Health Status and School Performance of Elementary School Children in a Philippine Barangay

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ABSTRACT

Background: Though several studies have already shown how health affects a child's school performance, more local studies need to be done, which may be used in a targeted approach to bolster the school performance of the Filipino child from the health perspective.

Objective: This cross-sectional study aimed to determine if there is a significant relationship between the health status, defined as the presence or absence of morbidities, and school performance, measured by the final grade point averages (GPAs), of the children enrolled in Calubcub 1.0 Elementary School (C1ES).

Methods: With parental consent, C1ES children underwent physical examination (PE) last March 2007 and the frequency distribution of the morbidities found in the children was obtained from the accomplished PE forms. Treatments and referrals were made as necessary. With the approval of the principal, the final GPAs of the children for that school year were obtained from the school records. Two hundred fourteen children were included in this study.

Results and Conclusions: Stunting was found to be significantly correlated to the GPA ($p<0.01$) with correlation coefficient of -0.186. No significant correlation was found between all the other morbidities found in the children and their GPA.

Key Words: health status, school performance, stunting, school children, nutritional status

Introduction

Health plays a big role in the school performance of a child. According to Novello, DeGraw, and Kleinman[1], children must be physically and emotionally healthy in order to learn effectively. The World Health Organization (WHO), through The Status of School Health released in 1996[2] and Research to Improve Implementation and Effectiveness of School Health Programmes released in the same year[3], highlights the significant correlation between the health of a child and his school attendance and performance. It specifically pointed out nutritional deficiencies, in the form of protein-energy malnutrition (PEM) and deficiencies in iron, vitamin A, or iodine; parasitic worm infections, especially schistosomiasis, roundworm and other intestinal helminth infections; other morbidities such as malaria and dental caries; physical and mental disabilities; and reproductive problems in the form of premature fertility, sexual violence, and sexually transmitted diseases. Similarly, Swingle[4] cited nutrition, physical fitness, substance abuse, familial and societal violence, reproductive health, early childhood factors, and emotional and mental health conditions as affecting student learning.

Nutritional status is one indicator of health. Many indices have been formulated to assess a child's nutritional status. As defined by the WHO and Demographic Health Surveys, weight-for-age is a parameter which depicts nutritional status and can be used to identify cases of malnutrition. In fact, it is the most widely used nutritional marker on growth charts. Using this parameter, moderate underweight is two standard deviations (SD) below the median weight-for-age of the reference population, while severe underweight is three SD below the median weight-for-age. On the other hand, weight-for-height is used to depict a child's current health and nutritional status. A deficit in weight-for-height is defined as wasting. Using this parameter, moderate wasting and severe wasting are 2 SD and 3 SD below the median weight-for-height of the reference population, respectively. Height-for-age reflects the chronic nutritional status of a child. A deficit in the height-for age is called stunting, which is defined as 2 SD below the median height-for-age of the reference population.[3]

WHO, in The Status of School Health[2], mentions various researches done in Honduras, Kenya, and the Philippines, which showed that students with good nutritional status fared better than their classmates with poor nutritional status in terms of academic performance. It must be noted that factors such as family income, school quality, teacher ability, and mental ability were taken into account and controlled for in these studies. The article also cites another study in Kenya in 1998, which revealed a strong relationship between nourishment and verbal comprehension as well as attention. According to Swingle[4], it has also been demonstrated that chronically undernourished children fared worse on standardized achievement tests, particularly language ability tests, and that total food energy was highly associated with school achievement.

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The detriment caused by nutritional deficits on school performance is attributed by the WHO in The Status of School Health[2] to weakened immune resistance, impaired growth of muscle and bone, deteriorating visual and auditory functions, and dwindling mental function. According to the same article, PEM is associated with lethargy, diminished concentration, frequent illness, and poor memory.

As for micronutrient deficiencies, iron and vitamin C are the nutrients found to have the strongest relationship with achievement.[4] Iron deficiency, which in large part is due to inadequate diet but may also be worsened by intestinal worm infection, has been found to cause mental retardation, impaired mental and motor development, and anemia.[2] However, according to the same article, it can be treated and is reversible. The article also mentions other micronutrient deficiencies such as deficiencies in iodine and vitamin A. Iodine deficiency is known to cause cretinism and mental retardation, while vitamin A deficiency has been shown to encumber physical and mental development. The latter has also been linked to acute respiratory infections in some countries, while also affecting the severity of measles and diarrhea. All these affect school attendance and absenteeism.[2]

Intestinal worm infections are known to cause malnutrition by causing decreased appetite, chronic diarrhea and nutrient malabsorption.[5] Consequently, worm infections are seen to negatively affect school performance as they lead to decreased well-being, lessened activity, impaired growth and development and absenteeism, which may all be secondary to anemia, diarrhea, intestinal obstruction, blindness and cough.[2]

Dental caries is one of the top health problems occurring in school-age children worldwide.[2,3] In the Philippines, studies have shown that dental decay is more prevalent than other diseases combined.[6] According to the same article, the relationship between nutrition and oral health is a cyclical one. Deficient oral health prevents adequate nutritional intake. On the other hand, poor nutrition impairs the development of the teeth and other oral tissues and predisposes them to oral pathologies. Furthermore, chronic micronutrient deficiency, such as that of ascorbic acid, zinc and iron, renders them more susceptible to oral disease. It has also been shown that oral health is significantly related to a child's academic performance and his functions in later life. The same article states that absenteeism is 12 times more likely in children with inadequate oral health than in those without. Poor oral health has also been linked to stunting and malnutrition.[2]

These are the top health issues facing school-age children in the Philippines and worldwide. Though several studies have already shown how these issues affect a child's school performance, more local studies need to be done, which may be used in a targeted approach to bolster the school performance of the Filipino child from the health perspective.

A child's school performance can be measured using various parameters according to Devaney, et. al.[7] These include class grades and grade point averages (GPA), grade and enrolment information, grade promotion, standardized achievement test scores, awards, dropout status, attendance information, and the like.

Calubcub 1.0 is a barangay in San Juan, Batangas, with a local elementary school, Calubcub 1.0 Elementary School (C1ES). Annual physical examination (PE) of the children enrolled in the said school from grades 1-6 last March 2007 revealed the following top morbidities and their corresponding percentages: malnutrition (58%), pediculosis capitis (38%), dental caries (28%), upper respiratory tract infection (URTI) (26%), and impacted cerumen (12%).

No studies have been done yet to see if there is a significant relationship between health status and school performance in C1ES. Therefore, the municipal health office, has requested that studies of this nature be conducted in accordance with the health programs of the municipality, to aid in devising means to further improve the school performance of the children in the municipality from the health perspective.

Statement of the Problem

Is there a significant relationship between the health status and school performance of the children enrolled in C1ES?

Objective

This study aimed to determine if there is a significant relationship between the health status and school performance of the children enrolled in C1ES.

Scope and Limitations

Only C1ES children enrolled for the school year 2006-2007 who underwent the PE conducted by University of the Philippines-Philippine General Hospital (UP-PGH) medical interns on March 2007 were included in the study.

This study did not take into account extraneous factors, which may also have an effect on the variables being studied such as age, social status, gender, domestic setup, and previous school performance.

Methods

Research Design

Cross-sectional study.

Population

Out of the 452 C1ES children enrolled for the said school year from kinder to grade 6, only 396 underwent the said PE. Fifty-six children were absent on the said day and so were not able to undergo the PE, the reason the school gave for which was that classes had become irregular because the academic year was about to end. Furthermore, 182 had no available GPA data (see subsection on data collection below). Thus, only 214 remained in this study, comprising 47% of the children enrolled in C1ES for the said school

year, with an age range of 6 to 15 years, 121 of which are females (56.5%), and 93 males (43.5%)

Definition of Variables

In this study, health status was defined as the presence or absence of morbidities, which were identified from the PE done on March 2007. Table 1 depicts the morbidities found in the children who underwent the said PE and whose GPAs were available, and their corresponding frequency and percentage.

Stunting and wasting were also scored based on National Center for Health Statistics (NCHS) into 0 as normal, 1 as mild, 2 as moderate, and 3 as severe. Table 2 presents the frequency and percentage of the children based on this scoring.

Lastly, this study measured school performance using each child's final GPA obtained at the end of the school year 2006-2007.

Table 1. Frequency and Percentage of Morbidities

Morbidity	Frequency	Percentage
Stunting	92	42.99%
Wasting	76	35.51%
Pediculosis capitis	76	35.51%
Upper Respiratory Tract Infection	52	24.30%
Dental caries	51	23.83%
Impacted cerumen/Retained Cerumen	22	10.28%
Ear Infection/Inflammation	5	2.34%
Acute Gastroenteritis	3	1.40%
Tinea versicolor	3	1.40%
Bronchial Asthma	3	1.40%
AVI	2	0.93%
Intestinal parasitism	2	0.93%
Atopic Dermatitis	1	0.47%
Branchial Cleft Fistula	1	0.47%
Folliculitis	1	0.47%
Insect Bite	1	0.47%
Perforated Tympanic Membrane	1	0.47%
Preauricular Sinus	1	0.47%
Reactive Lymphadenopathy	1	0.47%
Seborrheic Dermatitis	1	0.47%
Soft Tissue Contusion	1	0.47%
Gastritis	1	0.47%
Traumatic Fracture	1	0.47%
Pulmonary Tuberculosis	1	0.47%
None	23	10.75%

Table 2. Frequency and Percentage of the Degrees of Wasting and Stunting

		Frequency	Percentage
Wasting	Normal (or Absence of Wasting)	138	64.49%
	Mild	55	25.70%
	Moderate	18	8.41%
	Severe	3	1.40%
Stunting	Normal (or Absence of Stunting)	122	57.01%
	Mild	71	33.18%
	Moderate	21	9.81%
	Severe	0	0%

Data Collection

Secondary data (accomplished PE forms) was used to obtain the frequency distribution of the morbidities of the children. The actual PE of the children and the completion of the PE forms were done by medical interns who preceded the authors in rotating in the barangay. The final GPAs of the children for that school year were obtained from the school records by the authors. However, the final GPA of the children from 5 sections, namely the kinder level, and one section each from grades 1, 2, 3 and 5, were not obtained as they were not handed over to the researchers on time. A total of 182 children were subsequently excluded from the study for the said reason. Table 3 presents the distribution of C1ES children remaining in the study per grade level.

Since 182 children were excluded due to lack of GPA data, there is the possibility of sample bias. There may be more children with morbidities in the excluded group or the children here may have lower GPAs than those remaining in the study, or the opposite. To account for the first possibility, Pearson Chi Square value was obtained using Statistical Package for the Social Sciences (SPSS) statistical software (16.0. for Windows; SPSS Inc.) to check for homogeneity of the excluded and included children with respect to absence or presence of morbidities, with p value set at <0.05. The Pearson Chi Square value obtained was 0.01, with a significance value of 0.921. Thus, the groups of excluded and included children can be considered homogenous with respect to absence or presence of morbidities. Table 4 presents the frequencies of morbidities in the included and excluded groups of children and the result of Pearson Chi Square. However, as for the second possibility, it cannot be

Table 3. Grade Level Distribution of Subjects Remaining in the Study after Exclusion of those without GPA Data

Grade Level	Number of Children who Underwent PE	Number of Children who Underwent PE with GPA	Percentage of Children Remaining in the Study
Kinder	8	0	0%
1	90	28	31.1%
2	64	28	43.8%
3	57	25	43.8%
4	47	47	100%
5	75	31	41.3%
6	55	55	100%
Total	**396**	**214**	**54.0%**

Table 4. Result of Test of Homogeneity of Included and Excluded Subjects

	Excluded Subjects	Included Subjects	Total
Without Morbidities	19	23	42
With Morbidities	163	191	354
Total	182	214	396
		Pearson Chi Square	0.01
		Significance	0.921

determined whether the group of excluded children has lower or higher GPAs than the group of included children, due to the original problem, the lack of GPA data of the excluded group.

Statistical Analysis

Associations between wasting and GPA, and stunting and GPA were computed using Pearson Product Moment Correlation Coefficient, which is commonly used to measure the strength of relationship between two continuous or interval variables. Associations of each of all the other morbidities to the GPA of the children were computed using Point Biserial Correlation Coefficient, which is commonly used to measure the strength of relationship between a dichotomous variable and a continuous variable. Two-tailed tests were used for the p values. Statistical significance was set at p value <0.05. Analysis was done using SPSS statistical software.

Ethical Issues

In compliance to the recent order of the Department of Education that annual health assessments of school children be done, C1ES asked the UP-PGH medical interns rotating in the area to do a physical examination on their pupils. The children's parents were informed and their consent sought prior to the physical examination. Letters were sent to the parents regarding each child's diagnosis. Treatments and referrals to the Regional Health Unit and specialists were made as necessary.

Approval of the study was given by the C1ES principal. Records of the GPAs of C1ES children were then lent to the authors, and were returned to the school after the encoding.

Results

The correlation coefficients between each of the morbidities and the GPA of the children included in the study are depicted in Table 5.

Table 5. Correlation Coefficients between Morbidities and the GPA and Significance Level

Morbidity	Correlation Coefficient	Significance
Stunting	-0.186	0.006
Wasting	-0.042	0.544
Pediculosis Capitis	-0.051	0.458
Upper Respiratory Tract Infection	-0.018	0.789
Dental Caries	-0.009	0.900
Impacted Cerumen/ Retained Cerumen	-0.071	0.302
Ear Infection/Inflammation	-0.093	0.174
Acute Gastroenteritis	0.051	0.460
Tinea Versicolor	-0.088	0.201
Bronchial Asthma	0.043	0.534
Acute Viral Illness	0.015	0.824
Intestinal Parasitism	-0.117	0.087
Atopic Dermatitis	0.066	0.337
Branchial Cleft Fistula	0.038	0.577
Folliculitis	-0.029	0.669
Insect bite	0.052	0.448
Perforated Tympanic Membrane	0.038	0.577
Preauricular Sinus	0.043	0.532
Reactive Lymphadenopathy	-0.070	0.311
Seborrheic Dermatitis	0.015	0.823
Soft Tissue Contusion	0.011	0.875
Gastritis	0.015	0.823
Traumatic Fracture	-0.087	0.206
Pulmonary Tuberculosis	0.119	0.083
None	0.029	0.676

Discussion

The results show that there is no significant correlation (p>0.05) between the following morbidities and the GPA of the C1ES children in this study: wasting, pediculosis capitis, upper respiratory tract infection (URTI), dental caries, impacted or retained cerumen, acute gastroenteritis (AGE), ear infection or inflammation (which includes chronic otitis media and acute otitis media), tinea versicolor, bronchial asthma, acute viral infection (AVI), intestinal parasitism, atopic dermatitis, branchial cleft fistula, folliculitis, insect bite, perforated tympanic membrane, preauricular sinus, reactive lymphadenopathy, seborrheic dermatitis, soft tissue contusion, gastritis, traumatic fracture, and pulmonary tuberculosis. Also, no significant correlation was found between having no morbidity and GPA.

The absence of correlation between wasting and school performance of the 214 C1ES children included in the study can be explained by the fact that wasting, or a deficit in weight-for-height, is a reflection of current nutritional status, in contrast to stunting, which is an indicator of chronic nutritional status. As for dental caries, although some sources have associated it with school performance, there is still a paucity of literature that could explain how dental caries is related to school performance, compared to that on the relationship between nutritional status and school performance. It can thus be surmised that there could be other or intermediate factors in the association between dental caries and school performance which were not accounted for in this study. On the other hand, intestinal parasitism, which has been known to lead to malnutrition through decreased appetite, chronic diarrhea and nutrient malabsorption, has consequently been associated with poor school performance in the literature. However, its lack of significant association with the school performance of the children in this study may be explained by its very low frequency in the given population.

The same thing can be said for the rest of the morbidities, except for pediculosis capitis. Furthermore, the acute nature of most of these morbidities, such as URTI, AGE, and AVI, may not have allowed any significant adverse effects on the GPA of the children, which is of a long-term nature.

Pediculosis capitis, despite having a large enough frequency, was not found to be significantly related to school performance of the children in this study. This may be due to its real lack of association with cognitive function.

Lastly, the results indicate a significant negative correlation (p<0.05) between stunting and the GPA of

the C1ES children included in this study. In other words, stunting is associated with poorer school performance of these children. In line with this, a greater severity of stunting is linked with worse school performance. However, with a relatively low pearson correlation coefficient (r=-0.186), stunting accounts for only 3% of the variance in the GPA. This leaves 97% of the variance in these children's GPA being accounted for by other variables.

Causes of Stunting

Stunting, which is the effect of chronic damage to the growth plate leading to decreased chondrocyte proliferation and maturation, can occur at different times in a child's development. Failure of growth can occur as early as the gestational period, which has been found to be related to short maternal stature, low pre-pregnancy BMI and low pregnancy weight gain.

Nutrient deficiency [5,8], frequent infections and inadequate caregiver feeding practices then lead to stunting later on in the child's growth.[5] Specifically, deficiency of iron, zinc, and vitamins A, C and D has been related to stunting.[5]

According also to Branca and Ferrari [5], research has shown that areas with high rates of parasitic and other infections due to poor sanitation and insufficient water supply also have an increased frequency of stunted children. Lastly, one particular study cited in the same article, which was conducted in Chad has proven that a child's height-for-age is associated with caregiving practices.

Stunting, Cognitive Ability and School Performance

Steegmann, Datar, and Steegmann[9] performed a similar correlation study of 50 Filipino boys and girls (25 boys and 25 girls), with similar results, and found that the grades of the children correlated best to their percentage of median height based on NCHS, and not to weight-for-height. In addition, they also found a significant correlation, although not as strong, between grades and visual motor skill.

Studies carried out by the Institute of Nutrition of Central America and Panama (INCAP) and Nutrition Collaborative Research Support Program (Nutrition CRSP) also prove that early malnutrition leads to permanent growth stunting and related functional deficits, such as in cognitive and behavioral areas, which may persist to adulthood.[8] Branca and Ferrari (5) cited studies wherein severe stunting at age 2 in Filipino children has been linked to impaired cognitive function. This can be explained by another study cited indicating that stunting due to chronic malnutrition in the first 2 years later led to cognitive deficits in childhood. Still another study cited showed that stunted Guatemalan children performed worse in school compared to their non-stunted counterparts. Moreover, the WHO in The Status of School Health[2] mentioned a study conducted in 1992 linking grade repetition among Honduran students with being below height-for-age. It has also been shown that children of short stature achieved lower scores in mathematics[10, 11] and Spanish, and were more likely to have learning disabilities and to fail in school.[11]

Other Effects of Stunting

As already mentioned, growth failure in childhood tends to persist until adulthood. This is then associated with decreased working capacity and other such limitations in function.[5, 8] Branca and Ferrari[5] also cited a study indicating a relationship between a woman's stature and reproductive performance, such that Intrauterine Growth Retardation (IUGR) is more likely to occur in stunted girls. The article also mentioned that aside from developmental delay, other detrimental effects associated with stunting include increased morbidity and mortality, weakened immune function, and heightened risk for chronic diseases such as hypertension, reduced glucose tolerance and obesity.

Prevention and Treatment of Stunting

According to Branca and Ferrari[5], the prevention of stunting can be achieved by interventions targeted at different stages of a child's development. From the article, the importance of proper maternal nutrition for intrauterine growth cannot be overemphasized, while exclusive breastfeeding until 6 months of age has been shown to be vital for sufficient infant growth. Providing a well-balanced diet has also been proven to prevent stunting up to 2 years of age. It is important to stress that all these must be combined with proper caregiving, good hygiene and adequate sanitation. Also, economic factors play a big role in the prevention and treatment of stunting. It has been shown that there is an association between Gross National Product (GNP) and the occurrence of stunting. For example, it has been recently observed that stunting rates have gone down in South-East Asia, wherein considerable economic progress has been made in the past 15 years.[5]

It is emphasized in the literature that stunting is treatable and is reversible, but usually only until the age of 5.[5] During this period, catch-up growth may still be achieved with a well-balanced diet, adequate and active caregiving practices, clean water, proper sanitation and treatment of any concomitant infections. One study cited by Branca and Ferrari[5] showed that catch-up growth without the above interventions was either rare or incomplete by 5 years of age in stunted children in developing countries. Specifically, only 30% of stunted Filipino children had attained normal height by 8.5 years of age and 32% by 12 years of age.

Aside from physical growth, deficits in cognitive ability associated with stunting can also be reversed, although this only applies until 3 years of age.[5] According to the article, it has been shown that micronutrient supplementation and psychosocial stimulation improve cognitive function, especially when used in combination.

Conclusion and Recommendations

In conclusion, this study found a significant relationship between health status and school performance of the C1ES children included in this study. Stunting, in particular,

significantly, is negatively correlated to the school performance of these children as measured by their GPA. All the other morbidities did not show this negative correlation.

Since the children in this study all fall within the age range of 6 to 15 years, catch-up in physical and cognitive development cannot be achieved that easily. However, it must be pointed out that, despite being significant, only a low correlation was found to exist between stunting and the school performance of the said children. That is, only 3% of the variance in the GPA can be accounted for by the presence of stunting in these children, leaving 97% of the variance in the children's GPA to be accounted for by other variables. Therefore, aside from addressing the problem of stunting in these children, equal or greater importance must be given to address the other factors which may have contributed to these children's poor school performance. Further research can then be done to look into these other factors.

It must therefore be emphasized to the community of Calubcub 1.0 that the prevention of stunting starts during the gestational period and continues throughout the rest of the child's development. Therefore, to improve the school performance of children, with special reference to the children enrolled in C1ES, stunting must be prevented or treated early on, even prior to starting school.

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