

Research Article

Effect of Leishmaniasis on the Performance of Elementary School Students: A Case Study among Syrian Refugees in Some Bekaa (Lebanon) Area Schools

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ABSTRACT

Since the Syrian conflict started, Lebanon became a common destination receiving a huge number of Syrian refugees that are living in camps spread all over the country, with the largest concentration in the Bekaa Valley. Generous steps are being taken to increase the access to formal education, such as offering free public education and opening second shifts in the public schools in the afternoon. Yet barriers, such as child labor and health-related factors like the spreading of some communicable diseases, like *Leishmania*, are keeping children out of classroom. The present study was done with the aim of investigating the effect of leishmaniasis on the performance and the academic achievement of Syrian refugee children. The results showed varying degrees of knowledge and dealing with the case of leishmaniasis. The disease clearly had an effect on the students' attendance in schools, and by proxy on their academic performance.

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1. INTRODUCTION

It is well known that education in a child's life has the power to develop him/her personally, socially, as well as economically. Owing to the value of education and its significance, governments, Non-Governmental Organizations (NGOs), as well as educational institutions are investing more than ever on education. To bring improvements to this sector, some of the factors influencing the academic performance of students such as attitude, leadership aspects, and psychological and health-related factors are being studied thoroughly.

Since the eruption of the Syrian conflict in 2013, Lebanon began hosting fleeing refugees [1]. Because of Lebanon's open border policy with Syria, the country has sheltered around 1.5 million Syrian refugees, as estimated by the Lebanese government and a number of local NGOs. According to a report published by the United Nations High Commissioner for Refugees in 2016, the refugees were spread all over the country as follows: Bekaa (36%), Beirut (26%), North Lebanon (26%), and South Lebanon (12%) [2]. Unfortunately, Syrian refugees live under very poor conditions. Inadequate sanitation, lack of access to clean water, overcrowding in their temporary settlements as well as limited access to healthcare infrastructure favor the spreading of a number of

communicable diseases, such as hepatitis A, influenza, leishmaniasis, and so on [3].

Leishmaniasis is a parasitic zoonosis caused by protozoans of the genus *Leishmania*. The pathogen is transmitted by insects known as phlebotomine sand flies, which are found in wild or urban environments [4,5]. Transmission of the disease occurs mainly through the infected insects; non-vector transmission is rare. There are three main forms of leishmaniasis: visceral leishmaniasis (VL), cutaneous leishmaniasis (CL), and mucocutaneous leishmaniasis (ML) [6]. Cutaneous leishmaniasis is the most common form of leishmaniasis, characterized by skin manifestations causing skin lesions, papules, and nodules that may ulcerate leaving scars and serious disability [7].

Leishmaniasis is an endemic disease in Syria, and the presence of war/conflict has greatly increased the risk for new disease cases in the country as well as in the surrounding areas of the Middle East [8–10]. Population displacement, poverty, and the poor living conditions, among other factors, help in the rapid transmission of the infection [11,12]. Following the civil war in Syria, the Syrians started migrating to Lebanon and living in low-income, low-sanitation, and high-population camps on the border with Syria, where the highest prevalence of leishmaniasis is recorded [13]. As young people usually are the most affected due to their lack of previous exposure to the disease, students in school are one of the main populations affected by this problem [14–16].

The number of studies tackling issues related to Syrian refugees in Lebanon have been on the rise recently. However, there are no

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Data availability statement: The raw data used in this study may be requested from the authors.

studies that approach the correlation between *Leishmania* and school performance. This study aims to assess the effect of leishmaniasis on the academic performance of elementary school students in Bekaa, Lebanon.

2. MATERIALS AND METHODS

2.1. Study Design

For this study, we use and apply a descriptive mixed method as described by Creswell [17]. He defines the term mixed method as a research approach that arises from merging both qualitative and quantitative methods in a constant long-term program of investigation to address the research questions. Such integration allows more harmonious usage of data than selectively using each type alone. Using mixed study has several advantages:

1. In a mixed method, we confirm our quantitative results using qualitative experiment. As a result, this method will enable the researcher to relate and confirm the effect of leishmaniasis on the performance of elementary school students by using the data from both an interview (qualitative) and a survey (quantitative) in the Bekaa schools.
2. The mixed method gives us multiple perspectives and more understanding of the topic by having results not only from Bekaa schools but also from directly interviewing parents of infected students at refugee camps.

This study is classified as descriptive mixed method as it analyzes data collected from surveys, interviewing teachers/parents of infected students, and managers at Bekaa schools.

2.2. Data Collection

Primary approval from the University's Institutional Review Board was granted to conduct research at Bekaa schools, where students are potentially infected by leishmaniasis. The surveys were distributed and the data were collected by hand to ensure that the queried people understood the questions; an important aspect due to the social circumstances in which the study was conducted. Also, personal interviews with Bekaa school principals, the head of Communicable Diseases Department at the Lebanese Ministry of Public Health (LMoPH), some NGOs, and managers of drug dispensaries in western Bekaa were also conducted. The academic performance of the students under survey was probed prior, during, and after being diagnosed with – and later on treated from – leishmaniasis.

Data concerning cases among different age groups were collected from the LMoPH for the years 2016 and 2017 (only available data) [18].

3. RESULTS

3.1. Overview

Almost all (99%) of the surveyed schools reported having Syrian refugees among their student bodies. Also, 83.6% of these schools testified that they have formal medical supervision of the students. Only 20% of the schools had formal awareness campaigns about communicable diseases. In addition, 4% of the schools had no form of health awareness, 53% did have some scattered activities in that regard, ranging from seminars, weekly sessions, and some publications, with the different schools approaching the matter differently. Only 27% answered correct queries about leishmaniasis, whereas 20% had completely wrong answers, and the rest showed some degree of knowledge. In all, 97% of the interviewees reported encountering at least one case of leishmaniasis.

3.2. Academic Performance

Academic performance was categorized as weak, acceptable, good, very good, and excellent. Pre-infection (non-infected) students were distributed as 0.3%, 10.3%, 75.9%, 6.9%, and 6.9%, respectively (Table 1). Infected students were distributed as 56.2%, 33.4%, 10.4%, 0%, and 0%, respectively (Table 1). Post-infection (treated) students were distributed as 24.2%, 41.4%, 27.6%, 3.4%, and 3.4%, respectively (Table 1). When comparing some of the averages of students before and after infection with respect to their classmates, our results show clear differences and decrease in academic performance of students affected by CL (Table 2). On comparing these same infected students to peers who had the same academic averages from previous years, we could also see a decrease in the performance of affected students after the infection (Table 3).

3.3. Attendance of Students

Attendance was categorized as extremely low, lower than normal, normal, and permanent. Pre-infection (non-infected) students were distributed as 0%, 0%, 62.1%, and 37.9%, respectively (Table 4). Infected students were distributed as 6.9%, 72.4%, 20.7%, and 0%, respectively (Table 4). Post-infection (treated) students were distributed as 6.9%, 41.4%, 44.8%, and 6.9%, respectively (Table 4).

3.4. Gender and Age

In terms of gender, the percentages of affected boys and girls were 60.3% and 39.7%, respectively. The reported cases ranged from 3 to 14 years of age. The age groups that were most affected by the

Table 1 | The academic performance of students in the different phases of infection

	Weak (%)	Acceptable (%)	Good (%)	Very good (%)	Excellent (%)	Total (%)
Pre-infection	0.3	10.3	75.9	6.9	6.9	100
During infection	56.2	33.4	10.4	0	0	100
Post-infection	24.2	41.4	27.6	3.4	3.4	100

Table 2 | Comparison of individual student averages before and after infection with their corresponding classes

Student	Before <i>Leishmania</i> infection		After <i>Leishmania</i> infection	
	Student average	Class average	Student average	Class average
a	58.3	60.3	45.4	61.4
b	69.4	60.3	58.2	61.4
c	55.8	57.5	51.4	58.6
d	56.4	51.4	49.3	53.5
e	52.6	67.7	47.6	62.8
f	67.3	67.7	52.7	62.8
g	65.5	67.7	54.5	62.8
h	56.1	55.4	48.1	59.6
i	66.5	70.2	50.8	71.8
j	54.8	58.6	47.4	60.4

Table 3 | Comparison of the total individual averages of some CL-affect students before and after infection with a cohort of students having had similar averages in the previous years/semesters

Student	Before		After	
	Student average	Cohort average	Student average	Cohort average
a	58.2	58.1	45.2	59.4
b	69.4	68.5	58.5	70.1
c	55.2	54.75	51.8	55.4
d	56.7	56.2	49.5	58.3
e	52.5	51.8	47.4	54.5
f	67.4	66.7	52.3	68.8
g	65.7	66.5	54.6	69.4
h	56.4	57.8	48.4	60.3
i	66.8	65.4	50.1	66.5
j	54.2	54.5	47.4	56.8

Table 4 | Attendance of students in different phases of the infection

	Extremely low (%)	Lower than normal (%)	Normal ^a (%)	Permanent ^b (%)	Total (%)
Pre-infection	0	0	62.1	37.9	100
During infection	6.9	72.4	20.7	0	100
Post-infection	6.9	41.4	44.8	6.9	100

^aNormal attendance was based on the average attendance of noninfected students in the same class; ^bNo absence was reported during the timeframe of the study.

Table 5 | Distribution of infection among different age groups

Age group (years)	Number of cases
0–4	250
5–9	248
10–19	222
20–39	191
40–59	66
60+	20

disease were that of 0–4 and 5–9 years of age with 250 and 248 cases, respectively (Table 5). The age group with the least number of cases was that of >60 years of age with 20 cases. These case numbers were from the years 2016 and 2017.

3.5. Parental Awareness and Responses

For the parents of affected students, 75.9% of them received general health awareness, 3.4% received published material specific to the disease, and 3.4% were trained to deal with such cases, whereas 17.2% showed complete indifference. Around 5% of parents answered that they have no children suffering from any communicable diseases, 19% answered that their children had a history of leishmaniasis, 9% said that their children have a current infection with measles; 14% said that their children have a current infection with leishmaniasis, other parents said that their children have a chicken pox infection, and the remaining 33% of the parents said that their children are currently suffering from other communicable diseases such as hepatitis (A, B, or C), rotavirus, or rubella.

3.6. Subtype

The subtype of leishmaniasis most frequently affecting the people in Lebanon is the cutaneous one. Almost 93% of the reported cases were of this subtype.

4. DISCUSSION

Our results show that there is a correlation between the performance and attendance of students when infection with leishmaniasis is present. Students infected with *Leishmania* were underperforming and not attending their classes regularly. The effect of CL on attendance – and by corollary – on the students’ performance was quantitatively analyzed in two ways: (a) by comparing the averages of some of the affected students before and after infection (disregarding the material taught during the days of infection) to those of the corresponding classes, all while eliminating the mathematical contribution of the studied subjects from the overall averages (Table 2); and (b) by comparing the total averages of the same CL-affected students before and after infection (disregarding the material taught during the days of infection) with a cohort of students having had similar averages in previous years/semesters (Table 3).

It is obvious from the data shown in Table 2 that all the infected students who were compared with their peers before and after infection suffered a considerable drop in their academic performance, as assessed by their grade averages. It is worth noting here that such a drop is ubiquitous, meaning it affected both the students who had higher or lower averages than their corresponding classes.

Table 3 shows a comparison in the performance of the CL-affected students vis-à-vis their retrospective cohorts. A group of students whose averages in the immediate previous semester/year were almost identical to any one of the CL-affected students in the current semester/year was selected as a benchmark cohort. The averages of such cohorts in the current semester/year were then calculated and compared with those of the CL-affected subjects. It is clear that, although the averages of all the cohort groups ameliorated, the averages of all of the infected students exacerbated. This is another indication that leishmaniasis indeed affects the academic performance of the infected student.

Several studies have already proved that there is a strong correlation between attendance and academic performance [19,20]. Therefore,

it comes as no surprise that with the decreased attendance students are facing due to their infection with *Leishmania*, their academic performance has decreased as well. The issue thus diverts into the cause behind the spread of this disease and the stigma behind it, which are affecting attendance and academic performance. Students affected with this disease were possibly also missing extra school days because of the bad reputation associated with it. The presence of this disease in the Bekaa area and particularly among elementary students can be explained by a number of reasons.

First, the Lebanese health system is composed of services rendered by the public and the private sectors, as well as the NGO sector. The dominant sector is the private one, as it provides most of the services [21]. Around 50% of Syrian refugees live in the poorest areas of Lebanon, informally [21]. Consequently, in the 6 years of Syrian crisis, the healthcare services rendered across the Syrian refugee population in Lebanon was below appropriate standards, and explains the spread of infection and in turn the decreased attendance and underperformance of affected students.

Second, with the high influx of Syrian refugees into Lebanon, a sudden increase in *Leishmania* cases was noted. Syrians have been known to be infected with this parasite since 1990 [22]. This new outbreak of leishmaniasis in Lebanon is the first of its kind for over a decade [13]. The LMoPH implemented an active surveillance for leishmaniasis since the beginning of the Syrian conflict; LMoPH diagnosed the cases by traditional techniques of smear, histological analysis of skin biopsies, and parasite culture [13,23–25]. Leishmaniasis is considered one of the most neglected diseases in the world, in the time where the parasite may be able to propagate in different areas in Lebanon, particularly in Bekaa district, where the vector may find a favorable habitat and where appropriate zoonotic reservoirs are present. This increased influx as well as suitable habitat is another reason for the spread of the diseases among individuals in the area of our study. Tactics such as the ones formed by other countries including South American and East Asian countries to combat infection can be used to halt the propagation of the disease in Lebanon [26].

The problem of Syrian refugee influx is not only contained to Lebanon. Other countries in the Middle East, such as Jordan, Iraq, and Egypt [27,28], like Lebanon, have been plagued with some diseases spread among the Syrian refugee populations they have been hosting. Leishmaniasis was one of the most common diseases reported in the Syrian refugee camps in these countries. Risk factors such as malnutrition, poverty, population displacement, poor housing, and decreased hygiene are all met among the refugees and the camps they are settling in among host countries [29]. Therefore, precautions and healthcare plans such as immediate containment and treatment of affected personnel were made to halt spread of *Leishmania* among the host populations and avoid further disease propagation. Workshops and campaigns were also introduced in a few neighboring countries of Syria to train medical personnel to recognize the disease promptly to deal with the issue as soon as possible and prevent further spreading of leishmaniasis [4].

Third, political tensions and strings attached to the different Lebanese ministries (e.g., Public Health, Social Affairs, Refugees and Displaced, Education, and so on), and the political conflicts that may exist between the heads of these ministries in the Lebanese cabinet pose another problem in combating leishmaniasis and, by proxy, in solving the issue of performance and attendance among

students [30–33]. A clear indication to such an argument was the lack of coordination between the schools (under the control of the Ministry of Education), NGOs (under the control of the Ministry of Social Affairs), and primary healthcare centers (under the control of the MoPH). Our study reported that 64.3% of the schools lacked any kind of coordination with the LMoPH centers, whereas only 28.6% of the schools were in direct relationship with the LMoPH offices. Such an argument is further corroborated by the fact that the LMoPH provided the necessary medicines and vaccines to 70% of the reported cases.

Another matter that is affected by the political tensions in Lebanon is the lack of funding and development present in public schools, the place where most Syrian refugee children go. Owing to the low standards of health education present in these schools (only 20% had formal awareness campaigns about communicable diseases such as *Leishmania*) and administrations, as presented by the school administrators, fighting the spread of *Leishmania* among children of these institutions is even more difficult, exacerbating the matter of attendance and academic performance among students.

Younger age groups were shown to be the most infected in our study. This is due to the fact that they are immunologically immature compared to adults and do not have the biological means to fight off the disease [34]. More efforts must be put into prevention among the younger age groups by attempting increased screening and increased vaccination and immunity boosters to help this vulnerable population. Increased research is also key to develop prevention techniques and therapies for such diseases in the Arab world in general and Lebanon in specific [35–37].

A majority of parents were exposed to some awareness campaigns concerning leishmaniasis. This is imperative to stop the spread and management of the disease.

5. RECOMMENDATIONS

On the basis of our results, the following recommendations and directions for further studies are proposed: first, additional research is needed to determine the factors that affect students' attendance and other health-related factors that may affect students' attendance and performance. Second, educating parents on the importance of attending school daily in early ages to improve the overall academic performance of students. Third, establishing control programs and awareness campaigns for various communities. Fourth, create and increase coordination between schools (under the control of Ministry of Education), NGOs (under the control of Ministry of Social Affairs), and primary healthcare centers (under the control of LMoPH). Coordination among these agencies will help in preventing infection with leishmaniasis and other communicable diseases. Fifth, develop vaccines against all types of vaccine preventable diseases, especially for *Leishmania*, where vaccination remains the most promising approach for prevention. Sixth, increase funds to ensure equitable provision of health services to meet essential health needs at the primary, secondary, and tertiary healthcare levels. Seventh, avoid political strings attached to the different Lebanese ministries (Public Health, Social Affairs, Refugees and Displaced, and Education), in addition to the conflicts existing between the heads of these ministries. Finally, develop public awareness among Syrian refugees to assess the effects of communicable diseases on children's education.

6. LIMITATIONS

The validity of our data relies on the validity of the responses presented by the interviewees. Completely objective assessments such as test scores and an exact count of days missed because of the disease were not possible to collect because of the lack of accurate data from the source (schools and respective administrations). Not all subjects' academic records were accessible due to either endless bureaucratic processes or the unwillingness of the school principals to share such data. Another limitation was that none of the interviewees consented to be quoted in this work.

7. CONCLUSION

Evidence accumulated has shown that refugee camps are not good for anyone, especially for the youth. In this study, we addressed one communicable disease; however, there are still more issues that remain to be answered. These factors include – but are not limited to – psychological stress during and after migration, challenges that affect the ability of the refugee students to adapt to the host schools' system, and so on. This is despite the fact that educational access and opportunities for refugee children remains low. In conclusion, our study raises a critical point of the effect of communicable diseases on the performance of elementary students, in particular the Syrian refugees. Leishmaniasis is an example of one factor that keeps children out of the classroom. How other health-related factors may also affect could be further evaluated. In addition, public awareness within Syrian refugees might also be a subject of further investigation to assess its effect on children's education. This can be further implemented by school administration and their partnership with parents and/or guardian of the refugee students. The main question that remains to be answered with respect to the Lebanese community is whether the Lebanese authorities have enough knowledge in dealing with such education-related health problems despite the fact that leishmaniasis is not endemic in Lebanon.

CONFLICTS OF INTEREST

The authors declare they have no conflicts of interest.

AUTHOR CONTRIBUTIONS

H.H.K., F.J.Z., N.H. and H.M.K. were responsible for study conceptualization and writing (original draft) the manuscript. Data curation and formal analysis were carried out by H.H.K., E.S. and W.R. Project administration and supervision was carried out by H.M.K. Review and editing of the final manuscript was done by H.H.K. and H.M.K.

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APPENDIX

Kindly note that all of the surveys present in the appendix have been translated from their original language (Arabic) to English.

1. School Administration Survey

The purpose of this questionnaire is to examine the performance of some Syrian refugee children living in camps on the Lebanese–Syrian border and how their academic performance was affected due to being absent because of Leishmania infection. The other purpose was to evaluate how the respective schools and the municipalities dealt with Ministry of Health regarding with these cases.

1. Are there students of Syrian nationality at your school?
 - Yes
 - No
2. Is there health supervision in your school to monitor the health condition of students?
 - Yes
 - No
3. Do you have an awareness program on infectious diseases? If yes, what is the program?
 - Your answer (answer freely)
4. What do you know about *Leishmania*?
 - Your answer (answer freely)
5. Have you recorded cases of leishmaniasis in your school?
 - Yes
 - No
6. Which sex was most affected by any infection?
 - Boy
 - Girl
7. What are the ages of the infected students?
 - 3–5 years
 - 6–10 years
 - More than 10 years
8. What is the type of infection found in affected students?
 - Skin
 - *Leishmania* (blood)
9. What is the degree of the disease to the best of your knowledge?
 - A little
 - Medium
 - Strong
 - Poor
 - Acceptable
 - Good
 - Excellent
10. How was the academic performance of students before injury?
 - Poor
 - Acceptable
 - Good
 - Excellent
11. How was the academic performance of students after injury?
 - Poor
 - Acceptable
 - Good
 - Excellent
12. How was attendance before the injury?
 - Rare
 - Few

- Good
 - Permanent
13. How did students attend during an injury?
- Rare
 - Few
 - Good
 - Permanent
14. How was attendance after the injury?
- Rare
 - Few
 - Good
 - Permanent
15. How was the situation dealt with for infected students?
- Health awareness (seminars and lectures on the disease and treatment methods)
 - Training courses to deal with the situation
16. How was the situation dealt with for the family of infected students?
- Health awareness (seminars and lectures on the disease and treatment methods)
 - Training courses to deal with the situation
17. How was the situation handled for teachers with infected students?
- Health awareness (seminars and lectures on the disease and treatment methods)
 - Training courses to deal with the situation
18. Does your school have a social and psychological counselor that follows the psychological and social situation for affected children?
- Yes
 - No
19. Is there coordination between you and the Ministry of Health or refugee-related associations to follow up on the cases in your school in regards to medical condition and psychologic condition?
- Yes
 - No
20. Does the Ministry of Health provide vaccines and medicines to students?
- Yes
 - No

2. Family Interview Questions

Interview questions with family members of Syrian refugees living in Syrian camps on the Syrian–Lebanese border, enrolled in Lebanese schools. The purpose of this questionnaire was to learn how primary school performance is affected by school absenteeism

due to leishmaniasis, and how the respective school dealt with these infection cases.

1. If your child has or has had a recent infection, which of the following was he/she infected with?
 - Hepatitis A
 - Viral hepatitis B
 - Viral hepatitis C
 - German measles
 - *Leishmania*
 - Smallpox
 - The rotary virus
 - Other
2. What is the sex of your affected child?
 - Male
 - Female
3. How old was your child at the time of infection? In which class was he/she enrolled in?
 - Answer freely
4. Did your child skip school due to illness?
 - Yes, a little
 - Yes, there is a great loss
 - No, he/she did not
5. How did your child retrieve material that he/she missed from school?
 - He asks his friend
 - The professor asks
 - Parents follow the school
6. How was his/her performance affected by the absence?
 - Performance is remarkably low
 - Performance decreased slightly
 - Performance was not affected by the absence
7. How do you expect the academic outcome would have been had your child not missed any school days?
 - Your answer
8. How did your respective school cooperate with you in this issue (diseased child)?
 - Your answer
9. Were adequate treatment options provided to your affected child? Who provided the treatment?
 - School
 - Specialized associations
 - The municipality
 - He/she did not receive any treatment
10. Have you been invited to attend awareness seminars on leishmaniasis and infectious diseases?
 - Yes
 - No

3. Interview Questions to Ministry of Public Health Representatives

The aim of this interview is to examine the incidence of leishmaniasis in Lebanon after Syrian displacement and how the Ministry of Health dealt with this problem in coordination with the Ministry of Education.

1. What is the incidence rate of *Leishmania* infection in the last few years in Lebanon?
 - Answer freely
2. Which region recorded the highest incidence of *Leishmania* infections?
 - Answer freely
3. Which is the age group with the highest incidence of people infected?
 - Answer freely
4. Which subtype of leishmaniasis had the highest incidence among infected individuals?
 - Answer freely
5. Are all infected individuals Syrian nationals or people of other nationalities?
 - Answer freely
6. Are there cases of death related to *Leishmania*? If yes, what were the age groups of the deceased individuals?
 - Answer freely
7. To what extent did the Ministry of Health care about the problem and how was it dealt with?
 - Answer freely
8. Did the Ministry of Health assign any medical team to the Syrian camps in which the disease was most prevalent?
 - Answer freely
9. Does the Ministry of Health provide appropriate vaccines and treatment options to infected individuals?
 - Answer freely
10. Was there any sort of coordination between the Ministry of Health and the associations concerned with refugees to follow up on the psychiatric and general health conditions of infected individuals? If yes, how?
 - Answer freely
11. Was there any coordination between the Ministry of Health and the Ministry of Education? If yes, how did the Ministry of Education respond regard this subject? Please elaborate.
 - Answer freely