities on the prevalence of these conditions and their potential impact on the academic performance of their students, and provide baseline data for other schools as well as guide teachers and school physicians or nurses in planning programs to address these conditions. It will also guide in providing appropriate education across all levels of prevention to students having difficulty in school.

This study can also be added to the scarce literature investigating the association of these three conditions with academic performance as a source for similar future studies.

DECLARATIONS

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Conflict of interests: The authors declare that they have no competing interests with the results of this study.

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Ethics approval and consent to participate: This study was approved by the Research Ethics Board of the affiliated university prior to its commencement.

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