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# Influenza A2 and B in the USSR in 1966–67, and Some Aspects of Global Epidemiology of Influenza *

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*An epidemic wave of influenza caused by the A2 virus was recorded in the USSR in the winter of 1966–67; this was the fifth wave since this pandemic strain first appeared. In contrast to the last wave of 1965, it developed simultaneously with, or followed, an epidemic of influenza B. The epidemic spread of influenza was observed for a period of 2 years in the USSR; influenza B prevailed in 1966, influenza A2 in 1967, and the two viruses spread at different speeds. A slow spread and a gradual increase in intensity during most of the year was characteristic of influenza B while influenza A2 spread rapidly and involved a considerable part of the country within 3 months.*

*Although the influenza B started to spread almost 9 months before influenza A2 became active, the periods of maximum intensity of both outbreaks coincided in most parts of the USSR in the winter of 1966–67. The approach of summer temporarily stopped the spread of influenza B but did not bring the outbreak to an end nor lessen the intensity of the next wave in the autumn. Among the haemagglutinating agents isolated in the USSR in 1966–67 were 121 strains of virus B and 132 strains of virus A2. A study of the antigenic structure of the B strains showed that they were not all similar; some of them were closely related to B/Johannesburg/33/58, a greater number were more closely related to B/Singapore/3/64 and a number of strains differed from both varieties.*

*Among the A2 viruses isolated and investigated were strains similar to those of pandemic prototype A2/Singapore/1/57, strains close to A2/England/12/64 and A2/USSR/Gor/62/65, strains antigenically different from all those strains but still related to the A2 subtype and strains that had S-antigen of A-type but which were not inhibited by antisera to the prototypes A2/57, A2/64 or A2/67.*

*Outbreaks of influenza A2 and B recorded in the USSR are considered to be parts of the global influenza epidemics.*

The complexity of organizing effective prophylactic measures against influenza depends to a considerable extent on the insufficiency of our knowledge about the origin of epidemic waves of influenza and the role of the pathogenic organism in the epidemiological process. The work carried out by the World Health Organization in the organization of a network of international and national influenza centres is an important contribution to the resolution of these problems.

For many years, the USSR Centre for Influenza and Acute Respiratory Diseases has been studying systematically the spread of epidemiological waves of influenza A and B by means of a complex analysis of clinical incidence, laboratory diagnosis and a comparative study of influenza virus strains isolated in different parts of this country and abroad.

Since the appearance in the USSR of the pandemic influenza virus A2, there were, until 1966–67, 4 waves caused by this virus (Ždanov et al., 1966a; Ždanov et al., 1967; Zakstel'skaja et al., 1968). The fifth wave caused by the influenza virus A2 was observed in the USSR in 1967 and in many localities, in contrast to the wave in 1965, it developed simultaneously with influenza B or followed the epidemic spread of influenza B. An analysis of the epidemio-

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logical situation during that period is given in this paper.

Recording of clinically diagnosed influenza and of the incidence of acute respiratory diseases (ARD) was carried out by summarizing the data received from 8 laboratories daily and from 55 others every 10 days.

Differential analysis of the spread of influenza A2 and B waves was conducted by systematically summarizing the laboratory diagnostic data from 25 laboratories in different parts of the country. Diagnosis was confirmed both by virus isolation and by serological investigations. Haemagglutination-inhibition (HI) tests, using standard commercial antigens and freshly isolated viruses, were employed for serological diagnosis. Data on laboratory diagnosis and on observed epidemiological characteristics of the outbreaks were received by the Centre quarterly.

The strains of influenza viruses were isolated mainly in embryonated eggs; the isolated viruses were identified in peripheral laboratories and studied in detail in the laboratory unit of the Influenza Centre. Much attention was given to a comparison of newly isolated viruses with those that had previously circulated in the USSR and with strains isolated in other countries before the epidemic spread of influenza in the USSR.

The antigenic structure of isolated viruses was studied by the complement-fixation (CF) and haemagglutination (HA) tests on rat antisera. Preliminary data had shown that, as regards simplicity, these sera are as good as ferret sera.

## RESULTS OF OBSERVATIONS

### *Spread of influenza A2 and B in the USSR in 1966–67*

After a wide wave of influenza A2 was observed in the USSR in the first quarter of 1965, influenza and incidence of ARD in most localities fluctuated within the limits of the corresponding inter-epidemic period. The proportion of influenza cases diagnosed by laboratory methods in the total number of patients with influenza-like diseases examined in the fourth quarter of 1965 was 6.4% and 6.3% for influenza A and B, respectively. In the second half of the first quarter of 1966, a considerable increase in morbidity from respiratory diseases was noted in the north-western regions of the country, the most pronounced increases being in Murmansk, Leningrad and, to some extent, in Moscow. However, there was no further spread of the epidemic wave, possibly owing to a rise in temperature throughout the country. In the second and third quarters, the incidence of influenza remained at the inter-epidemic level. A rise in the incidence of ARD was recorded in Dyushanbe, and later in Baku and Riga, in the autumn (November) and in Tashkent, Kuibyshev, Gorky and Novosibirsk in December; Moscow, Tbilisi, Leningrad, Omsk, Donetsk and Dnepropetrovsk were involved in January–February.

By the end of the first quarter, the number of ARD cases started to fall and by the beginning of the second quarter the incidence reached inter-epidemic levels in most localities.

From 1965 to 1967, laboratories collaborating with the USSR Influenza Centre examined 44 236 patients by means of laboratory methods. Results of laboratory diagnosis showed that the first rises in ARD morbidity observed early in 1966 in the north-western regions of the USSR were caused by epidemic spread of the influenza B virus. The outbreaks recorded in November–December of 1966 in Dyushanbe, Tashkent, Lugansk and other localities had the same etiology. However, outbreaks in a number of localities in December 1966 or January–February 1967 were, as a rule, of mixed etiology and were caused by the activation of both influenza B and influenza A2 viruses. From the middle of the first quarter of 1967, influenza B began to subside and influenza A2 dominated. By the beginning of the second quarter of 1967, the number of laboratory-confirmed cases of influenza decreased sharply in most localities of the USSR. During the second, third and fourth quarters, the frequency of influenza A2 and B fluctuated between 3.8% and 7.1% in the USSR as a whole (see Table 1).

In the second and third quarters of 1967 mainly sporadic cases of influenza A2 and B were registered, whereas in winter (the fourth quarter of 1967 and early 1968), in some localities where no rise in influenza incidence during the previous winter had been noted, local and limited outbreaks of influenza A2 were observed.

Thus the epidemic spread of influenza throughout the country was observed for 2 years. Influenza B dominated in 1966, influenza A2 in 1967 (Fig. 1).

The influenza A2 and B waves spread throughout the USSR independently, but peaks of outbreaks fused in most localities: in Murmansk and Dyushanbe, 2 peaks of incidence were clearly demonstrated, one of them being caused by influenza B virus, the other by influenza A2 virus (Fig. 2).

TABLE 1

FLUCTUATIONS IN FREQUENCY OF THE CASES CONFIRMED BY LABORATORY METHODS IN 1965–67 INFLUENZA OUTBREAK

| Year | Quarter | Frequency of cases (%) | | No. of patients examined |
|---|---|---|---|---|
| | | Virus A2 | Virus B | |
| 1965 | 1 | 42.0 | 5.3 | 5 686 |
| | 2 | 27.5 | 2.6 | 1 956 |
| | 3 | 12.0 | 5.7 | 583 |
| | 4 | 6.4 | 6.3 | 1 793 |
| 1966 | 1 | 6.1 | 11.3 | 8 003 |
| | 2 | 5.75 | 9.86 | 2 848 |
| | 3 | 5.22 | 5.05 | 1 108 |
| | 4 | 9.8 | 21.6 | 3 003 |
| 1967 | 1 | 26.9 | 15.6 | 9 228 |
| | 2 | 10.4 | 5.3 | 1 959 |
| | 3 | 3.8 | 7.1 | 2 343 |
| | 4 | 5.5 | 6.5 | 5 753 |

The investigations have showed that influenza A2 and B spread throughout the USSR at different rates and differed sharply in the character of their spread. Influenza B was characterized by a slow spread and a gradual increase in intensity, affecting the population during almost a whole year. On the contrary, influenza A2 spread rapidly and within 3 months a considerable part of the country was involved in the epidemic. For this reason, although the epidemic spread of influenza B started almost 9 months before A2 influenza, periods of maximum intensity of both outbreaks coincided in most localities of the USSR. In localities where simultaneous epidemic spread of A2 and B influenza was observed, some laboratory-confirmed cases of infection caused by both types of influenza viruses were recorded.

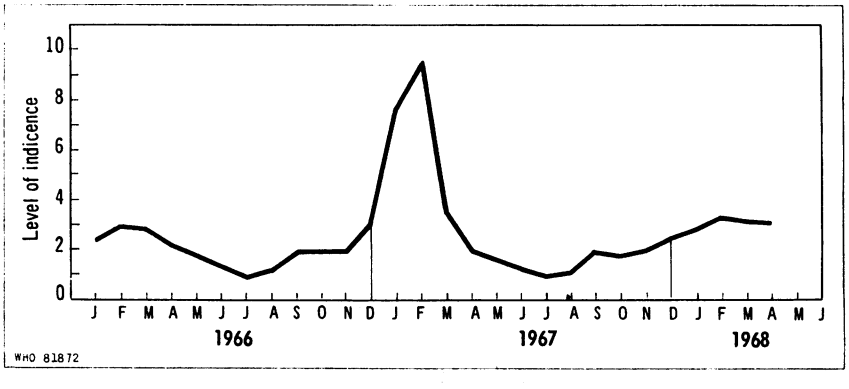
At the same time, a definite tendency to selective spread of influenza B and A2 throughout the country was noted. Some localities were not involved in the epidemic, though there were wide contacts with cities where the populations were affected by influenza. From the end of December, when influenza A2 and B was recorded at the same time in Moscow, Gorky and Novosibirsk, in Sverdlovsk an outbreak of influenza B occurred in spite of the fact that in the population the level of antibodies to A2 influenza viruses was lower than the level of antibodies to B viruses.

*Antigenic structure of influenza viruses strains isolated in 1966–67*

During epidemic rises in the incidence of influenza in 1966–67, 373 haemagglutinating virus agents were isolated in different laboratories of this country. Preliminary identification of these agents carried out in local laboratories with commercial diagnostic sera showed that 121 strains belonged to type B, 132 strains to A2; in 32 cases the results of identification were not clear and in 88 cases haemag-

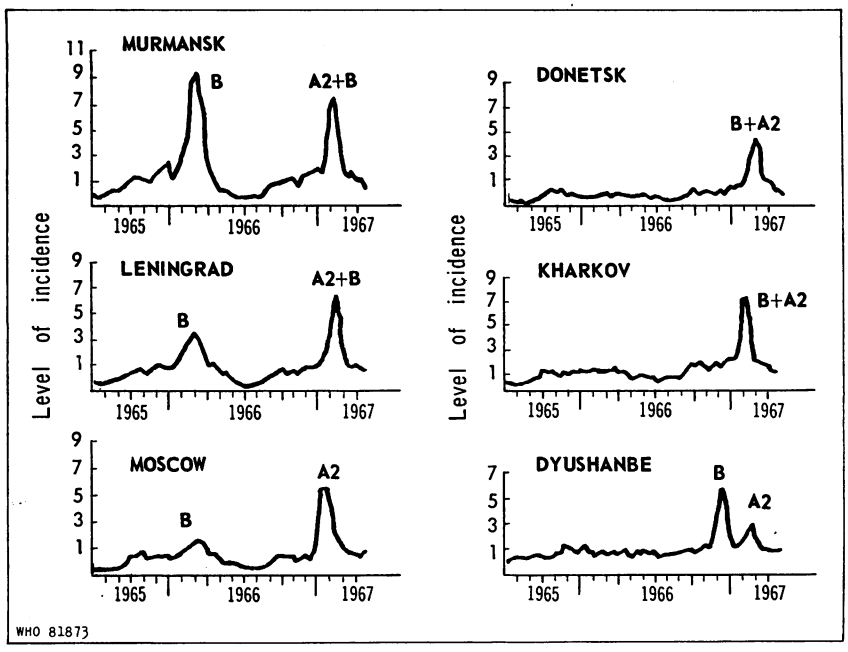
FIG. 1

INCIDENCE OF INFLUENZA AND ACUTE RESPIRATORY DISEASE IN THE USSR IN 1966-67[a]




[a] The level of incidence is shown on an arbitrary scale; the level in the summer months of 1964 was taken as 1 unit.

FIG. 2
SPREAD OF INFLUENZA A2 AND B[a] IN DIFFERENT LOCALITIES OF THE USSR IN 1965-67




[a] The level of incidence is shown on an arbitrary scale; the level in the summer of 1964 was taken as 1 unit.

glutinating agents grew in chick embryos very poorly and were lost during passages.

Altogether, 45 strains isolated within this period were also studied thoroughly in the central laboratory. Most of the strains received for investigations multiplied poorly in chick embryos and HI titres in allantoic fluid were 1 : 2 or 1 : 8. Strains were well adsorbed on both fresh and formolized chick-embryo erythrocytes and could be eluted, completely or in part.

The above-mentioned properties made it possible to prepare and use some purified and concentrated antigens from newly isolated strains for investigation. The antigenic structure of the strains was studied by means of the HI test. Antisera were prepared by immunization of rats with newly isolated or standard strains.

The strains of influenza B virus were not all identical and could be divided into 3 subgroups (Table 2):

(1) Strains revealing a close similarity in antigenic structure to B/Johannesburg/33/58;

(2) Strains more similar to B/Singapore/3/64 or B/USSR, Tash/804/64;

(3) Strains with evidence of a slight shift from both above-mentioned varieties.

Most of the strains isolated during this season belonged to the subgroups (1) and (2) and seemed to play the main role in causing an epidemic outbreak.

The influenza A2 viruses were also not all identical in antigenic structure; 4 variants of A2 viruses were isolated during the epidemic season:

(1) Strains similar to A2/Singapore/1/57;

(2) Strains similar to A2/England/12/64 or A2/USSR, Gor/62/65;

(3) Strains that showed a more pronounced shift from A2/Singapore/1/57 and a slight shift from the strains circulating in 1964–65 (Table 3);

(4) Atypical strains that produced S-antigen, characteristic of influenza A viruses, but which were not inhibited by antisera against representative strains A2/57, A2/64 or A2/67.

TABLE 2
ANTIGENIC STRUCTURE OF INFLUENZA B VIRUSES ISOLATED IN 1966

| Viruses | Antisera[a] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 11 | 12 | 15 | 16 | 17 |
| 1. B/USSR, Bm/8/52 | 1 | 1/4 | 1/4 | 1/4 | 1/8 | 1/8 | 1/16 | 1/8 | 1/8 |
| 2. B/Johannesburg/33/58 | 1/2 | 1 | 1/2 | 1/2 | 1/4 | 1/4 | 1/32 | 1/2 | 1/32 |
| 3. B/USSR, Mich/59 | 1/2 | 3/4 | 1 | 1 | 1/4 | 1/4 | 1/8 | 1/4 | 1/8 |
| 4. B/USSR, Ser/63 | 1/2 | 1/2 | 1 | 1 | 1/4 | 1/4 | 1/8 | —[b] | 1/16 |
| 5. B/USSR, Don/83/66 | 1/4 | 1 | 1 | 1/2 | 1/4 | 1/8 | 1/16 | 1/4 | —[b] |
| 6. B/USSR, H/1/66 | 1/2 | 1/2 | 1/2 | 1/2 | 1/8 | 1/4 | 1/4 | 1/2 | 1/4 |
| 7. B/USSR, Vl/175/66 | 1/4 | 1/2 | 1/2 | 1/2 | 1/4 | 1/2 | 1/4 | 1/2 | —[b] |
| 8. B/USSR, Ln/350/66 | 1/4 | 1 | 1 | 1/2 | 1/4 | 1/2 | 1 | 1/2 | 1/4 |
| 9. B/USSR, Lu/349/66 | 1/4 | 1/2 | 1/2 | 1/2 | 1/16 | 1/8 | 1 | 1/2 | 1/4 |
| 10. B/USSR, Lu/250/66 | 1/8 | 1/2 | 1/2 | 1/2 | 1/4 | 1/4 | 1 | 1/2 | 1/4 |
| 11. B/Singapore/3/64 | 1/8 | 1/4 | 1/4 | 1/4 | 1 | 3/4 | 1 | 1 | 1/8 |
| 12. B/USSR, Tash/804/64 | 1/8 | 1/4 | 1/4 | 1/4 | 3/4 | 1 | 1 | 1 | 1/4 |
| 13. B/USSR, T/83/65 | 1/4 | 1/4 | 1/4 | 1/4 | 1/16 | 1/8 | 1/4 | 1 | —[b] |
| 14. B/USSR, Du/1/66 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/14 | 1 | 1/4 | 1/8 |
| 15. B/USSR, Du/2/66 | 1/8 | 1/8 | 1/16 | 1/8 | 1/16 | 1/8 | 1 | 1/4 | 1/16 |
| 16. B/USSR, M/341/66 | 1/8 | 1/8 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1 | —[b] |
| 17. B/USSR, M/1/66 | 1/8 | 1/8 | 1/4 | 1/4 | 1/8 | 1/16 | 1/8 | 1/2 | 1 |
| 18. B/USSR, M/365/66 | 1/16 | 1/16 | 1/16 | 1/16 | 1/16 | 1/16 | 1/4 | 1/4 | —[b] |
| 19. B/USSR, Si/118/66 | 1/8 | 1/8 | 1/8 | 1/4 | 1/16 | 1/4 | 1/4 | 1/4 | —[b] |

[a] The fractions show the portion of heterologous activity of the sera when the homologous titre is taken as a whole unit.
[b] — = test not done.

Most of the A2 strains belonged to the group (2) but whereas the strains that caused the outbreak in the USSR in 1964–65 were related to A2/USSR, Gor/62/65 and showed a slow antigenic shift from A2/England/12/64 (Ždanov et al., 1966b), during the 1966–67 season most of the strains were almost identical with A2/England/12/64. The atypical strain A/USSR, Tash/1846/67 showed only a 1-way relationship to some A2 strains. This virus was isolated in January 1967 at the time of the epidemic increase in morbidity from influenza; nevertheless, it did not seem to be of epidemiological importance. Patients from whom virus A/USSR, Tash/1846/67 was isolated showed an increase in antibodies against typical A2 strains only and not against this atypical strain.

Some newly isolated strains, including atypical viruses, were sent to the World Influenza Centre in London and the results of preliminary investigations performed there by Dr Pereira have confirmed our data.

In accordance with special agreements, samples of the most characteristic representative strains were sent to national influenza centres in Bulgaria, Poland, Hungary and eastern Germany; some new strains were received in exchange from the national influenza centres of these countries. A comparative study of the strains isolated in the USSR and in some European countries showed that the influenza viruses that caused epidemic waves were similar (Table 4) and they all showed close antigenic similarities to the strains circulating in 1964–65.

TABLE 3

ANTIGENIC STRUCTURE OF INFLUENZA A VIRUSES ISOLATED IN 1967

| Viruses | Antisera [a] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 4 | 5 | 9 | 10 | 12 | 13 | 18 | 19 |
| 1. A2/Singapore/1/57 | 1 | 1/8 | 1/32 | 1/64 | 1/8 | 0 | 0 | 0 | 1/32 |
| 2. A2/USSR Sm/72/66 | 1 | 1/16 | —[b] | —[b] | 1/32 | —[b] | —[b] | —[b] | —[b] |
| 3. A2/USSR, M/1499/67 | 1 | 1/4 | 1/8 | 1/64 | 1/32 | 1/64 | 1/64 | —[b] | —[b] |
| 4. A2/England/12/6[illegible] | 1/16 | 1 | 1/2 | 1/4 | 1 | 1 | 1 | 0 | 1/4 |
| 5. A2/USSR, M/1847/67 | 1/8 | 1 | 1 | 1 | 1/4 | 1 | 1 | 0 | 1/4 |
| 6. A2/USSR, Evt/67 | 1/8 | 1 | 1/2 | 1 | 1/4 | 1 | 1/4 | 0 | 1/32 |
| 7. A2/USSR, M/375/67 | 1/16 | 1 | 1 | 1 | 1/4 | 1 | 1/2 | 0 | 1/8 |
| 8. A2/USSR, R/23/67 | 1/16 | 1 | 1 | 1 | 1/2 | 1 | 1 | —[b] | —[b] |
| 9. A2/USSR, M/1/67 | 1/64 | 1 | 3/4 | 1 | 1/4 | 1/2 | 1 | —[b] | —[b] |
| 10. A2/USSR, Gor/62/65 | 1/16 | 1/4 | 1/2 | 1/4 | 1 | 1 | 1 | 0 | 1/16 |
| 11. A2/USSR, Vl/36/67 | 1/16 | 1/8 | 1/4 | 1/8 | 1 | 1/16 | 1/2 | 0 | 1 |
| 12. A2/USSR, R/21/67 | 1/16 | 1/4 | 1 | 1 | 1 | 1 | 1/2 | —[b] | —[b] |
| 13. A2/USSR, Vl/25/67 | 1/32 | 1/8 | 1 | 1/4 | 1 | 1/4 | 1 | —[b] | —[b] |
| 14. A2/USSR, Dyu/1/67 | 1/64 | 1/2 | 1/2 | 1/2 | 1/8 | 1/2 | 1/2 | 1/8 | 1/4 |
| 15. A2/USSR, Si/158/67 | 1/8 | 1/8 | 1/2 | 1/4 | 1/4 | 1/2 | 1/4 | —[b] | —[b] |
| 16. A2/USSR, Tb/40/67 | 0 | 1/16 | 0 | 0 | 1/16 | 0 | 0 | 0 | 1/8 |
| 17. A2/USSR, Fr/222/67 | 1/16 | 1/16 | 0 | 1/16 | 1/16 | —[b] | 1/8 | 1/16 | —[b] |
| 18. A/USSR, Gl/1/66 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 19. A2/USSR, Tash/46/67 | 0 | 0 | 0 | 1/64 | 0 | 1/64 | —[b] | 1/32 | 1 |

[a] The fractions show the portion of heterologous activity of the sera when the homologous titre is taken as a whole unit.

[b] — = test not done.

TABLE 4

ANTIGENIC RELATION OF STRAINS OF INFLUENZA A2 VIRUSES, ISOLATED IN 1966–67 IN THE USSR AND NEIGHBOURING COUNTRIES

| Viruses | Antisera to the A2 viruses [a] | | | | |
|---|---|---|---|---|---|
| | Singapore 1/57 | England 12/64 | Mos 1/67 | Gor 62/65 | R 21/67 |
| A2/USSR, M/1/67 | 1/8 | 1 | 1 | 1/4 | 1/2 |
| A2/USSR, R/21/67 | 1/32 | 1/4 | 1 | 1 | 1 |
| A2/Sofia/557/66 | 1/8 | 1/4 | 1/2 | 1/2 | 1/2 |
| A2/Sofia/494/66 | 1/16 | 1/2 | 2/3 | 1 | 1 |
| A2/Berlin/248/67 | 1/8 | 1/2 | 1 | 1/2 | 1/2 |
| A2/Berlin/249/67 | 1/8 | 1 | 1/2 | 1 | 1 |
| A2/Poland/40/67 | 1/8 | 1 | 1/3 | 1 | 1 |
| A2/Budapest/2/67 | 1/8 | 1/8 | 1 | 1/4 | 1 |

[a] The fractions show the portion of heterologous activity of the sera when the homologous titre is taken as a whole unit.

*Influenza outbreaks in the USSR and their relation to global waves of influenza A2 and B*

An increase in influenza morbidity at the beginning of 1966 was preceded by the chain of outbreaks in central, east and northern parts of Europe. Similarly, an epidemic outbreak in Australia in August–September 1965, and local outbreaks in the USA, preceded the appearance of influenza in Europe (*Wkly epidem. Rec.*, 1965). After the epidemic of influenza B in the USSR had stopped in the spring of 1967, outbreaks continued to be observed in Europe, spreading to the south-west (Yugoslavia, the Federal Republic of Germany, Switzerland and Italy), and subsequently, in the third and fourth quarters of 1967, influenza B outbreaks were recorded in Oceania and in Africa. Moreover, according to information from the World Influenza Centre (*Wkly epidem. Rec.*, 1965), the strains that caused influenza B outbreaks in most

countries showed antigenic relationships to B/Singapore/3/64 or had a slight antigenic shift from that strain.

These data correspond to the results of our investigation and support the view that influenza B outbreaks in the USSR are part of a global wave.

Before influenza A2 appeared in the USSR in the winter of 1966–67, some outbreaks in other countries were recorded. In the summer of 1966, an outbreak of influenza A2 occurred in Australia and in the autumn of 1966 it spread throughout Europe—the central parts being involved first.

In the first quarter of 1967, influenza A2 was recorded in Hungary, Romania and France, simultaneously with outbreaks in the USSR; later, there were outbreaks in Finland, Norway and in some areas of the USA. However, there was no further spread of influenza, probably because of the onset of the warm period of the year in the countries of the northern hemisphere.

In the autumn of 1967, influenza A2 appeared again in the USA and in northern Europe and began to spread to other countries. In the winter of 1967–68 there was no real epidemic increase in influenza morbidity in the USSR as a whole although sporadic and limited local outbreaks were observed. Influenza A2 strains causing outbreaks in different countries were similar and, according to the information of the World Influenza Centre, belonged to 3 subgroups, like those isolated in the USSR in 1966–67. Direct comparison of representative strains received from Bulgaria, eastern Germany, Poland, Hungary and the USSR provided additional evidence for a common etiology of influenza A2 outbreaks in different countries. Thus, the outbreak of influenza A2 recorded in the USSR was also part of a global wave of this infection.

Therefore, the 2 global waves of influenza, A2 and B, crossed the USSR in the winter of 1966–67. This was the cause of a prolonged and intensive increase in the incidence of ARD in this country.

## DISCUSSION

Data obtained in the course of this study suggest some ideas concerning the epidemiology of influenza. Since the antigenic structure of the strains isolated during the 1966–67 epidemic was not identical there are grounds for supposing that the spread of the global wave of influenza A2 had 3 etiological peculiarities: (1) the repeated activation of the strains that had caused the previous epidemic wave; (2) the epidemic distribution of antigenic variants which appeared during the previous epidemic wave; (3) the appearance of new variants.

New variants are usually of no epidemiological significance during the current influenza season but might have an epidemic importance in the future. For the period of 1966–67, this supposition was confirmed by a simultaneous circulation of the 3 above-mentioned subgroup strains of influenza A2 and B.

In this connexion, the question arises whether every atypical antigenic variant of influenza viruses can be of future epidemiological importance. On the one hand, the strains of B/Taiwan/62, with clear antigenic differences, played an insignificant epidemiological role and did not spread throughout the world. On the other hand, it was established that a few strains of the A2 variants that caused the 1964–65 epidemic wave were discovered among the A2/USSR, Kor/62, isolated in the 1962 wave (Ždanov et al., 1966b).

In addition, a clear correlation between the intensity of the spread of influenza and the antigenic peculiarities of epidemic strains in 1951 pointed to the importance of variation in the antigenic structure of influenza viruses.

It is also reasonable to discuss some data concerning the rate of spread of global waves of influenza A2. It was noted (Ždanov et al., 1966a) that the global epidemic waves of influenza A2 spread more slowly year after year. So the first and second waves of 1957 and 1959 spread throughout the world within 1 year, but it took 2 years for the third and fourth influenza waves to spread throughout most countries. In the first season both waves spread to the countries of Western Europe, North America and Asia, and only in the next cold season did they reach the USSR (1960–61, 1961–62, 1963–64, and 1964–65, respectively). The fifth global wave of influenza A2 also spread throughout the world within 2 years. However, unlike the previous years, the USSR was involved in the epidemic during the first year. Thus, the direction of spread of influenza A2 waves was changed in 1966.

It is interesting to emphasize that summer breaks in the spread of the influenza B epidemics occurred in the USSR in 1962 and 1966. These facts allow us to assume that, besides the specific immunity of the population, some non-specific factors play a certain role in the spread of influenza.

## RÉSUMÉ

### LA GRIPPE À VIRUS A2 ET B EN URSS EN 1966-1967; QUELQUES ASPECTS DE L'ÉPIDÉMIOLOGIE GLOBALE DE LA GRIPPE

Au cours de l'hiver 1966-1967, une vague de grippe due au virus A2 atteignit l'URSS; c'était la cinquième depuis la première apparition de cette souche pandémique. Contrastant avec la dernière poussée survenue en 1965, cette épidémie se développa à peu près en même temps qu'une épidémie de grippe B. La propagation de l'affection sur tout le territoire de l'URSS se poursuivit pendant deux ans; la grippe B fut plus fréquente en 1966, la grippe A2 en 1967, la diffusion des deux virus s'effectuant à des rythmes différents. La grippe B était caractérisée par une extension lente et une augmentation progressive d'intensité pendant la plus grande partie de l'année, tandis que la grippe A2 se répandait rapidement et touchait une grande partie du pays en l'espace de trois mois. Bien que la propagation du virus B ait débuté près de 9 mois avant celle du virus A2, les deux épidémies atteignirent leur acmé simultanément dans la plupart des localités de l'URSS au cours de l'hiver 1966-1967. A l'approche de l'été, on assista à une régression temporaire de l'épidémie de grippe B, mais celle-ci fit sa réapparition à l'automne suivant avec une vigueur non amoindrie.

Parmi les 373 souches de virus hémagglutinants isolées en 1966-1967 dans différents laboratoires du pays, 121 appartenaient au type B et 132 au sous-type A2. Une étude plus approfondie de la structure antigénique des souches de virus B, effectuée au Centre national de la Grippe de l'URSS, montra leur diversité: certaines étaient étroitement apparentées à la souche B/Johannesburg/33/58, d'autres à la souche B/Singapore/3/64, un troisième groupe enfin différait légèrement de ces deux variétés.

Parmi les virus A2 isolés et étudiés, on décelait 4 groupes de variants antigéniques: des souches similaires au prototype A2/Singapore/1/57; des souches étroitement apparentées à A2/England/12/64 ou A2/USSR/Gor/62/65; des souches antigéniquement différentes des variétés précédentes, mais appartenant néanmoins au sous-type A2; enfin des souches atypiques, présentant l'antigène S caractéristique des virus A, mais qui n'étaient pas inhibées par les antisérums préparés contre les virus A2/57, A2/64 ou A2/67.

L'étude comparative des souches isolées en URSS et dans des pays voisins d'Europe a montré que les poussées de grippe observées en URSS en 1966-1967 faisaient partie d'une vague épidémique globale.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