

Nine-year study of WHO virus reports on fatal viral infections

F. ASSAAD¹ & I. BORECKA²

In 1963, the World Health Organization established a system for the collection and distribution of information on viruses. The present study is based on 2737 reports of fatal viral infections received from laboratories in 39 out of a total of 47 countries participating in the scheme. In the industrially developed countries, from which most of the reports came, more than one-third of the total number of deaths were associated with influenza A virus, while in the developing countries, the enteroviruses, and in particular poliovirus, came high on the list.

In general, a steady increase in the number of reports received by WHO has been noted, especially during the last three years. The greatest variations in the yearly number of reports were seen in those concerning influenza A virus, and coincided with the clinical and epidemiological patterns observed since the advent of the A/Hong Kong/68 strain.

In children, death was most frequently associated with enteroviruses, and in adults, with influenza A virus. However, some of the viruses, and in particular herpesvirus, were reported in both children and adults.

Overall, respiratory diseases were the most frequent cause of death, mainly because of influenza A virus infection; next most frequent were herpesvirus infections, especially of the central nervous system, and particularly among young adults. The findings in this study confirm that it is the most serious central nervous system viral infection in the developed world.

In contrast to the above, the enteroviruses are still the most important killers in the developing world and the cases occur among infants and young children. Poliovirus, in particular type 1, is still the most prevalent.

At the beginning of 1963 a system for the collection and distribution of laboratory and epidemiological information on virus diseases was organized by WHO (1). Under this system, the WHO Collaborating Centres for Virus Reference and Research and suitable national virus laboratories complete standard record forms on infections diagnosed by virus isolation and/or serology. WHO then collates the forms and prepares quarterly and annual reports, which are distributed under confidential cover to the collaborating laboratories.

By the end of 1975, 121 laboratories in 47 countries were participating in this scheme. The number of reporting laboratories and the populations they cover vary according to country. In some instances

the reports cover the virus laboratory work of a whole country, e.g., Canada and the United Kingdom; in others, they cover only part of a country e.g., reports from the United States of America cover only seven states, and from Australia only two states.

There are many difficulties in comparing data from different laboratories: variations in the level of technical performance or in the facilities for laboratory work; interest limited to certain groups of viruses; delays in reporting and in completion of tests (mainly the final typing of viruses); the emphasis placed by public health authorities on the importance of certain virus diseases in comparison to others. Notwithstanding these limitations, a comparison of data from different laboratories can be useful, and the results obtained may give valid indications of trends in viral infections with time on a global basis, although the picture will not be complete. The

¹ Medical Officer, Virus Diseases, World Health Organization, Geneva, Switzerland.

² Technical Officer, Virus Diseases, World Health Organization, Geneva, Switzerland.

results of two studies, one concerning a WHO report on enteroviruses other than poliovirus (2), and the other involving a WHO report on respiratory viruses (3), were sufficiently encouraging to justify initiating the present study, which is limited to fatal viral infections reported to WHO over the nine-year period from 1967 to 1975.

METHODS

The study is restricted to the nine-year period during which the information was stored on magnetic tape for computer analysis (1967-75).

The viruses are discussed separately, and the different types of adenovirus, coxsackievirus A and B, echovirus, etc. are mentioned only when of interest. In the tables, types are grouped and presented together for each virus. No mention is made of the antigenic variations of influenza A virus, but it is

assumed that up to 1968, variants of A/Singapore/1/57 (H2N2) were reported, and that after the summer of 1968, A/Hong Kong/1/68(H3N2) or its variants were reported (4). No distinction is made between the antigenic variants of influenza B virus. Viruses with less than 10 available reports have been excluded from the study.

RESULTS

Laboratories in 39 countries reported a total of 2737 fatal cases during the period under study, 1967-75 (Table 1). Out of the 39 countries studied, 23 were in Europe, 6 in the Americas, 5 in Asia, 4 in Africa, and 1 in Oceania. Most of the reports (2573, or 94% of the total) came from the developed world. European countries and Israel reported 1674 cases (61.2%); 715 (26.1%) were reported by Canada and the United States of America, and 184

Table 1. Number of fatal viral infections (1967-75) by region ^a

Virus	Africa (excl. N. Africa)	The Americas (excl. Canada & USA)	Asia (excl. Japan)	Europe + Israel	Canada & USA	Australia & Japan	N. Africa	Total	
								No.	%
Adenovirus	9	2	0	148	65	18	0	242	8.8
Influenza A virus	2	10	3	661	218	18	0	912	33.8
Influenza B virus	0	1	0	31	19	4	0	55	2.0
Parainfluenza virus	4	1	0	41	26	13	0	85	3.1
Resp. syncytial virus	1	0	0	37	10	2	0	50	1.8
Coxsackievirus A	3	1	3	15	7	5	0	34	1.2
Coxsackievirus B	11	0	1	76	17	23	0	128	4.7
Echovirus	0	2	0	67	16	50	0	135	4.9
Poliovirus	12	45	3	44	25	10	10	149	5.4
Herpesvirus	24	4	0	235	151	13	0	427	15.6
Varicella-zoster	2	0	0	38	27	2	0	69	2.5
Cytomegalovirus	3	0	0	86	58	7	0	154	5.6
Mumps virus	0	0	0	13	4	0	0	17	0.6
Measles virus	1	0	0	22	12	2	0	37	1.4
Rubella virus	0	2	0	21	24	2	0	49	1.8
Hepatitis B surface antigen	0	2	0	67	17	12	0	98	3.6
<i>M. pneumoniae</i>	1	0	0	42	5	0	0	48	1.8
Others	0	0	1	30	14	3	0	48	1.8
Total	73	70	11	1674	715	184	10	2737	100.0

^a No fatal cases were reported from "North Africa and the Eastern Mediterranean — including Turkey and excluding Israel".

(6.7%) were reported by Australia and Japan. The developing world, represented in this study by 11 countries, accounted altogether for 164 reports (or 6%).

Influenza A virus was, by far, the most frequently implicated virus (912 reports, or one-third of the total reported) and herpesvirus followed with 427 reports (15.6%). Cytomegalovirus was reported in 154 cases, poliovirus in 149 cases, echovirus in 135 cases and coxsackievirus B in 128 cases (5.6%, 5.4%, 4.9%, and 4.7%, respectively). However, adenovirus was reported in 242 cases—a finding that is hard to evaluate. Other viruses accounted for less than 5% each (Table 1). This picture reflects, more or less, the situation in the developed world, with the exceptions of Australia and Japan where there were few fatal influenza infections, and where echovirus and coxsackievirus play a rather more important role. In the developing world, 70 out of a total of 164 reports (40.7%) were on poliovirus; 15 reports (9.1%) were on influenza A virus and almost double this number, i.e., 28 reports (17.1%), were on herpesvirus.

There has been a steady increase in the number of reports on fatal cases received by WHO; in 1967 there were only 81 reports, but in 1975 the number increased seven-fold to 597 (Table 2). The most marked increase was seen in the annual number of reported cases of fatal influenza A virus infection. The advent of the Hong Kong strain of influenza virus awakened interest in the influenza virus, and the increase in the number of reports since 1969 has been very marked but has also been subject to annual fluctuations which follow the epidemic waves of influenza (see "Seasonal pattern").

In contrast to reports on fatal influenza A virus infections, there was no marked increase in reports on influenza B virus except in 1974, when there was marked influenza B virus activity in the winter.

Hepatitis B infections were first reported in 1971, and included fatal cases. Since then, there has been a steep rise in the number of reports. There were also marked increases in the numbers of reports on adenovirus, coxsackievirus B, echovirus, herpesvirus, and cytomegalovirus but these increases started only in

Table 2. Number of fatal viral infections by year of collection/receipt of specimen

Virus	1967	1968	1969	1970	1971	1972	1973	1974	1975
Adenovirus	18	21	14	28	10	19	38	53	41
Influenza A virus	1	22	121	101	79	105	228	80	174
Influenza B virus	2	0	4	3	6	1	2	31	6
Parainfluenza virus	3	4	5	7	5	10	16	13	22
Resp. syncytial virus	0	0	1	1	2	5	12	17	11
Coxsackievirus A	6	3	3	6	2	0	5	5	4
Coxsackievirus B	5	11	10	7	8	6	36	24	20
Echovirus	11	9	6	7	5	13	19	20	43
Poliovirus	18	20	10	27	11	11	10	13	28
Herpesvirus	8	27	28	29	33	34	65	100	97
Varicella-zoster	0	2	3	6	8	5	11	16	16
Cytomegalovirus	4	5	5	14	11	13	19	32	47
Mumps virus	1	0	0	3	4	2	0	1	6
Measles virus	1	0	3	5	3	2	6	8	8
Rubella virus	2	5	8	2	4	3	10	5	10
Hepatitis B surface antigen	0	0	0	0	11	8	18	24	37
<i>M. pneumoniae</i>	1	0	1	3	7	4	8	12	8
Others	0	4	3	2	1	4	7	8	19
Total:	81	133	225	251	210	245	510	462	597

1972 or 1973, in spite of their inclusion in the WHO virus reporting system since its introduction.

Reports on parainfluenza, respiratory syncytial virus, *Mycoplasma pneumoniae*, and varicella-zoster have shown a slow but steady increase, while reports on mumps, measles, and rubella have displayed a marked but small increase. There has been hardly any change in the number of reports on coxsackievirus A, while reports on poliovirus have shown fluctuations that more or less correspond to outbreaks in individual countries.

These trends over time may presumably be ascribed to two causes: (a) the increased number of laboratories participating in the scheme, and (b) the increased number of investigations into viral infections in a large number of the reporting laboratories. The latter is attributed to a greater interest in viral infections, an increase in the number of competent technicians, the availability of reagents, the simplification of techniques, etc.

Fatal cases in relation to the total number of reported cases

Relating the number of reports on fatal cases to the total number of reports received, four groups of viruses can be readily discerned. Influenza A virus, cytomegalovirus, and varicella-zoster virus form one group with a high proportion of reports on fatal cases; 912/46 847 (19.5 per 1000), 154/7741 (19.9 per 1000), and 69/5284 (21.0 per 1000), respectively. The second group comprises poliovirus and herpesvirus, where approximately 10 per 1000 of reported cases were fatal. The third group includes adenovirus, coxsackievirus B, and hepatitis B surface antigen; more than 5 per 1000 cases but less than 10 per 1000 of the cases ended in death. Less than 5 per 1000 cases were reported fatal in other virus infections.

It is recognized that these figures give only an indication of the relative severity of the different viral infections, since, only a proportion of reports mentioned the outcome and the intensity of sampling differed from one laboratory to another. It is still difficult to account for the proportion of reports on adenovirus (over 5 per 1000) with a fatal outcome, and the relatively few reports on respiratory syncytial virus infection—less than 3 per 1000 of the total number of reports.

Among adenoviruses (5), the type most frequently cited in fatal cases was type 7. The reports on adenovirus types 1, 2, and 7 accounted for nearly 60% of all fatal cases associated with an adenovirus. These three types were also the types most often

reported in general. The type of parainfluenza virus most frequently reported as fatal was type 3. In general, irrespective of outcome, the types most often reported (in almost equal numbers) were types 1 and 3. The proportions of fatal to total cases reported was 6.5 per 1000 for type 3 and 1.8 per 1000 for type 1. With coxsackievirus A, a rather high proportion of the types that were infrequently reported were associated with a fatal outcome: 2 out of 27 cases associated with type 3 and 3 out of 18 cases associated with type 19. The numbers of fatal cases associated with the types reported in moderate numbers are shown below:

<i>Coxsackievirus A type</i>	<i>Total number of reports</i>	<i>No. of fatal cases</i>	<i>No./1000</i>
2	403	2	5
4	580	3	5
6	204	2	10
10	351	6	17

Conversely, some of the coxsackievirus A infections that were commonly reported, were associated with a smaller proportion of deaths: 8 fatal cases out of a total of 3039 cases of coxsackievirus A9 infection reported, and 2 out of 1654 cases of coxsackievirus A16 infection.

In the case of coxsackievirus B, the cases associated with the four more frequently reported types, i.e., types 2, 3, 4, and 5, had the highest proportion of fatal cases, ranging from 5.9 to 9.4 per 1000.

With the echoviruses, some, but by no means the majority, of the types that were in general infrequently reported had a high proportion (over 10 per 1000), of associated fatal cases, i.e., types 1, 8, 22, 23, 24, and 31. The types most frequently reported, i.e., types 6 and 9 (4774 and 5237 reports, respectively), were among the least frequently associated with death (14 cases each). The above findings raise the question of how many of these viruses are merely "passengers", especially in the case of viruses that are frequently reported irrespective of outcome, e.g., the adenoviruses. There is at present no answer to this question.

Of the poliovirus types, the highest frequency of association with fatal cases was encountered in cases of type 2, followed by types 3 and 1 in that order:

<i>Poliovirus type</i>	<i>Total No. of reports</i>	<i>No. of fatal cases</i>	<i>No./1000</i>
1	8 074	72	9
2	2 360	43	18
3	2 427	27	11

Seasonal pattern

Influenza viruses follow the epidemiological seasonal pattern of the clinical disease (6). This is best seen in the case of influenza A virus (Fig. 1), where there is a clear seasonal pattern (October to March), and also a very marked variation in the yearly epidemics. By superimposing the graph for the reports on fatal cases on to that for the total number of reports on influenza A infection, the parallels between laboratory findings and clinical experience may be demonstrated. In the 1968–69 influenza season, associated with the A/Hong Kong/1/68 virus, the mortality was high in the United States of America, but not so high in other parts of the Northern Hemisphere. In the following season, influenza was widespread all over the world, with the exception of the United States of America, and A/Hong Kong/1/68 was the only virus involved. The 1970–71 influenza season was marked by very little clinical influenza and very little activity of the A/Hong Kong/1/68 virus. The 1971–72 influenza sea-

son was marked by several outbreaks in different parts of the world, and three variants were involved: A/England/878/69, A/Hong Kong/5/72, and, towards the end of the season, A/England/42/72. The latter virus replaced all other variants in the 1972–73 season and caused worldwide epidemics with a high mortality. The high mortality is faithfully reflected in the reports on fatal cases (Fig. 1). The following season was one of mild to moderate outbreaks mainly associated with A/England/2/72, but A/Port Chalmers/1/73 also made its appearance. The 1974–75 season was marked by widespread outbreaks but with little mortality, which again, was accurately reflected in the reporting to WHO of fatal cases. That season was dominated by A/Port Chalmers/1/73; A/Scotland/840/74 was hardly involved except in the United Kingdom (7).

In contrast to influenza A virus infections, which usually reached a peak in January, influenza B virus was associated with fatal cases in February and March. Respiratory syncytial virus was diagnosed

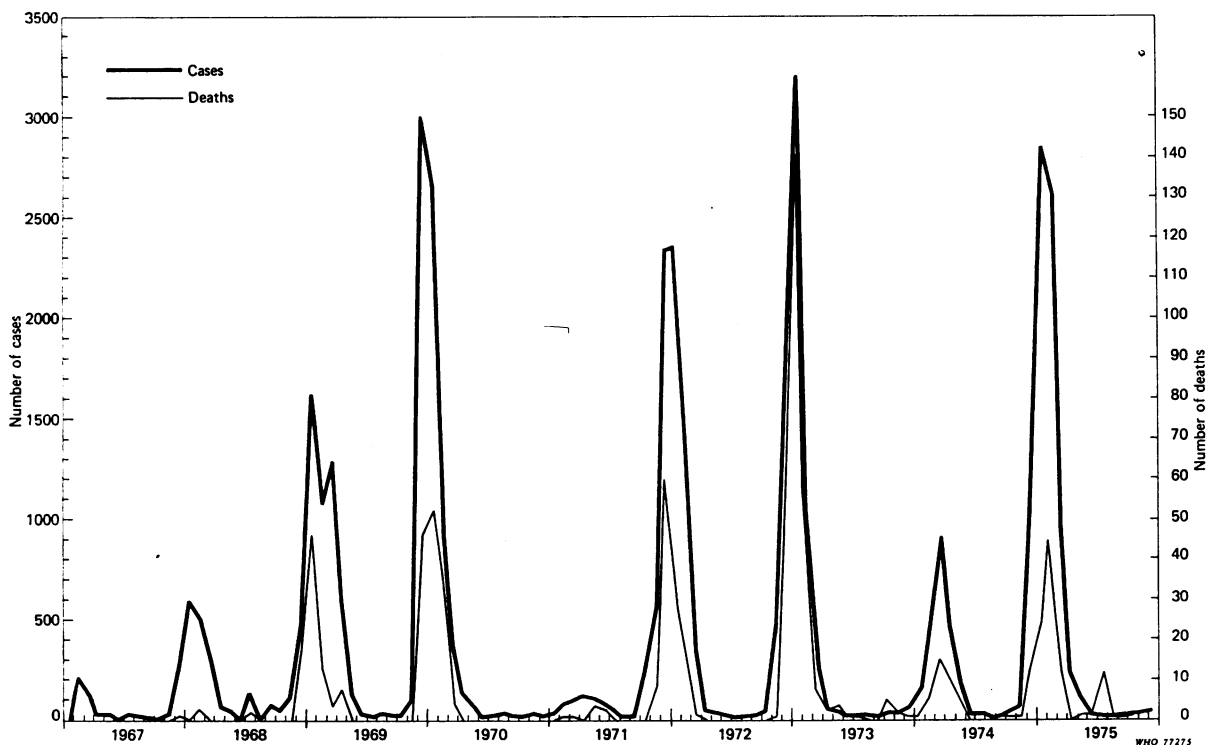


Fig. 1. Number of reports of cases and deaths associated with influenza A virus by month and year of collection or receipt of specimen—Northern Hemisphere.

Table 3. Number of fatal viral infections (1967-75) by age at death

Virus	<6 months	6-11 months	1-4 years	5-14 years	Children		15-24 years	25-59 years	≥60 years	Adults		Total
					0-14 years					≥15 years		
					No.	%				No.	%	
Adenovirus	71	50	75	10	206	91	9	8	3	20	9	226
Influenza A virus	31	16	42	30	119	14	32	291	381	704	86	823
Influenza B virus	6	6	7	7	26	50	10	7	9	26	50	52
Parainfluenza virus	30	16	18	6	70	88	0	4	6	10	13	80
Resp. syncytial virus	18	8	9	5	40	82	1	2	6	9	18	49
Coxsackievirus A	10	4	12	3	29	85	1	4	0	5	15	34
Coxsackievirus B	78	4	14	10	106	85	3	10	5	18	15	124
Echovirus	50	20	24	8	102	78	14	8	6	28	22	130
Poliovirus	36	31	53	15	135	96	3	2	1	6	4	141
Herpesvirus	56	14	46	38	154	38	41	152	56	249	62	403
Varicella-zoster	2	5	4	11	22	34	5	27	10	42	66	64
Cytomegalovirus	48	4	9	8	69	48	14	49	12	75	52	144
Mumps virus	1	1	4	7	13	81	0	3	0	3	19	16
Measles virus	0	0	12	16	28	76	5	3	1	9	24	37
Rubella virus	26	3	8	1	38	81	5	4	0	9	19	47
Hepatitis B surface antigen	2	0	0	6	8	10	13	32	31	76	90	84
<i>M. pneumoniae</i>	2	1	2	9	14	30	0	16	17	33	70	47
Others	13	7	8	4	32	74	4	6	1	11	26	43
Total	480	190	347	194	1211	48	160	628	545	1333	52	2544

most frequently in January, and parainfluenza virus in the autumn (November). Herpesvirus and *Mycoplasma pneumoniae* were reported more frequently during the winter. Conversely, coxsackievirus B and echovirus were most frequently diagnosed during summer and early autumn. The other viruses did not show any discernable seasonal pattern.

Age at death

The viruses associated with fatal cases discussed in this paper may be divided into three distinct groups according to the age at death (Table 3).

1. Predominantly children, i.e., below 15 years of age: adenovirus, parainfluenza, respiratory syncytial virus, coxsackievirus A and B, echovirus, poliovirus, mumps, measles, and rubella virus belong to this group. Furthermore, 40-60% of the total number of reports were on cases of less than 1 year of age, except in the case of coxsackievirus B and rubella

virus, for which the proportion was even higher. Over 55% of fatal rubella cases were in infants of less than 6 months of age, almost all congenital cases.

2. Both children and adults: to this group belong influenza B virus, herpesvirus, varicella-zoster, and cytomegalovirus. However, in the case of herpesvirus and varicella-zoster about 40% of reports involved deaths in persons aged 25-59 years.

3. Predominantly adults: namely the influenza A virus, hepatitis B surface antigen, and *Mycoplasma pneumoniae*. However, over 46% of fatal influenza cases were aged 60 years and over. No deaths due to *Mycoplasma pneumoniae* were reported in the age group 15-24 years.

Clinical manifestations

The majority of the reported viruses can be divided into two groups according to the principal body system affected (Table 4):

Table 4. Number of fatal viral infections (1967-75) by the principal associated clinical manifestation

Virus	Respiratory	Central nervous	Cardio-vascular	Gastro-intestinal	Liver	Skin & mucous membranes	Fever	Fetal damage	Others	Total
Adenovirus	135	27	2	20	0	1	4	1	16	206
Influenza A virus	669	31	29	3	1	0	63	1	12	809
Influenza B virus	34	9	1	1	0	0	3	0	2	50
Parainfluenza virus	49	7	4	1	0	1	2	0	9	73
Resp. syncytial virus	29	4	3	0	0	1	0	2	4	43
Coxsackievirus A	5	15	4	0	0	2	1	0	2	29
Coxsackievirus B	20	40	24	5	1	1	2	4	10	107
Echovirus	17	50	4	11	2	4	1	3	14	106
Poliovirus	15	89	3	8	0	2	1	1	12	131
Herpesvirus	58	251	3	3	5	40	10	10	29	409
Varicella-zoster	12	19	0	1	0	31	1	0	5	69
Cytomegalovirus	43	7	3	2	10	2	5	22	41	135
Mumps virus	0	13	1	0	0	0	0	0	2	16
Measles virus	13	17	0	0	0	4	0	0	1	35
Rubella virus	0	4	0	0	0	9	0	32	3	48
Hepatitis B surface antigen	0	2	0	1	77	0	0	0	3	83
<i>M. pneumoniae</i>	28	5	6	0	0	0	5	0	1	45
Other	15	3	0	7	0	8	2	0	4	39
Total	1142	593	87	63	96	106	100	76	170	2433

1. Respiratory system: the viruses include influenza virus A and B, parainfluenza virus, respiratory syncytial virus, and *Mycoplasma pneumoniae*.

2. Central nervous system: the viruses include coxsackievirus A and B, echovirus, poliovirus, herpesvirus, varicella-zoster, mumps, and measles. In 22% of the reports on coxsackievirus B, the cardiovascular system (heart) was mentioned as the principal system affected. In measles, 37% of reports mentioned the respiratory system.

Of the other viruses, hepatitis B was nearly always associated with liver disease and the great majority of rubella reports mentioned congenital disease. In the case of cytomegalovirus, various conditions are mentioned, including respiratory and liver disease, and fetal damage. Cytomegalovirus infection was also cited in patients under immunosuppressive treatment, in cases of malignancy, etc.

DISCUSSION AND CONCLUSIONS

The WHO virus reporting system acts as a repository for information on viral infections from all parts of the world. As such, and notwithstanding the shortcomings of such a system, it has provided useful information on the role viruses play in grave diseases. But even with such a wide source of information, when it comes to diseases ending in death, time has to be allowed before sufficient meaningful information is gathered. It has taken WHO nine years to collect information on less than 3000 fatal viral infections.

In the last three years (1973-75) there has been a considerable increase in the number of reports and this can be attributed, at least in part, to the greater use of laboratories in investigating diseases. Also, since 1973, WHO has introduced a more comprehensive report form asking for more details and this

may have affected the number and quality of reports.

Most of the information obtained and most of the recent increase concerns primarily the developed world. The number of laboratories in the developing world is increasing steadily and every effort is being made to encourage, within national health programmes, the setting-up of diagnostic virus laboratories and the upgrading of existing ones.

The study shows that in the developed world, of all viruses, influenza A is the main killer, especially in the elderly. The number of fatal cases reported to WHO coincides remarkably well with the noted clinical outbreaks of influenza and their severity, and therefore lends credence to clinical and epidemiological observations.

The other respiratory viruses play a much less important role. Influenza B virus appears to play only a minor role, which is in accordance with the

clinical and epidemiological findings. It attacks younger age groups and is much less widespread. Even then, the outbreak in the 1973-74 epidemic season has clearly left its mark in deaths.

Parainfluenza virus and respiratory syncytial virus are causes of death among infants and young children, but only a small number are reported.

After respiratory viruses, herpesviruses were the next most frequent viruses associated with death, especially those affecting the central nervous system, and particularly in young adults. The findings in this study confirm that it is the most serious central nervous system viral infection in the developed world (8).

In contrast to the above, the enteroviruses are still the most important killers in the developing world and the great majority of cases occur among infants and young children. Poliovirus, in particular type 1, is still the most prevalent (9).

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RÉSUMÉ

RAPPORTS À L'OMS CONCERNANT LES INFECTIONS VIRALES MORTELLES: ÉTUDE PORTANT SUR 9 ANS

En 1963, l'Organisation mondiale de la Santé a établi un système de collecte et de diffusion des informations sur les virus, dont vers la fin de 1975 les laboratoires virologiques de 47 pays faisaient partie. La présente étude est basée sur 2737 rapports d'infections virales mortelles reçus des laboratoires de 39 pays, de 1967 à 1975. Plus d'un tiers du nombre total de décès étaient associés à des infections par le virus grippal A et un peu plus d'un sixième à des infections par l'Herpesvirus. Cette répartition reflète toutefois la situation dans les pays industrialisés, d'où émanait la plupart des rapports (2673). Dans les pays en développement, ce sont les décès associés aux entérovirus — notamment aux poliovirus — qui étaient le plus fréquemment rapportés.

On a observé d'importantes variations annuelles de la proportion de décès associés au virus grippal A. Si l'on excepte 1967, c'est-à-dire avant l'arrivée du virus A/Hong Kong/68, la plus faible proportion a été observée en 1974. En revanche, c'est cette même année qu'on a observé la plus forte proportion de décès liés au virus grippal B, ce qui concorde bien avec le tableau épidémiologique de ce virus dans l'hémisphère nord en 1974. La propor-

tion de décès associés à l'Herpesvirus présentait des fluctuations annuelles beaucoup plus faibles.

En général, le nombre annuel de rapports parvenus à l'OMS a augmenté régulièrement, avec toutefois une augmentation plus rapide pendant les trois dernières années, à savoir 1973-1975. Ce dernier fait peut s'expliquer par la plus grande participation des laboratoires virologiques au diagnostic, et également par des modifications du système de notification.

Contrairement aux infections par le virus grippal A, dont le pic se situe en janvier, les cas mortels associés au virus grippal B surviennent plus tard dans l'hiver. Le virus respiratoire syncytial était fréquemment diagnostiqué en janvier, et le virus paragrippal en automne. Quant à l'Herpesvirus et à *Mycoplasma pneumoniae*, ils étaient plus fréquemment signalés en hiver, alors que les entérovirus l'étaient en été et au début de l'automne.

Les virus ont pu être divisés en trois groupes selon l'âge du décès. Les entérovirus, les virus des oreillons, de la rougeole, de la rubéole, le virus paragrippal, le virus respiratoire syncytial et les adénovirus étaient principalement responsables des décès chez l'enfant. Le virus

grippal B, l'Herpesvirus, le virus de la varicelle et le cytomégalo-virus frappaient à la fois les enfants et les adultes, tandis que le virus grippal A, le virus de l'hépatite B et *M. pneumoniae* s'observaient surtout chez les adultes.

La plupart des virus signalés pouvaient se diviser en deux groupes selon le système touché, respiratoire (virus grippaux A et B, virus paragrippal, virus respiratoire syncytial et *M. pneumoniae*) ou nerveux central (entérovirus, Herpesvirus, virus varicello-zonateux des oreillons et de la rougeole). Dans les pays développés, l'Herpesvirus est responsable des infections du système nerveux central les plus graves, tandis que dans les pays en déve-

loppement ce sont encore les entérovirus qui les provoquent. Dans plus d'un cinquième des rapports concernant le virus Coxsackie B, le système cardio-vasculaire (cœur) était mentionné, tandis que dans plus d'un tiers des rapports concernant la rougeole c'était le système respiratoire qui était le plus souvent touché. Hors de ces deux systèmes, l'hépatite B était presque toujours mentionnée en association avec des maladies hépatiques, et la majeure partie des cas de rubéole étaient associés à des malformations congénitales.

L'étude dépeint la gravité relative des infections virales dans le monde entier, et souligne les différences entre les pays industrialisés et les pays en développement.

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