

# Correlation of Trends in the Incidence of Selected Infectious Diseases with Healthcare Expenditures: An Ecological Study

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## Abstract

**BACKGROUND/AIMS:** Although progress has been made in the prevention and treatment of infectious diseases, they continue to represent global public health problems, leading to the deaths of millions of people. This study aimed to evaluate the correlation between the trends in the incidence of human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS), syphilis, tuberculosis and Hepatitis B and the changes in health expenditure between 2007 and 2016 in Northern Cyprus.

**MATERIALS AND METHODS:** The incidences of particular infectious diseases over time were examined using the serial measure method. The area under the curve (AUC) line was calculated to determine the frequency of infectious disease occurrence. P-values less than 0.05 were accepted as significant.

**RESULTS:** The AUC value for Hepatitis B was the highest, followed by syphilis, tuberculosis and AIDS (AUC=2482.50 for Hepatitis B, AUC=149.07 for syphilis, AUC=99.66 for tuberculosis and AUC= 72.82 for AIDS). There was a significant reduction in the incidence of tuberculosis and syphilis during the study period ( $r = -0.702$ ;  $F = 7.792$ ;  $p = 0.024$  for tuberculosis) and ( $r = -0.663$ ;  $F = 6.263$ ;  $p = 0.037$  for syphilis). There was a statistically significant negative correlation between the trends in health expenditure and tuberculosis ( $r = -0.829$ ;  $F = 11.404$ ;  $p = 0.010$ ;  $r^2 = 0.588$ ) and syphilis ( $r = -0.755$ ;  $F = 10.583$ ;  $p = 0.012$ ;  $r^2 = 0.467$ ).

**CONCLUSION:** The reducing trend in the incidence of tuberculosis and syphilis corresponding to increasing health expenditure suggests the need for health policies to sufficiently fund preventive measures against infectious diseases, particularly hepatitis B.

**Keywords:** Area under the curve, health expenditures, epidemiology, infectious diseases, serial measurement method

## INTRODUCTION

The variety and number of infectious diseases observed in a region or country are among the most crucial indicators of the health status of that country. Despite progress in prevention and diagnostic methods, infectious diseases are still a major challenge in terms of global infection control.<sup>1,2</sup> There is varied evidence on the impact of social, economic and behavioral conditions on the epidemiology of diseases around

the world.<sup>3,4</sup> For example, the rates of human immunodeficiency virus (HIV), syphilis and Hepatitis B are higher in low- and middle-income countries compared to high income regions.<sup>5</sup>

The pathogens causing infectious diseases can be transmitted to the human body indirectly or through direct contact, such as from human to human or from water, food, or non-human vectors to humans.<sup>6</sup> In order to determine the current situation regarding the impact of infectious

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diseases, legal regulations have been established to ensure that countries report statistics correctly. Nations have introduced regulations that make the reporting of infectious diseases, such as tuberculosis (TB), Acquired Immunodeficiency Syndrome (AIDS), Hepatitis B, syphilis and others, obligatory. According to figures provided by the World Health Organization (WHO) in 2017, there were 940,000 deaths from AIDS, 1.4 million deaths due to TB and 208,000 deaths associated with Hepatitis B.<sup>2</sup> In a study conducted in the European Union and the European Economic Area, the ranking of selected infectious diseases according to the annual Disability Adjusted Life Years (DALYs) per 100,000 population was determined. The results showed that the highest was influenza, second was TB, and third was HIV, followed by Hepatitis B and syphilis.<sup>7</sup>

Hepatitis B, a viral infection which can cause both acute and chronic diseases, is an important global public health problem. It has been estimated that 325 million people worldwide are chronic carriers of this disease. Hepatitis B can be transmitted during labor or through exposure to infected blood. The virus can spread through the blood or other bodily fluids of an infected person. It is also a significant occupational hazard for healthcare workers. The chronic infection that it causes in the liver may lead to more serious problems, such as cirrhosis of the liver and liver cancer. Hepatitis B, however, can be prevented by safe and effective vaccines, with a 95% effectiveness in preventing Hepatitis B infections.<sup>8</sup> Syphilis is a sexually transmitted disease (STD) that has primary, secondary, latent and tertiary stages.<sup>9</sup> It is among the notifiable diseases because its incidence is increasing around the world.<sup>10</sup> With the increase in the severity of the disease, syphilis can cause serious problems such as central nervous system and cardiovascular system diseases.<sup>11</sup>

Syphilis is a major public health problem that has significant potential to cause adverse outcomes. One of the major concerns related to syphilis is that, similar to other sexually transmitted diseases, it is also associated with HIV and leads to adverse health outcomes.<sup>12</sup> People with syphilis infections are more likely to be infected with HIV.<sup>11</sup>

TB is considered to be a major public health threat.<sup>13</sup> In the WHO declaration in 2016, the elimination of the TB epidemic is one of the sustainable development goals. TB originates from bacteria that primarily affect the lungs. It can be treated and prevented. In addition, people with HIV, malnutrition, diabetes, tobacco users and people with weakened immune systems are at increased risk of developing this disease.<sup>14</sup> HIV infection is identified as the strongest risk factor for TB, meaning that there is a high likelihood of TB in HIV positive individuals. About a quarter of the world's population has hidden TB.<sup>15</sup>

HIV/AIDS can be regarded as a major global health problem as it leads to many opportunistic infections by increasing the susceptibility of patients to many other infectious diseases. Drug addicts, sex workers, prison inmates and others living in closed environments are among the populations at high risk of HIV transmission. Unsafe injections with HIV contaminated needles, non-sterile medical procedures, and unsafe sexual intercourse are all associated with an increased risk of HIV infections.<sup>16</sup>

Particular infectious diseases have adverse impacts on the social and economic welfare of societies.<sup>17</sup> The health status of populations can be affected by various factors, including ecological balance, demographic and cultural structure, and natural resources. Ecosystem and climate changes, population growth, migration, substance abuse,

microbiological changes, and lack of public health programs can increase infectious diseases, thus leading to poor health. Poverty is a crucial factor affecting the transmission of various infectious diseases and the health outcomes of infectious diseases represent one of the most important indicators of poverty, thus increasing the prevalence and severity of poverty.<sup>18</sup>

Within the scope of preventive health services, various screening tests are performed for the early diagnosis of diseases. The health expenditure allocated for these services has an important place in general health expenditures. In the literature, it has been determined that those expenditures made for the purpose of detecting STDs have an impact on the incidence in the population.<sup>19</sup> Therefore, an accurate determination of disease burdens can lead to an increase in health expenditures in preventive health care or public health practices and a decrease in the incidence of these diseases in the future. This situation has a positive impact on the health and financial situation of a society.<sup>20-22</sup> Similarly, a reduction in expenditure on infection prevention and control programs in European Countries has had a negative impact on the health level of the population, particularly in terms of preventing the diagnosis of diseases such as TB and HIV.<sup>23</sup>

Uncontrolled population growth causes various public health concerns in societies. In particular, the high prices for accommodation in crowded populations, high costs or inadequate healthcare services, and the lack of sufficient manpower are factors that can increase the burdens on healthcare services. To meet the needs for shelter and food, unprotected and risky sexual practices are also increasing the risk of infectious diseases, mainly HIV/AIDS, syphilis, Hepatitis B and TB.<sup>24</sup> In crowded living conditions, inadequate nutrition, increased use of alcohol and substances, increasing sexual and physical violence and discrimination make the diagnosis and treatment of diseases such as HIV and TB more difficult, leading to the rapid progress of such diseases. Therefore, this leads to negative impacts on the health of societies.<sup>25,24</sup>

HIV/AIDS, syphilis, TB, Hepatitis B, Hepatitis C, and Gonorrhoea are among the infectious diseases that are reported by State Hospitals and Health Centers in Northern Cyprus. HIV/AIDS, syphilis, TB and Hepatitis B are infectious diseases whose recordings are obligatory and are the most frequently seen notifiable infections in the country. Although progress has been made in the prevention and treatment of these infectious diseases, they continue to represent global public health problems, leading to the deaths of millions of people. The main aim of this study was to evaluate the trends in the major notifiable infectious diseases, namely HIV/AIDS, syphilis, TB and Hepatitis B, in Northern Cyprus. This study further aimed to evaluate the correlation between the trends in particular infectious diseases and any changes in health expenditure.

## MATERIALS AND METHODS

An ecological study design was employed to study the trends in the incidence of the selected notifiable infectious diseases, including AIDS, syphilis, TB and Hepatitis B. Data on the cases diagnosed with the particular infectious diseases reported between 2007 and 2016 were collected from reports published by the Prime Ministry, State Planning Organization (SPO).<sup>26</sup> The incidences of these infectious diseases were calculated based on the total population (at risk population) living in Northern Cyprus. The total population numbers for Northern Cyprus between 2007 and 2016 were also collected from the records of the SPO (excluding military personnel and non-residents).

Permission to collect and analyze the data was obtained from the SPO. The study methodology was approved by the university's Ethics Committee of European University of Lefke with reference number ÜEK/63/02/07/2021/03 and date 06.07.2021.

### Statistical Analysis

In this study, the data were analyzed using the IBM Statistical Package for Social Science (SPSS) software version 23.0 (IBM Corp., Armonk, NY, USA) and MedCalc Package Programs version 18.11 (1993-2019 MedCalc Software bvba). Trends in the incidence of AIDS, Hepatitis B, syphilis and TB between 2007 and 2016 were assessed using descriptive analysis. Using the MedCalc package program, the incidences of particular infectious diseases over time were examined using the serial measure method. The area under the curve (AUC) was calculated, which allowed for the determination of the frequency of the disease within a certain period of time. For this purpose, the AUC line was calculated to determine the frequency of infectious disease occurrence.<sup>27</sup>

The correlation between the incidence of infectious diseases and health expenditures was investigated by regression and correlation analysis. The functional structure of the relationship between the diseases and health expenditures is explained using the linear regression model. P-value <0.05 was accepted as significant.

## RESULTS

This study includes four notifiable diseases. The descriptive statistics on the incidence of the selected infectious diseases are shown in Table 1. The mean incidence between 2007 and 2016 for Hepatitis B was greater compared to other infectious diseases, with 277.91±29.30 cases per 100,000 population diagnosed with Hepatitis B. The mean incidence for AIDS was the least, with 8.48±3.18 cases per 100,000 population.

The trends and frequency of the infectious diseases observed in the study period were determined based on the AUC line. The AUC graphs show fluctuations for the 10-year period for each of the diseases studied. For Hepatitis B infection, in the ten-year period, the lowest value was determined in 2011 and the highest value in 2016 (Figure 1a). For syphilis and TB infections, in the ten-year period, the lowest incidence was determined in 2016 and the highest value in 2007 (Figures 1b and Figure 1c). AIDS was found to have its highest value in 2015 and lowest in 2009 (Figure 1d).

The status of these studied diseases in the population over the 10-year period are shown in Figure 1. The AUC graphs show in which time period the highest and lowest values of incidence occurred. When the changes in the incidence of each infectious disease between the years of 2007 and 2016 were compared, there were significant decreases in the incidence trends of TB and syphilis during the study period ( $r = -0.702$ ;  $p = 0.024$  for TB and  $r = -0.663$ ;  $p = 0.037$  for syphilis) (Table 2). There were no significant changes in the incidence of Hepatitis B and AIDS ( $p = 0.409$  for Hepatitis B and  $p = 0.154$  for AIDS).

In the regression model used to study the correlation between the changes in health expenditure and the selected notifiable infectious diseases, a statistically significant correlation was found between the health expenditure with TB ( $p = 0.010$ ) and health expenditure with syphilis ( $p = 0.012$ ) (Table 3). There was no significant relationship between health expenditure and AIDS or Hepatitis B ( $p$ -value >0.05). Since there were significant correlations between health expenditure

and syphilis and TB, the trends in health expenditures and the incidence of syphilis and TB were studied for the period between 2007 and 2016. A correlation model for the relationship between health expenditure and the selected notifiable infectious diseases was studied by checking the incidence of each infectious disease. When allowing for the incidence of the other infectious diseases studied, there were still significant negative correlations between health expenditure with syphilis and TB ( $r = -0.683$ ,  $p < 0.05$  for Syphilis and  $r = -0.767$ ,  $p < 0.01$  for TB). However, a positive correlation was found between TB and syphilis ( $r = 0.961$ ,  $p < 0.01$ ) (Table 4). According to these results, Hepatitis B was determined to have had an important disease in the population. The AUC value of Hepatitis B was the highest among the studied diseases, followed by syphilis, TB and AIDS respectively (AUC=2,482.50 for Hepatitis B, AUC=149.07 for syphilis, AUC=99.66 for TB and AUC= 72.82 for AIDS) (Table 5).

The health expenditures in North Cyprus increased in Turkish Lira from 183 million TL (\$140 million) to 321 million TL (\$125 million) between 2007 and 2016. The median and mean health expenditures in the study period were 210 million TL and 226 million ± 467 million TL, respectively (1 USD = 1.3 TL, Inflation rate % = 9.4 in 2007), (1 USD = 3.02 TL, inflation rate % = 10.19 in 2016). Figures 2a and 2b show the correlation between health expenditure and the incidence of syphilis and TB. In the period between 2007 and 2016, as the health expenditure increased, there was a significant decline in the incidence of syphilis and TB ( $r^2 = 0.467$  and  $r^2 = 0.588$ ). First, last, minimum, maximum and AUC values of the infectious diseases are included in this table. The AUC graphs are used to compare the incidence of the cases in the society and show their importance for the society. According to this, Hepatitis B was seen to be the most important disease in the time period examined (Figure 3).

The trends in health expenditure and infectious diseases are shown in Figure 4. While the infectious disease rates changed per 100,000 population per year, health expenditure increased between 2007 and 2014, decreased between 2014 and 2015 and increased again between 2015 and 2016.

## DISCUSSION

### Main Findings of This Study

Both the health expenditure and the population of the Turkish Republic of Northern Cyprus (TRNC) increased every year between 2007 and 2016. The selected infectious diseases, namely Hepatitis B, TB, AIDS and syphilis, which are defined as notifiable diseases, were studied in terms of the changes in their incidence and the correlation between their incidence rates and health expenditures. The most commonly observed notifiable infectious disease in the study period was reported to be Hepatitis B, however there was no significant change in its trends or its incidence. The trends in the incidence of syphilis and the TB incidence

**Table 1. The mean incidence of infectious diseases, namely Hepatitis B, Syphilis, Tuberculosis and AIDS observed between the years of 2007 and 2016**

Variable	Median	Mean ± SD	Minimum	Maximum
Hepatitis B	286.89	277.91±29.30	221.83	320.56
Tuberculosis	10.65	11.06±3.68	4.12	17.82
AIDS	8.07	8.48±3.18	4.19	12.67
Syphilis	15.90	16.71±5.06	8.84	27.25

AIDS: acquired immunodeficiency syndrome, SD: standard deviation.

rate showed a significant decrease during the study period (2007 and 2016). The analysis of the correlation between the changes in health expenditures and trends in the incidence of infectious diseases showed that there were significant correlations between health expenditures and syphilis and TB. There was a significant decrease in the incidence of TB and syphilis as health expenditures increased. There was also a significant positive correlation between TB and syphilis incidence.

**Explanation and Comparison With Existing Literature**

The present study revealed that Hepatitis B had the greatest incidence during the 10-year study period, with no significant decline in its incidence during these years. This may indicate that the population is not sufficiently vaccinated to reduce the incidence of this disease and there is a crucial need to develop policies and interventions to increase

**Table 2. Comparison of the changes in incidence of the infectious diseases, namely Hepatitis B, Syphilis, Tuberculosis and AIDS**

Diseases	r	B0	B	F	p-value	95% CI	
						Lower	Upper
Hepatitis B	0.295	-5457.318	2.851	0.760	0.409	-4.691	10.393
Tuberculosis	-0.702	1732.06	-0.856	7.792	0.024	-1.562	-149
AIDS	0.487	-1022.56	0.513	2.483	0.154	-238	1.263
Syphilis	-0.663	2245.90	-1.108	6.263	0.037	-761	0.031

p<0.05 was accepted as significant.  
AIDS: acquired immunodeficiency syndrome, CI: confidence interval.

**Table 3. The Comparison of the correlation between health expenditure and infectious diseases, namely Hepatitis B, Syphilis, Tuberculosis and AIDS observed between the years of 2007 and 2016**

Diseases	r	B0	B	F	p-value	95% CI	
						Lower	Upper
Hepatitis B	0.360	6.63x10 <sup>8</sup>	5752772	1.194	0.306	-6387884.215	-4054471949
Tuberculosis	-0.829	4.577x10 <sup>9</sup>	-9.878x10 <sup>8</sup>	11.404	0.010	-163675862	-30846102.3
AIDS	0.612	8.037x10 <sup>9</sup>	7.054x10 <sup>8</sup>	4.683	0.060	-5845508.865	184161747.1
Syphilis	-0.755	5.476x10 <sup>9</sup>	-1.158x10 <sup>9</sup>	10.583	0.012	-63120685.2	23857422.03

p<0.05 was accepted as significant.  
AIDS: acquired immunodeficiency syndrome, CI: confidence interval.

**Table 4. The results of the correlation analysis between health expenditure and the incidence of infectious diseases, namely Hepatitis B, Syphilis, Tuberculosis and AIDS observed between the years 2007 and 2016**

	Health Expenditure (95% CI)	Hepatitis B (95%CI)	Syphilis (95% CI)	Tuberculosis (95% CI)
Hepatitis B	0.360 (L: -0.348 U: 0.807)			
Syphilis	-0.683* (L: -0.918 U: -0.094)	0.203 (L: -0.489 U: 0.738)		
Tuberculosis	-0.767** (L: -0.042 U: -0.265)	0.046 (L: -0.601 U: 0.656)	0.961** (L: 0.839 U: 0.991)	
AIDS/HIV	0.608 (L: -0.036 U: 0.895)	0.463 (L: -0.235 U: 0.846)	-0.023 (L: -0.643 U: 0.615)	-0.145 (L: -0.710 U: 0.553)

\*p<0.05, \*\* p<0.01 was accepted as significant.  
AIDS: acquired immunodeficiency syndrome, HIV: human immunodeficiency virus, CI: confidence interval.

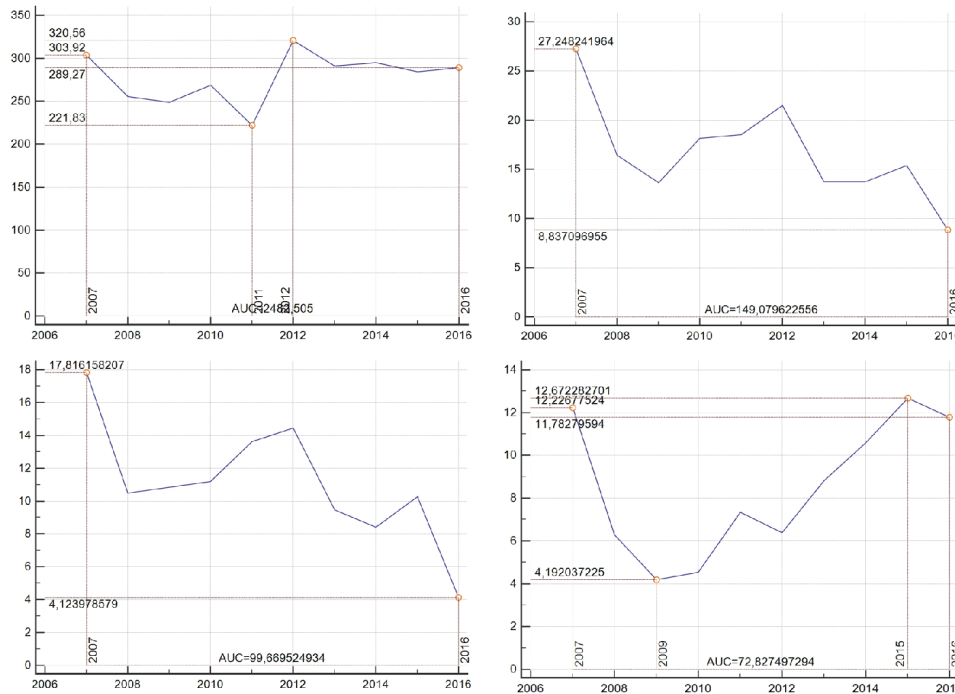
**Table 5. The AUC values of the trends in the incidence of infectious diseases, namely Hepatitis B, Syphilis, Tuberculosis and AIDS observed between the years of 2007 and 2016**

Variables	First	Last	Min	Max	AUC
Hepatitis B	303.92	289.27	221.83	320.56	2482.50
Syphilis	17.81	4.12	4.12	17.81	99.66
Tuberculosis	27.24	8.83	8.83	27.24	149.07
AIDS	12.22	11.78	4.19	12.67	72.82

Area under curve (baseline = 0).  
AUC: area under the curve, AIDS: acquired immunodeficiency syndrome, Min: minimum, Max: maximum.

the coverage of Hepatitis B vaccinations in the region.<sup>28</sup> There was a decreasing trend in the incidence of tuberculosis in the study period. Although there is no data regarding tuberculosis in Northern Cyprus, there is data regarding tuberculosis incidence, treatment and control in the Southern part of the country, which is home to the officially

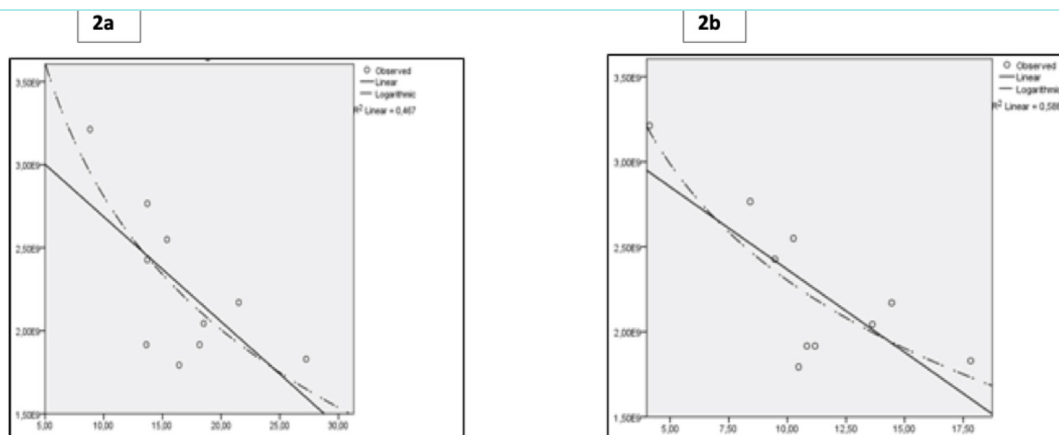
recognized government which joined the European Union (EU) in 2004. There is evidence that surveillance systems and control measures are adequately implemented in this region and this has helped to reduce the number of tuberculosis cases, particularly in the Cyprus born population.<sup>29</sup> However, the increase in migration to Cyprus is reflected



**Figure 1.** The trends in the incidence of Hepatitis B, Syphilis, Tuberculosis and AIDS between the years of 2007 and 2016 shown as the area under the AUC line.

**a)** The trends in the incidence of Hepatitis B infection between 2007 and 2016, **b)** The trends in the incidence of Syphilis infections between 2007 and 2016, **c)** The trends in the incidence of Tuberculosis infection between 2007 and 2016, **d)** The trends in the incidence of AIDS infections between 2007 and 2016.

AUC: area under the curve, AIDS: acquired immunodeficiency syndrome.



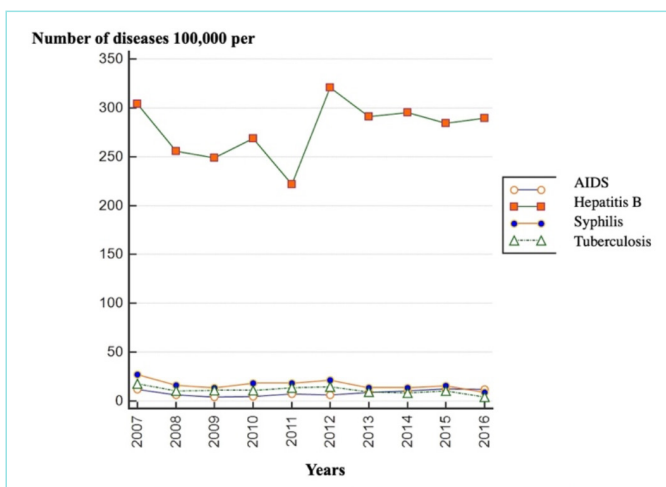
**Figure 2.** The correlation between trends in health expenditure and trends in the incidence of the infectious diseases, namely syphilis and tuberculosis between the years of 2007 and 2016.

**a)** The correlation between the trends in health expenditure and syphilis between the years of 2007 and 2016, **b)** The correlation between the trends in health expenditure and tuberculosis between the years of 2007 and 2016.

in the increased incidence of tuberculosis, particularly among the foreign-born population.<sup>30</sup> This was not reflected in the trends shown in our study. This is likely because cases seen in migrants are managed by the healthcare services in Southern Cyprus and the decrease in the recording of TB cases in Northern Cyprus is more representative of the decreases in the Cyprus born population.<sup>29</sup> Therefore, this may show that cases involving residents in the country cannot be detected and this may lead to a significant threat to life for the whole population as a result of the risk of transmission to healthy people.

The study also showed that there was a significant decrease in the incidence of syphilis in the country. Syphilis infection rates are strongly correlated with sexual activities and the prevalence of AIDS.<sup>12</sup> AIDS is not widely prevalent in the country and this study also showed that the 10-year incidence of the disease was low. In addition, the country has policies for screening groups that are sexually active and provides treatment for sexually transmitted diseases.<sup>31</sup> These may explain why the syphilis incident rate has reduced.

The correlation analysis between the trends in health expenditure and the incidence of notifiable infectious diseases showed that the incidence of TB and syphilis decreased in tandem with the increase in the health expenditure. There is broad evidence that supports the importance of healthcare expenditure, particularly spending on public health and prevention services to control STDs.<sup>32,21</sup> The evidence regarding TB shows that although spending on treatment of TB has an impact on the reduction of its incidence to a certain extent,<sup>33</sup> public health and social service spending play the most important role in controlling the incidence of this disease among populations.<sup>34,35</sup> Although there are limited data regarding the trends in health expenditures allocated to public health services and policies for the prevention of infectious diseases in Northern Cyprus, the amount of health expenditure allocated to public health services,<sup>25</sup> and the enhancement in the vaccination program against tuberculosis may explain this association.<sup>36</sup> In a general study on STDs, it was also shown that incidence control is not associated with the level of healthcare expenditures.<sup>32</sup> It is therefore important to further investigate this association between the incidences of infectious diseases, especially by allowing for other factors, such as public health spending, social service spending etc.

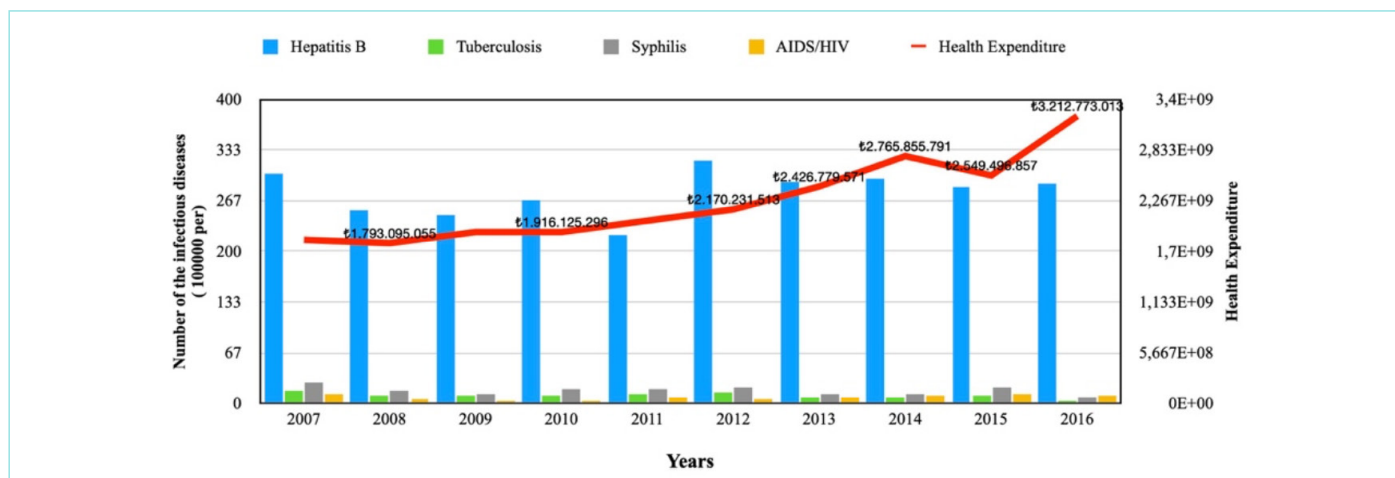


**Figure 3.** The trends in the number of infectious diseases, namely Hepatitis B, Tuberculosis, Syphilis, AIDS/HIV per 100,000 population observed between the years of 2007 and 2016.

AIDS: acquired immunodeficiency syndrome, HIV: human immunodeficiency virus

**Strengths and Weaknesses of the Study**

This study is the first study to evaluate trends in selected important infectious diseases in Northern Cyprus, which have largely not been represented in studies discussing the health status and health problems in Southern Cyprus, which is the officially recognized part of the country supported by many international healthcare organizations. Due to political reasons, many important health problems have not been sufficiently treated in the country and it is important to provide evidence and support those parties who are influential in enhancing public health in the region. This study, therefore, carries crucial importance in providing guidance for the control of infectious diseases in the region. Another strength of this study is that it uses the AUC method to study the frequency of infectious diseases in the population, rather than for the evaluation of diagnostic performance. Hence, this study provides evidence supporting the use of this method



**Figure 4.** The trends in the incidence of infectious diseases, namely Hepatitis B, Tuberculosis, Syphilis, AIDS/HIV and health expenditure observed between the years of 2007 and 2016.

AIDS: acquired immunodeficiency syndrome, HIV: human immunodeficiency virus

for different purposes and this approach can act as a guide for researchers performing studies in the field of epidemiology. Ecological data were used in this study, which are collective data representing the whole population, but not individuals. When resources for collecting data are limited, this approach is advantageous as it can be used to quickly and economically to collect data about the health status of a population. However, ecological data provides information for the total population, and the findings may not be applicable for all individuals. This renders studies using ecological data prone to ecological fallacy, which assumes that individuals in a population all have similar characteristics. Another limitation of this study is that the data on the incidence of infectious diseases were collected from the vital registration system of Northern Cyprus, which is a developing region. In developing regions, vital registration systems may not be accurately recorded, particularly as they may not take international recording standards into consideration. For example, the disease records may not be based on the International Coding System of Diseases, e.g. ICD-10. This may also reduce the accuracy of the findings obtained using vital statistics data to evaluate trends in infectious diseases.

Infectious diseases represent a significant threat to public health, particularly in developing countries, which makes it essential to investigate their distribution in different regions in order to provide guidance for their prevention and control. This study focused on the incidence of four notifiable infectious diseases in Northern Cyprus, namely Hepatitis B, TB, HIV/AIDS and syphilis, and evaluated the trends in their incidence as well as the correlation of their incidence with healthcare expenditure. Hepatitis B was shown to be the most prevalent condition in the region with trends indicating a decline between 2007 and 2016. TB and syphilis were shown to have reduced incidences and these trends were associated with increases in health expenditures. Policies must be developed to effectively treat Hepatitis B cases and take preventive measures in order to reduce the transmission of this infection within the population. Although TB, HIV/AIDS and syphilis were not shown to be a significant threat to public health in the population, the reduced incidence observed could be as a result of the migrant population using healthcare services other than those in Northern Cyprus or due to the poor detection rates of cases. Therefore, it is necessary to continually improve healthcare services and public health spending for the control and prevention of these diseases.

## CONCLUSION

Infectious diseases, namely HIV/AIDS, TB, syphilis and Hepatitis B have been important public health problems that require targeted interventions for their control and this warrants studies on the trends in incidence of these diseases that have been classified as notifiable diseases. The incidence of Hepatitis B was the highest among the other diseases studied, although with no increase in the incidence between 2007 and 2016. TB was the only notifiable disease studied, which showed significant reduction in incidence in the specified study period. These incidence rates are providing important implications for developing measures for improving the management of the Hepatitis B vaccinations and continuing the prevention measures taken against TB. Further studies must be conducted to assess the rates of infectious diseases and the association between the rates of diseases and other factors such as, public health spending, social service spending and others.

## MAIN POINTS

- This study used the serial measure method to study the trends in AIDS, Hepatitis B, syphilis and tuberculosis between 2007 and 2016 in Northern Cyprus.
- There was a significant reduction in the incidence of tuberculosis and syphilis during the study period.
- This study also reports a negative correlation in the trends in health expenditure and tuberculosis and syphilis.

## ETHICS

**Ethics Committee Approval:** The study methodology was also approved by the European University of Lefke Ethics Committee with the number and date ÜEK/63/02/07/2021/03.

**Informed Consent:** Informed consent is not warranted in this study as the data used in the study was ecological data, not including information on individual patients. The consent for the use of data from the State Planning Organization of Turkish Republic of Northern Cyprus (TRNC).

**Peer-review:** Externally peer-reviewed.

## Authorship Contributions

Concept: S.B., M.A.Ö., Design: S.B., M.A.Ö., Data Collection and/or Processing: S.B., M.A.Ö., Analysis and/or Interpretation: S.B., M.A.Ö., Literature Search: S.B., M.A.Ö., Writing: S.B., M.A.Ö., Critical Review: S.B., M.A.Ö.

## DISCLOSURES

**Conflict of Interest:** No conflict of interest was declared by the authors.

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