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Immunization during a cerebrospinal meningitis epidemic in the Mongolian People's Republic, 1974-75

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An epidemic of cerebrospinal meningitis (CSM) in the Mongolian People's Republic, starting in 1969, reached its peak in 1974. In that year and in early 1975, 65 000 children in the 0–8-years age group in the main towns and in the provinces were immunized with meningococcal vaccine of serogroup A. The morbidity rates due to CSM were 12 times higher in the non-immunized than in the immunized children. This result demonstrates the value of an immunization programme to control epidemics of CSM.

The epidemiology of cerebrospinal meningitis (CSM) is not fully understood in spite of fairly extensive and intensive studies of the disease (*1-3*). A striking feature was the unexpected rise in morbidity during the period of 1967–76 in countries outside, as well as within, the so-called cerebrospinal meningitis belt of Africa. According to the official notifications of cases of CSM to the World Health Organization (*4*), the absolute number of patients within this belt in Africa increased sharply in Chad (in 1970), Dahomey (1968), Mali (1969), Niger (1968–70), Nigeria (1969–70), Senegal (1967), Sudan (1968), and Upper Volta (1970). In South America a similar situation was observed in Brazil during the period 1971–75 with a maximum attack rate of 25 per 100 000 inhabitants (Brazil, Ministry of Health, unpublished data). In Asia an increase in morbidity was noticed in the Mongolian People's Republic (1972–75), while in Europe a similar trend occurred in France (after 1969), Italy (1967), Poland (1967), Spain (1971), Turkey (1972), United Kingdom (1970), Yugoslavia (1970), and USSR (1969) (*5*). An epidemic with an overall attack rate of 26.3 cases per 100 000 inhabitants and a total case fatality rate of 14.1 % was reported in northern Norway in 1974–75 (*6*). The trigger mechanism that set off this pandemic has not yet been explained. It seems that during the interepidemic periods, or at least at the beginning of epidemics, a number of different serogroups of *Neisseria meningitidis* were circulating in the population.

Immunization of various populations in other countries with polysaccharide meningococcal vaccines of serogroups A and C in controlled field trials had proved to be particularly effective during the first year after immunization (*3, 7*). In Brazil, a well organized campaign of immunization with polysaccharide meningococcal vaccines of serogroups A and C halted the spread of an epidemic (Brazil, Ministry of Health, unpublished data). These are encouraging data, which, if supported by further observations might be of importance for public health authorities for the effective and economic control of CSM epidemics.

The present paper describes the protection obtained from the immunization of children with

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Table 1. Morbidity per 10 000 population due to CSM among immunized and non-immunized children 0–8 years of age in Ulan Bator

Period	No. of children under observation	Immune status	No. of cases of CSM	Morbidity rate per 10 000
January 1974 to February 1975	25 094	Immunized	4	1.5
	67 706	Non-immunized	28	4.3
February 1975 to July 1975	35 094	Immunized	20	5.7
	52 706	Non-immunized	371	70.4

vaccine of serogroup A[a] in the Mongolian People's Republic during an epidemic of the disease in 1975.

The 1974–75 epidemic

An increase in the incidence of cerebrospinal meningitis was first seen in 1969 and by July 1972 about 20 cases of CSM were reported each week throughout the country. The epidemic reached its height in April 1974 with 567 cases and 46 deaths and, although declining between July and December of that year, it resumed in the early months of 1975.

Diagnosis was based mainly on clinical symptoms rather than on bacteriological or serological findings. Immediately after establishment of the diagnosis, patients received between 200 000 and 300 000 IU of penicillin per kg of body weight. More than 90% of patients were hospitalized within 24 hours. Bacteriological investigation of the cerebrospinal fluid gave positive results in less than 20% of cases. The case fatality rate among CSM patients in Ulan Bator Infectious Diseases Hospital was 6–7%.

The greatest number of patients was registered during March and April. About 90% of the patients were below 16 years of age and males and females were affected equally.

The distribution of *N. meningitidis* serogroups among carriers was studied by examining groups of children living in different parts of the country. Randomized sampling was not applied. According to the results provided by the Institute of Hygiene, Epidemiology and Microbiology, 31.4% of the population examined were found to be carriers, about 20% of whom had serogroup A, 27% serogroup B, and 12% serogroup C.

Until 1973, local authorities required disinfection of houses with chloramine, and penicillin prophylaxis of all contacts. Since these procedures appeared unsuccessful, all measures except hospitalization of patients and treatment of contacts with nasopharyngitis were discontinued.

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THE IMMUNIZATION CAMPAIGN IN ULAN BATOR

According to the Central Statistics Department, there were about 87 800 children aged 0–8 years in Ulan Bator at the end of 1974. Immunization was carried out throughout this city from 10 to 15 October 1974 in the nurseries, kindergartens, and schools. A total of 25 094 children in the 0–8-years age group were immunized, each child receiving one subcutaneous dose of vaccine (50 μg) in the region of the deltoid muscle. The second immunization campaign was conducted in the Najzamdal district of Ulan Bator, between 17 and 27 February 1975. About 10 000 children in the 0–8-years age group who were not attending nurseries or schools were vaccinated. For ethical reasons, there were no control groups.

In October 1974, following immunization, children from two nurseries and two kindergartens were kept under close observation. No cases of severe reaction occurred (temperature above 39 °C and local inflammation exceeding 4 cm in diameter).

Protection obtained

From the epidemiological point of view, it is not entirely sound to compare the morbidity among immunized and non-immunized children, but there was no alternative.

Table 1 gives the results of an analysis of morbidity among immunized and non-immunized children. The difference in morbidity rates between the immunized and the non-immunized during the February to July 1975 period of observation was about 12-fold, which was unlikely to be due solely to differences in socioeconomic conditions.

The following calculation may be used to support this view. According to statistics provided by the Ulan Bator Sanitary Epidemiological Station, 64% of all cases of CSM were registered among the inhabitants of traditional tent dwellings or "gers". Assuming that about one-third of the population of Ulan Bator live in "gers", one can split proportion-

ally the total number of cases of CSM among non-immunized children (from February to July 1975) in the following way:

	Non-immunized children of Ulan Bator	*Children living in "gers"*	*Children living in apartments*
Absolute number of children	52 706	17 568	35 138
Number of cases of CSM	371[a]	237[b]	134
Morbidity rates	70.4[c]	134.9	38.1

[a] Reported cases.
[b] Assuming that 64% of all the cases of CSM occurred among inhabitants of "gers".
[c] From Table No. 1.

Thus, the morbidity rate due to CSM among non-immunized children living in "gers" (134.9 per 10 000) would exceed the rate among non-immunized children living in apartments (38.1 per 10 000) only 3.5-fold, and not 12-fold.

IMMUNIZATION OF CHILDREN IN THE PROVINCES

About 30 000 children in the 0–8-years age group were vaccinated in 12 provinces (aimaks) and Darhan town during February 1975. The results of vaccination were difficult to analyse owing to the absence of comparable control groups. However, an attempt was made to assess the differences in morbidity rates of CSM among immunized and non-immunized children.

According to the information gathered by the Institute of Hygiene, Epidemiology and Microbiology, the morbidity due to CSM among immunized children (4.56 per 10 000) was 7.66 times less than among the non-immunized (34.97 per 10 000). In Hovd and Uvs in the far west of the country, however, there were no appreciable differences in the rates of morbidity between immunized and non-immunized groups, possibly owing to the prevalence of *N. meningitidis* of serogroups other than A.

Immunization of 30 000 children in the provinces could have prevented at least 105 episodes of CSM (if the general morbidity rate of 35.0 per 10 000 were applicable to all child populations) and saved 13 children from death, since the general case fatality rate due to CSM in 1975 was 12.4%.

DISCUSSION AND CONCLUSIONS

The available data indicate that an epidemic of cerebrospinal meningitis started in 1969 in the provinces of Bulgan, Bayan-Hongor, Arhangay, and Töv, spread gradually to other provinces during 1970–74, and reached its culmination in 1974 in those provinces which had been free from CSM in 1969. The highest morbidity rates were reported in 1974 in the principal towns (Darhan and Ulan Bator) and the provinces of Dornogovĭ, Dundgovĭ, and Hentiy (320 per 100 000 inhabitants). The number of cases usually started to increase in October of each year, reaching a peak in March or April, and then declined to the lowest level in September. About 97.0% of all cases were reported between January and July. About 90% of all patients were under 16 years of age. Total case fatality rates ranged from 9.3% to 12.4%.

During 1975, the number of cases of CSM started to decline throughout the country, indicating that the climax of the epidemic had occurred in 1974.

Studies on different serogroups of *N. meningitidis* circulating in the population showed the prevalence of serogroup B among cases of CSM and carriers at the beginning of the rise in incidence. From the available information it was not clear which serogroups of *N. meningitidis* prevailed during the climax of the epidemic in 1974. However, surveys indicated the predominance of serogroup A in Ulan Bator (50%), Darhan (92.6%), and some provinces (Dornogovĭ 93.3%, Dornod 60.0%, and Hentiy 42.8%).

From 10 to 15 October 1974, 25 094 children 0–8 years old in nurseries, kindergartens and schools were immunized with meningococcal vaccine A. A second group of 10 000 children was immunized with the same vaccine in the Najzamdal district of Ulan Bator between 17 and 27 February 1975. There were no reports of severe general or local reactions after vaccination.

An attempt was made to compare morbidity rates due to CSM in immunized and non-immunized children of the same age group (0–8 years old). The difference was about 12-fold in Ulan Bator and about 7.7-fold in 10 provinces. However, in Uvs and Hovd, there was no appreciable decline of morbidity among immunized children, possibly because the disease was caused by other serogroups. It has been calculated that 237 cases of CSM were prevented by immunization and the lives of 29 children were saved thereby. The cost of prevention was about US$ 20 000.

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RÉSUMÉ

VACCINATION AU COURS D'UNE ÉPIDÉMIE DE MÉNINGITE CÉRÉBRO-SPINALE EN RÉPUBLIQUE POPULAIRE DE MONGOLIE, 1974-1975

L'incidence de la méningite cérébro-spinale en République populaire de Mongolie a notablement augmenté de 1972 à 1975, atteignant un sommet avec l'épidémie de 1974. Environ 90% des malades étaient âgés de moins de 16 ans.

A Oulan-Bator, le vaccin anti-méningocoques A (Institut Mérieux, Lyon) a été administré du 10 au 15 octobre 1974 à un groupe de 25 094 enfants de 0 à 8 ans, et du 17 au 25 février 1975 à un second groupe de 10 000 enfants; 30 000 enfants des provinces ont d'autre part été vaccinés en février 1975. Pour des raisons d'éthique médicale, on n'a pas constitué de groupe témoin auquel aurait été administré un placebo. Aucune réaction postvaccinale grave, générale ou locale, n'a été observée. On a tenté de comparer les taux de morbidité par méningite cérébro-spinale dans des groupes normalisés d'enfants du même âge (0 à 8 ans) vaccinés et non vaccinés. Chez les enfants non vaccinés le taux était plus élevé de 12 fois environ à Oulan-Bator, et de 7,7 fois environ dans 10 provinces.

Les provinces de Uvs et de Hovd sont les seules où l'on n'ait pas enregistré de baisse appréciable de la morbidité chez les enfants vaccinés, sans doute parce que la maladie y était causée par des méningocoques d'autres sérogroupes que le sérogroupe A. Des calculs approximatifs ont montré que le coût de la prévention s'élevait à quelque US$ 20 000 et le nombre total des cas de méningite cérébro-spinale évités par la vaccination à 237 environ. Les taux globaux de létalité s'établissant entre 9,3% et 12,4%, on a estimé qu'environ 29 enfants avaient été sauvés par la vaccination.

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