

Neurological disease surveillance and mandatory reporting: a trend and outcome of the National Neurological Institute of Health in Mexico City from 2005 to 2011

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Abstract

Introduction: There are regulated diseases for mandatory surveillance and reporting in the entire world; however, it is difficult observing the disorder's behavior, especially over time, mainly when it comes to conditions that due to their severity are treated in tertiary care units. **Objective:** To describe and analyze the behavior of the most important transmittable neurological conditions subject to epidemiological surveillance over a 7-year period in the main National Health Institution that takes care of neurological, neurosurgical and psychiatric conditions in Mexico. The most commonly treated and reported conditions are acute inflammatory polyneuropathy (Guillain-Barre syndrome) and viral encephalitis, with 19.7 and 18.5%, respectively. The condition showing a decreasing trend is neurocysticercosis, and the conditions more related with mortality are HIV-associated diseases and unspecified viral encephalitis. The conditions were more frequent in men, especially within the 25 to 44-year age group. It is necessary to insist on the importance of timely reporting those diseases subject to epidemiological surveillance in Mexico, since knowledge on their behavior allows for action decisions to be taken at all levels of care. (Gac Med Mex. 2014;150:531-42)

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Introduction

Epidemiological surveillance in Mexico is a system that collects information on several events of epidemiological interest, and it is able to analyze and provide a consistent outlook that allows for prevention and control actions to be initiated, taken forward or rectified¹.

In Mexico, information resulting from epidemiological surveillance is integrated in the Single Information System for Epidemiological Surveillance (SUIVE – *Sistema Único de Información para la Vigilancia Epidemiológica*), which comprises 114 diseases considered to be the most relevant and includes reporting on health damages and screening and laboratory diagnostic

tests results. The SUIVE consists of 4 components: the Epidemiological Surveillance Hospital Network, the Epidemiological and Statistical System for the Record of Deaths, the New Cases Weekly Reporting System and the Special Systems for Epidemiological Surveillance. These four reporting systems collect information regarding general, hospital-associated and specific morbidity and mortality².

Based on local, intermediate, state-wise or national information, data can be obtained on morbidity and mortality and hence develop criteria for planning, training, investigating and assessing programs for prevention, control, elimination and eradication or, when relevant, for treatment and rehabilitation¹.

Surveillance is fundamental at the time of planning, managing and distributing the resources required to modify the natural course of a disease, as well as to assess the impact of prevention programs on the subject³. It is an essential tool for countries to be able to have healthcare systems that allow for diseases to be prevented, controlled and eradicated.

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Hence the importance of research to be systematically conducted on populations in order to detect the onset and dissemination of a disease⁴.

The National Institute of Neurology and Neurosurgery (INNN – *Instituto Nacional de Neurología y Neurocirugía*) is a tertiary care institution in Mexico City that takes care of population not covered by social security services. It has clinical services specialized in Neurology, Neurosurgery, Psychiatry and Rehabilitation, as well as a range of Diagnostics and Treatment ancillary services, such as neuroimaging laboratories (cranial tomography, cranial magnetic resonance imaging, transcranial Doppler, among others) and clinical, pathology, microbiology and electrophysiology laboratories. Nevertheless, some more specialized studies, such as polimerase chain reaction for viruses and *Mycobacterium tuberculosis* in cerebrospinal fluid, viral load for HIV and lymphocyte sub-populations determination, are sent to other national reference centers for processing.

Objective

To describe the frequency, main epidemiological features, behavior in time and outcome of patients who received hospital medical care at the INNN, whose cause for medical care is subject to epidemiological surveillance, during a 7-year period.

Material and methods

A cross-over, descriptive, observational study was conducted. Included were new cases of transmittable conditions diagnosed from December 25 2004 through December 25 2011 (corresponding to the 2005-2011 period according to Mexico City epidemiological calendar) at the INNN, which were subject to mandatory reporting according to the Mexican Official Standard (NOM – *Norma Oficial Mexicana*) for epidemiological surveillance¹.

Information was obtained from medical records and data bases of the Epidemiology Department, where active epidemiological surveillance is practiced on a daily basis in order to identify all presenting mandatory reporting cases, either of transmittable and non-transmittable cause, for timely reporting to the immediate superior level according to periodicity established for each condition. The obtained information results from information provided by the patient, his/her family, clinical chart data and death certificates. The conditions are coded according to the International Statistical

Classification of Diseases and Related Health Problems (ICD-10)⁵ and recorded in a data base for their processing.

For statistical analysis, the statistical package PASW 19, formerly SPSS, was used⁶. Simple frequencies and central tendency measures were obtained. To compare proportions, the Mantel and Haenszel chi-square test was used. Annual incidence rate was obtained from the ratio of the number of new cases of each condition on a given year over the total number of conditions attended during the same year at the INNN, regardless of the cause, multiplied by 100. The tendency of the conditions throughout the studied period was calculated with Pearson's correlation coefficient (considering a normal distribution); a 95% level of confidence was used, and all p-values ≤ 0.05 were regarded as being statistically significant.

Results

During the study period, a total of 847 transmittable neurological conditions subject to epidemiological surveillance were detected and reported, out of which 329 (39%) corresponded to female and 518 (61%) to male cases.

With regard to age, the average was 36.1 years, with a minimum of 14 and a maximum of 91, and a standard deviation of 14.5. When age was divided in groups, the most frequent both for men and women was the 25 to 44-year group, with 46 and 52%, respectively. The rest of the distribution by age group and sex is shown in table 1.

Of the entire population, 304 (36%) had primary school education or less, 270 (32%) had secondary school education, 171 (20%) had high-school education, 93 (11%) had college or postgraduate degree and only for 8 cases (1%) there was no information available.

Place of usual residence was analyzed and 361 (43%) were found to be residents of the Distrito Federal (D.F.), 263 (31.1%) were residents of the state of Mexico or conurbated areas of the D.F. and only 117 (26%) came from some other state of the Mexican Republic.

With regard to their socioeconomic status, 675 (80%) were classified in levels 1 and 2, 148 (17%) in levels 3 and 4, and only 24 subjects (3%) in levels 5 and 6.

The first five main causes for medical care subject to epidemiological surveillance were; acute inflammatory polyneuropathy (G61) (167 cases [19.7%]), unspecified viral encephalitis (A86) (157 cases [18.5%]),

Table 1. Distribution of the main neurological conditions subject to epidemiological surveillance and mandatory reporting by age group and sex during the 2005-2011 period

N.º ICD-10 Conditions	Age groups												Total									
	Males						Females															
	≤ 24	25-44	45-59	60+	Subtotal	≤ 24	25-44	45-59	60+	Subtotal	n	%	n	%								
1 G61 Inflammatory polyneuropathy	22	19.6	49	18.2	29	27.4	12	39	112	21.6	9	9.9	28	18.5	11	20.8	7	20.6	55	16.7	167	19.7
2 A86 Unspecified viral encephalitis	38	33.9	35	13.0	7	6.6	3	9.7	83	16.0	38	41.8	29	19.2	4	7.5	3	8.8	74	22.5	157	18.5
3 B69 Cysticercosis	7	6.3	35	13.0	26	24.5	11	35	79	15.3	7	7.7	30	19.9	17	32.1	12	35.3	66	20.1	145	17.1
4 B20 HIV disease resulting in infectious and parasitic diseases	5	4.5	73	27.1	8	7.5			86	16.6	2	2.2	14	9.3					16	4.9	102	11.3
5 A17 Tuberculosis of nervous system	13	11.6	27	10.0	14	13.2	2	6.5	56	10.8	12	13.2	15	9.9	9	17.0	4	11.8	40	12.2	96	6.4
6 G00 Bacterial meningitis, not elsewhere classified	8	7.1	7	2.6	5	4.7			20	3.9	5	5.5	6	4.0	3	5.7	1	2.9	15	4.6	35	5.9
7 G04 Encephalitis, myelitis and encephalomyelitis	4	3.6	5	1.9					9	1.7	4	4.4	5	3.3	1	1.9	2	5.9	12	3.6	21	4.1
8 A87 Viral meningitis	2	1.8	3	1.1	1	0.9			6	1.2	3	3.3	5	3.3	1	1.9			9	2.7	15	2.5
9 B00 Herpesviral infections (herpes simplex)	3	2.7	5	1.9	2	1.9			10	1.9	2	2.2	3	2.0					5	1.5	15	1.8
10 B45 Cryptococcosis			5	1.9	2	1.9			7	1.4			1	0.7	1	1.9			2	0.6	9	1.8
Other	10	8.9	25	9.3	12	11.3	3	9.7	50	9.7	9	9.9	15	9.9	6	11.3	5	4.7	35	10.6	85	10.9
Total	112		269		106		31		518		91		151		53		34		329		847	100

n: frequency; %: percentage.

neurocysticercosis (B69) (145 cases [17.1%]), HIV disease resulting in infectious and parasitic diseases (B20) (102 cases [12%]), and tuberculosis of nervous system (A17) (96 cases [11.3%]). The remaining conditions are shown in table 1.

When the main conditions were analyzed by sex, inflammatory polyneuropathy (G61) (112 cases [21.6%]), HIV disease resulting in infectious and parasitic diseases (B20) (86 cases [16.6%]) and cysticercosis (B69) (79 cases [15.3%]) were found to be predominant in men; conversely, unspecified viral encephalitis (A86) (74 cases [22.5%]), cysticercosis (B69) (66 cases [20.1%]), inflammatory polyneuropathy (G61) (55 cases [16.7%]) and tuberculosis of nervous system (A17) (40 cases [12.2%]) are predominant in women. The rest of the distribution by sex is shown in table 1.

With regard to age, inflammatory polyneuropathy (G61) was found to be more frequent in the 24-44-year age group, corresponding to 47% of this condition total cases; cysticercosis (B69) and HIV disease resulting in infectious and parasitic diseases (B20) are also predominant in this age group. Conversely, unspecified viral encephalitis (A86) is predominant in the age group under 24 years, with 76 cases, equivalent to 49% of total cases of this condition (Table 1).

When the different conditions were compared by sex, all conditions subject to mandatory reporting were found to statistically significantly predominate in men, except for unspecified viral encephalitis (A86), which does not show predominance by sex (Table 2).

The conditions included in the HIV disease resulting in infectious and parasitic diseases category (B20) are cerebral toxoplasmosis (B208) (48%), cerebral cryptococosis (B205) (28.4%) and tuberculosis of nervous system (B200) (14.7%), with clear predominance in the male sex. The remaining conditions are presented in table 3.

When the behavior of the different conditions was analyzed throughout the study period (2005-2011), only a trend to an increase in herpetic infections was found to exist, although not statistically significant, whereas for cysticercosis, a statistically significant trend was found towards reduction ($p = 0.03$) (Table 4).

When the behavior by sex was assessed across the study period, a statistically significant decrease in cysticercosis could be appreciated only in women; the remaining conditions do not show differences with regard to sex throughout the study period (Tables 5 and 6).

When the days of hospital stay were compared between the different conditions subject to mandatory reporting, the longest stay was found to be associated with meningeal cryptococosis (B45), herpesviral infections (herpes simplex) (B00), tuberculosis of nervous system (A17) and HIV disease resulting in infectious and parasitic infections (B20), with an average of 37.0, 27.6, 24.8 and 18.8 days of hospital stay, respectively (Table 5).

The outcome of the different conditions was looked into and 756 (89%) cases were found to evolve towards improvement and only 91 (11%) died. When the conditions classified as the most common causes of mortality were analyzed, HIV disease resulting in infectious and parasitic infections (B20) was found to be at first place with 39 cases, followed by unspecified viral encephalitis (A86) with 13 cases, with tuberculosis of nervous system at third place with 10 cases, which represents 43, 15 and 11%, respectively, of total deaths (Table 8).

When the outcome of the conditions was analyzed with regard to different age groups, individuals aged 44 years or younger were found to generally have the highest improvement percentages (66%) of the entire study population (Table 8).

Discussion

The study population over 7 years included 847 cases of neurological conditions subject to mandatory reporting, i.e., an average of 120 cases are reported each year; the majority belongs to the male sex and the most common age of presentation is between 25 and 44 years, which might be related with the incidence of inflammatory polyneuropathy (G61) (Guillain-Barre syndrome).

The fact that the majority of the population was resident of the D.F. and areas conurbated to Mexico City (74%) may reflect accessibility to this healthcare institution.

The low levels of education and socioeconomic status of the study population might be linked to Mexico's social and economic context, since Mexico is the second poorest country of the Organization for Economic Co-operation and Development, after Turkey. In the year 2000, between 13 and 14% of the population lived with less than one dollar per day, and 46% with two dollars per day, and more than a fourth part of the population older than 15 years had not completed primary education. Additionally, Mexico shows one of the most uneven income and wealth distributions in the world, which reflects on the conditions of health⁷.

Table 2. Main neurological conditions subject to surveillance and mandatory reporting by sex during the 2005-2011 period

N.º	ICD-10	Condition	Both sexes		Male		Female		p
			n	%	n	%	n	%	
1	G61	Inflammatory neuropathy	167	19.7	112	67.1	55	32.9	0.00
2	A86	Unspecified viral encephalitis	157	18.5	83	52.9	74	47.1	0.10*
3	B69	Cysticercosis	145	17.1	79	54.5	66	45.5	0.01
4	B20	HIV disease resulting in infectious and parasitic diseases	102	12.0	86	84.3	16	15.7	0.00
5	A17	Tuberculosis of nervous system	96	11.3	56	58.3	40	41.7	0.00
6	G00	Bacterial meningitis, not elsewhere classified	35	4.1	20	57.1	15	42.9	0.00
7	G04	Encephalitis, myelitis and encephalomyelitis	21	2.5	9	42.9	12	57.1	0.00
8	A87	Viral meningitis	15	1.8	6	40.0	9	60.0	0.00
9	B00	Herpesviral infections (herpes simplex)	15	1.8	10	66.7	5	33.3	0.00
10	B45	Cryptococcosis	9	1.1	7	77.8	2	22.2	0.00
		Other	85	10.0	50	58.8	35	41.2	0.00
		Total	847	100	518		329		0.00

n: frequency; %: percentage; p: statistical significance; comparison of proportions (Mantel and Haenszel chi-square test).
*Fisher's exact test.

With regard to the most frequent conditions, inflammatory polyneuropathy (G61) was predominant in men aged between 25 and 44 years, which is consistent with other studies that have found the incidence of

Guillain-Barre to increase linearly with age, with men being affected more frequently⁸⁻¹⁰. Unspecified viral encephalitis (non-herpetic) (A86) follows in frequency, and it affects both sexes in similar proportions, is more

Table 3. Main neurological conditions associated with the presence of HIV disease subject to surveillance and mandatory reporting during the 2005-2011 period

N.º	ICD-10	Condition	Both sexes		Male		Female	
			n	%	n	%	n	%
1	B208	HIV disease resulting in other infectious or parasitic diseases	49	48.0	40	81.6	9	18.4
2	B205	HIV disease resulting in other mycoses	29	28.4	26	89.7	3	10.3
3	B200	HIV disease resulting in mycobacterial infection	15	14.7	12	80.0	3	20.0
4	B201	HIV disease resulting in other bacterial infections	3	2.9	2	66.7	1	33.3
5	B207	HIV disease resulting in multiple infections	2	2.0	2	100		
6	B203	HIV disease resulting in other viral infections	2	2.0	2	100		
7	B209	HIV disease resulting in unspecified infectious or parasitic disease	1	1.0	1	100		
8	B202	HIV disease resulting in cytomegalovirus disease	1	1.0	1	100		
			102	100	86		16	

n: frequency; %: percentage.

Tabla 4. Tendencia en el tiempo de los principales padecimientos neurológicos sujetos a vigilancia epidemiológica y notificación obligatoria durante el periodo 2005-2011

N.º	ICD-10	Condition	2005		2006		2007		2008		2009		2010		2011		Total	r	p	
			n	rate				n												
1	G61	Inflammatory polyneuropathy	21	0.8	21	0.8	22	0.9	22	0.9	18	0.6	29	1.0	34	1.1	167	0.9	0.43	0.34
2	A86	Unspecified viral encephalitis	22	0.9	16	0.6	26	1.0	11	0.4	24	0.8	35	1.1	23	0.7	157	0.8	0.14	0.76
3	B69	Cysticercosis	27	1.1	26	1.0	25	1.0	18	0.7	13	0.5	13	0.4	23	0.7	145	0.8	-0.81	0.03
4	B20	HIV disease resulting in infectious and parasitic diseases	19	0.7	12	0.5	26	1.0	12	0.5	13	0.5	9	0.3	11	0.3	102	0.5	-0.66	0.10
5	A17	Tuberculosis of nervous system	15	0.6	24	1.0	8	0.3	17	0.7	8	0.3	11	0.4	13	0.4	96	0.5	0.02	0.98
6	G00	Bacterial meningitis, not elsewhere classified	3	0.1	6	0.2	9	0.3	4	0.2	1	0.0	7	0.2	5	0.2	35	0.2	-0.07	0.89
7	G04	Encephalitis, myelitis and encephalomyelitis	8	0.3	1	0.0	0.0	0.0	6	0.2	2	0.1	2	0.1	2	0.1	21	0.1	-0.22	0.64
8	A87	Viral meningitis	0.0	0.0	1	0.0	1	0.0	2	0.1	3	0.1	4	0.1	4	0.1	15	0.1	0.64	0.12
9	B00	Herpesviral infections (herpes simplex)	1	0.0	1	0.0	2	0.1	2	0.1	3	0.1	4	0.1	2	0.1	15	0.1	0.72	0.07
10	B45	Cryptococcosis	0.0	0.0	0.0	0.0	3	0.1	1	0.0	2	0.1	1	0.0	2	0.1	9	0.0	0.41	0.36
		Other	15	0.6	6	0.2	9	0.3	12	0.5	11	0.4	16	0.5	16	0.5	85	0.4	0.21	0.65
		Total	131		114		131		107		98		131		135		847			
		Total discharges	2,566	5.1	2,484	4.6	2,587	5.1	2,464	4.3	2,850	3.4	3,044	4.3	3,200	4.2	19,195	4.4		

r: Pearson's correlation coefficient; p: statistical significance test. ≤ 0.05 .

Table 5. Main neurological conditions subject to epidemiological surveillance and mandatory reporting in males during the 2005-2011 period

N.º	ICD-10	Condition	2005		2006		2007		2008		2009		2010		2011		Total		r	p
			n	rate	n	rate														
1	G61	Inflammatory polyneuropathy	12	0.5	15	0.6	11	0.4	15	0.6	14	0.5	21	0.7	24	0.8	112	0.6	0.69	0.09
2	A86	Unspecified viral encephalitis	12	0.5	8	0.3	12	0.5	6	0.2	16	0.6	20	0.7	9	0.3	83	0.4	0.13	0.79
3	B69	Cysticercosis	12	0.5	13	0.5	11	0.4	10	0.4	9	0.3	8	0.3	16	0.5	79	0.4	-0.43	0.34
4	B20	HIV disease resulting in infectious and parasitic diseases	18	0.7	10	0.4	20	0.8	9	0.4	11	0.4	8	0.3	10	0.3	86	0.4	-0.70	0.08
5	A17	Tuberculosis of nervous system	9	0.4	14	0.6	4	0.2	11	0.4	6	0.2	4	0.1	8	0.3	56	0.3	-0.60	0.16
6	G00	Bacterial meningitis, not elsewhere classified	3	0.1	3	0.1	6	0.2	2	0.1	0.0	0.0	3	0.1	3	0.1	20	0.1	-0.27	0.56
7	G04	Encephalitis, myelitis and encephalomyelitis	3	0.1	0.0	0.0	0.0	0.0	5	0.2	0.0	0.0	1	0.0	0.0	0.0	9	0.0	-0.29	0.52
8	A87	Viral meningitis	0.0	0.0	1	0.0	0.0	0.0	0.0	0.0	2	0.1	1	0.0	2	0.1	6	0.0	0.63	0.13
9	B00	Herpesviral infections (herpes simplex)	1	0.0	1	0.0	2	0.1	1	0.0	3	0.1	1	0.0	1	0.0	10	0.1	0.00	1.00
10	B45	Cryptococcosis	0.0	0.0	0.0	0.0	2	0.1	1	0.0	1	0.0	1	0.0	2	0.1	7	0.0	0.32	0.49
		Other	7	0.3	3	0.1	8	0.3	8	0.3	7	0.2	10	0.3	7	0.2	50	0.3	0.00	1.00
			77		68		76		68		69		78		82		518			
		Total discharges	2,566	3.0	2,484	2.7	2,587	2.9	2,464	2.8	2,850	2.4	3,044	2.6	3,200	2.6	19,195	2.7		

r: Pearson's correlation coefficient; p: statistical significance test ≤ 0.05 .

Table 6. Main neurological conditions subject to epidemiological surveillance and mandatory reporting in females during the 2005-2011 period

N.º ICD-10 Condition	2005		2006		2007		2008		2009		2010		2011		Total		r	p
	n	rate	n	rate														
1 G61 Inflammatory polyneuropathy	9	0.4	6	0.2	11	0.4	7	0.3	4	0.1	8	0.3	10	0.3	55	0.3	-0.29	0.53
2 A86 Unspecified viral encephalitis	10	0.4	8	0.3	14	0.5	5	0.2	8	0.3	15	0.5	14	0.4	74	0.4	0.14	0.77
3 B69 Cysticercosis	15	0.6	13	0.5	14	0.5	8	0.3	4	0.1	5	0.2	7	0.2	66	0.3	-0.89*	0.01
4 B20 HIV disease resulting in infectious and parasitic diseases	1	0.0	2	0.1	6	0.2	3	0.1	2	0.1	1	0.0	1	0.0	16	0.1	-0.31	0.50
5 A17 Tuberculosis of nervous system	6	0.2	10	0.4	4	0.2	6	0.2	2	0.1	7	0.2	5	0.2	40	0.2	-0.43	0.34
6 G00 Bacterial meningitis, not elsewhere classified	0	0.0	3	0.1	3	0.1	2	0.1	1	0.0	4	0.1	2	0.1	15	0.1	0.32	0.49
7 G04 Encephalitis, myelitis and encephalomyelitis	5	0.2	1	0.0	0	0.0	1	0.0	2	0.1	1	0.0	2	0.1	12	0.1	-0.20	0.67
8 A87 Viral meningitis	0	0.0	0	0.0	1	0.0	2	0.1	1	0.0	3	0.1	2	0.1	9	0.0	0.72	0.07
9 B00 Herpesviral infections (herpes simplex)	0	0.0	0	0.0	0	0.0	1	0.0	0	0.0	3	0.1	1	0.0	5	0.0	0.41	0.36
10 B45 Cryptococcosis	0	0.0	0	0.0	1	0.0	0	0.0	1	0.0	0	0.0	0	0.0	2	0.0		
Other	8	0.3	3	0.1	1	0.0	4	0.2	4	0.1	6	0.2	9	0.3	35	0.2	0.21	0.65
Total	54		46		55		39		29		53		53		329			
	2,566	2.1	2,484	1.9	2,587	2.1	2,464	1.6	2,850	1.0	3,044	1.7	3,200	1.7	19,195	1.7		

r: Pearson's correlation coefficient; p: statistical significance test ≤ 0.05 .

Table 7. Days of hospital stay distribution as related to different conditions subject to epidemiological surveillance and mandatory reporting during the 2005-2011 period

N.º	CIE-10	Condition	Days of stay			
			Average	Minimum	Maximum	Standard deviation
1	G61	Inflammatory polyneuropathy	15.6	1	188	23.0
2	A86	Unspecified viral encephalitis	18.8	1	166	23.3
3	B69	Cysticercosis	12.7	1	41	6.5
4	B20	HIV disease resulting in infectious and parasitic diseases	23.9	1	91	17.9
5	A17	Tuberculosis of nervous system	24.8	1	123	19.9
6	G00	Bacterial meningitis, not elsewhere classified	15.9	1	70	15.1
7	G04	Encephalitis, myelitis and encephalomyelitis	17.4	5	56	12.8
8	A87	Viral meningitis	12.7	2	57	14.0
9	B00	Herpesviral infections (herpes simplex)	27.6	5	92	25.9
10	B45	Cryptococcosis	37.0	1	73	26.8
		Other	21.9	1	183	24.1
Total			18.8	1	188	20.2

frequent and lethal in those younger than 24 years and did not show any kind of trend throughout the study period (Tables 5-7). Isunza Torres, in the year 2000¹¹, described that viral encephalitis affects patients of all ages, but a third of cases occurs in subjects younger than 20 years, affecting both sexes equally. The low mortality of the viral encephalitis cases compared with other conditions, such as tuberculosis and HIV, is attributed to patients' age and to the fact that evolution of the condition in young people has a good prognosis when caused by enteroviruses¹²⁻¹⁴ and not associated with aggravating comorbidity factors, multi-drug resistance or hospital-acquired infections, since hospital stay for these patients is not long and the condition does not show a torpid and chronic evolution, as it is the case for meningeal tuberculosis, HIV-associated opportunistic infections or even herpetic encephalitis.

Neurocysticercosis was the third cause of mandatory reporting conditions, with 145 cases, with a discrete predominance in men (54.4%) and in the 25-44-year age group (44.1%), with low global mortality (3.4%) and sequel-free survival of 96.6% (Table 2). Hospital length of stay average is 12.7 days and a trend towards decrease is observed in females. In this regard,

human neurocysticercosis is a disease associated with underdevelopment and it occurs in countries with poor healthcare infrastructure and health education, as it is the case of Mexico.

Neurocysticercosis and taeniasis official reporting from 1990 on, in the SUIVE of the Health Ministry, showed that both conditions had decreasing trends, which may be linked to the fact that a national control program against *Taenia solium* was established in the country and living conditions have generally improved in Mexico¹⁵⁻¹⁷; additionally, the NOM standard for the control and prevention of the binomial taeniasis/cysticercosis, which is mandatory throughout the national territory, was published in 1994¹⁸.

Cysticercosis in Mexico has been controlled, but not eradicated. In our country, it remains as a public health problem. An epidemiological transition is undoubtedly taking place in Mexico, but there is evidence that *Taenia solium* remains a public health concern in Latin America and, although global socioeconomic development index in Mexico has improved in recent years, a significant proportion of the population – those in poverty and those living in rural areas of Mexico – is not included in this improvement, and it is in those areas where the life cycle of *Taenia solium* finds conditions

to persist¹⁹. In an analysis conducted in Guayaquil, Ecuador, the prevalence of active cases is shown to have changed significantly over the past few years in some cities from endemic countries such as Ecuador, which suggests that the incidence of new infections has decreased, which could be explained by the improvement of sanitation conditions, but also by the availability of imaging diagnostic methods that allow for active neurocysticercosis to be recognized and, hence, start treatment early and prevent the progression of the disease²⁰.

HIV disease resulting in infectious and parasitic diseases (B20) occupied the fourth place among the mandatory reporting conditions with 102 cases and predominance in the male sex (84.3%), affecting mainly the 25 to 44-year age group and with higher mortality in this same group. It is the primary cause of mortality among all conditions subject to mandatory reporting (42.9%).

The most commonly found HIV/AIDS-associated neurological manifestations (cerebral toxoplasmosis, cerebral cryptococcosis and meningeal tuberculosis) are consistent with reports by other studies, where HIV/AIDS-associated neurological manifestations described to be predominant in developing countries are diseases secondary to opportunistic infections²¹⁻²⁷.

In Mexico, in spite of free access to diagnostic tests and antiretroviral treatment, natural course of the HIV infection is still observed since, due to ignorance or fear, it is common for patients to seek help due to neurological manifestations secondary to infectious or parasitic diseases.

Tuberculosis of nervous system (A17) is the fifth cause among the studied conditions, where meningeal tuberculosis, tuberculoma and tuberculous abscesses cases are included (96 cases), out of which 58.3% corresponds to the male sex, with the 25 to 44-year age group being more affected and with high survival rate (89.6%), although it is the third cause of more prolonged hospital stay (24.8 days). Nevertheless, mortality was found to be low; however, survival of these patients is quite devastating due to sequels secondary to vasculitis problems (infarctions and hydrocephalus), since in adults, early diagnosis of tuberculous meningitis is difficult because clinical features are unspecific and current diagnostic methods lack sensitivity, which causes for treatment to be either unnecessarily indicated or late. Involvement of the nervous system is the most devastating form of tuberculosis, with high mortality and severe neurological sequels as a consequence of delayed diagnosis

due to clinical heterogeneity and manifestations by imaging, which range from focal leptomeningitis to tuberculomas²⁸. Meningeal tuberculosis kills or mutilates a higher proportion of subjects than any other form of tuberculosis²⁹

On the other hand, we consider that in this study, the population seeking medical help does it at very advanced stages due to the lack of a timely diagnosis at primary and secondary care institutions, in addition to lack of culture and education in our population, which hampers proper attention and health care for Mexican individuals.

Conclusions

Epidemiological surveillance allows for information to be obtained on specific problems to aid decision-making and risk prevention, and provides an outlook that allows for prevention or control actions to be initiated, taken forward or rectified. The results of this study reaffirm that Mexico continues to be a developing country where the prevailing conditions subject to mandatory reporting are still infecto-contagious in nature, with lack of health education and the socioeconomic context playing a major role in their development.

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