

## Observations on the nasopharyngeal carriage of *Haemophilus influenzae* type b in children in Kampala, Uganda

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(Received 26 January 1970)

### SUMMARY

*Haemophilus influenzae* type b was isolated from 4.5% of outpatient children living in various parts of Kampala city and its surroundings. In contrast, this serotype was carried by up to 53% (average 29%) of 14 to 18 children living as a group in an orphanage. This finding indicates that the high carriage rate for this serotype demonstrated by Turk (1963) in a group of orphanage infants in Jamaica was not an isolated finding, and that it may be expected where large groups of children live together.

*H. influenzae* type b did not appear to be a readily transmitted organism even in that group of children with a high carriage rate. This suggests that in ordinary open communities the transmission of this serotype from one household to another may be an extremely rare event.

### INTRODUCTION

Turk (1963), working in Jamaica, showed that up to 70% of infants living together in an orphanage could carry *Haemophilus influenzae* type b in their nasopharynx without any apparent illhealth that could be attributed to this serotype. This carriage rate contrasted sharply with that of less than 5% in children in ordinary open communities (Dawson & Zinnemann, 1952; Masters, Brumfitt, Mendez & Likar, 1958; Turk, 1963). It is not known whether the high carriage rate found in the Jamaican infants was peculiar to that study or whether it is to be expected in similar groups of children in other parts of the world. The purpose of this paper is to report that an essentially similar situation existed in a group of orphanage children in Kampala. Observations on the communicability of *H. influenzae* strains are also reported.

### MATERIALS AND METHODS

Two populations of children were investigated. The first consisted of children in Sanyu Babies' Home, an orphanage in Kampala, and the second of children attending an outpatient clinic in Mulago Hill Dispensary, Kampala.

The children in the orphanage lived in three separate groups that will be referred to as I, II and III. Group I children were infants confined to their cots for most of

the time. Most of the new admissions to the Home went into this group. Group II consisted of older children, most of whom were toddlers, often promoted from group I. Children in this group mixed freely with one another. The rooms occupied by these two groups were adjacent to each other on the same building but with no direct communication between them so that children in these two groups rarely mixed. Children in group II were however always brought into group I room for swabbing, at all swabbing sessions. They spent most of their day time playing in the garden a few yards outside group I room. Group III children lived in a separate house, about 50 yards away and were usually promoted from group II. The three groups were looked after by the same nurses who moved freely between these groups.

Per-nasal swabs were collected at intervals of between 1 and 4 weeks between mid-July 1967 and the last week of April 1968, except that group III children were not swabbed after the end of 1967.

Similar swabs from the outpatient children were collected on various dates between 20 May 1968 and 27 June 1968 inclusive and on each occasion between 10 and 60 consecutive subjects aged between 1 week and 10 years were swabbed. Altogether 198 children from 184 families living in the city or the neighbouring villages were investigated.

The method of collecting the nasopharyngeal swabs, of culturing them and of identifying and typing the *H. influenzae* strains were similar to those used by Turk (1963) except that the horse-blood-agar plate was omitted in this study.

## FINDINGS

### *Carriage rates and serotypes*

*The orphan home.* The carriage rates of *H. influenzae* strains in the orphanage groups are shown in Table 1. A hundred and twenty-one typable strains were isolated from the total of 646 swabs collected from this home over the 8½ month period; they all belonged to type b. No case of *H. influenzae* type b infection occurred in this home during the period of the survey.

*Outpatient children.* The numbers of strains of different serotypes and of untypable strains isolated from the outpatient children are shown in Table 2. *H. influenzae* type b was isolated from nine (4.5%) of the 198 children.

### *The interval between admission and acquisition of H. influenzae strains by children in the orphanage*

*Untypable strains.* There were 26 children who were admitted to group I after the study had commenced. Seven of these carried untypable strains on their first swabbing and were presumably carriers of these strains when admitted. Fifteen others, who apparently were not carriers of any *H. influenzae* strains on admission, became carriers of untypable strains within 20 weeks of admission (13 of them within 12 weeks). Only four children never became demonstrable carriers of any *H. influenzae* strains. These four had been in the home for only 4 to 10 weeks when the study was concluded.

*H. influenzae type b.* In contrast, only one child out of the 26 picked up a type b

strain while residing in group I, and of the seven who were subsequently promoted to group II where the carriage rate of this serotype varied between 6 and 53% (average 29%) only two became demonstrable carriers of this serotype within 6 weeks of their residence in group II. The other five apparently did not acquire this serotype although four of them had stayed in this group for 8 to 24 weeks before the study was concluded. All of the seven promoted children had acquired untypable strains while in group I.

Table 1. *Nasopharyngeal carriage of Haemophilus influenzae in children in Sanyu Babies' Home, Kampala*

| Group | No. of children per batch | No. of batches | No. of swabs taken | Average age in months                   | Percentage mean carrier rate for |                |
|-------|---------------------------|----------------|--------------------|---|----------------------------------|----------------|
|       |                           |                |                    |   | type b                           | All strains    |
| I     | 6-12                      | 22             | 207                | 5 $\frac{3}{4}$<br>( $\frac{1}{4}$ -12) | 7<br>(0-33)                      | 54<br>(9-100)  |
| II    | 14-18                     | 22             | 346                | 15<br>(4-84)                            | 29<br>(6-53)                     | 80<br>(40-100) |
| III   | 4-7                       | 16             | 93                 | 24<br>(4-48)                            | 4<br>(0-25)                      | 53<br>(17-83)  |

The figures in parentheses indicate the ranges of age, or of percentage carrier rate.

Table 2. *The carriage rates of Haemophilus influenzae strains in outpatient children*

| Age group       | No. of subjects examined | Typable strains |   |   |   |   |   | Untypable strains |
|-----------------|--------------------------|-----------------|---|---|---|---|---|-------------------|
|                 |                          | a               | b | c | d | e | f |                   |
| 1 week-3 months | 27                       | —               | — | — | — | 1 | — | 13 (48)           |
| > 3-12 months   | 56                       | —               | 4 | — | 1 | 2 | — | 31 (55)           |
| > 1-2 years     | 57                       | —               | 4 | — | — | 2 | 2 | 34 (60)           |
| > 2-5 years     | 41                       | —               | 1 | — | 1 | — | — | 27 (66)           |
| > 5-10 years    | 17                       | —               | — | — | — | — | — | 12 (71)           |
| Totals          | 198                      | —               | 9 | — | 2 | 5 | 2 | 117 (59)          |

Figures in parentheses refer to percentage for that age group.

#### DISCUSSION

*H. influenzae* is carried in the upper respiratory tract of a large proportion of healthy subjects (Turk & May, 1967). In this site in open communities, *H. influenzae* type b is carried by about 3% of children under 5 years of age and by about 1% or less of older subjects (Dawson & Zinnemann, 1952; Masters *et al.* 1958; Turk, 1963). The 4.5% carriage rate of this serotype in the outpatient children investigated in the present study is consistent with these findings.

On the other hand in the orphanage infants surveyed by Turk (1963) a carriage rate of between 17 and 70% (average 47%) for this serotype was found. In the present study the carriage rate for this serotype in group II children varied between 6 and 53% and averaged nearly 30%, and possibly a higher carriage rate

might have been demonstrated if, as in Turk's study, a blood agar plate had been used in addition to the 'chocolate' agar for primary isolation. Johnson & Fousek (1943) demonstrated a 54 % carriage rate in 13 children up to 10 years of age living in one ward of a convalescent hospital. In an adjacent ward consisting of 17 'older children' no nasopharyngeal carriers of this serotype were found. All of this suggests that where small children live together in fairly large numbers the tendency is for the carriage rate of this serotype to rise to a much higher level than that found in ordinary open communities. That this is not always the case is shown by the low carriage rates in groups I and III children in my study. In group III this might have been due to acquired immunity arising out of prior contact with the serotype as most of the children in this group were former residents of group II.

The difference in carriage rates of this serotype in the groups I and II is worthy of comment; it existed in spite of the following facts.

(a) The two groups of children lived adjacent to each other in the same building and group II children always played in the garden a few yards outside group I room from where infected droplets could have been conveyed to group I children through open windows by means of air currents.

(b) The two groups were looked after by the same nurses who moved freely between the two groups and could have communicated this organism from group II to I.

(c) Group II children were always swabbed in group I room at all of my swabbing sessions at intervals of between 1 and 4 weeks, on which occasions the carriers in group II presumably showered large numbers of infected droplets into the air as they screamed.

The existence of the difference in the carriage rates, therefore, suggests that as means of communicating *H. influenzae* type b air currents, adult contacts and occasional entry of carriers into the environment of a susceptible community are unimportant factors. The fact that group I children were generally younger than those in group II (Table 1) might be thought to be the explanation for the difference in the carriage rates but this seems to be unlikely because even premature newborn infants have been known to carry *H. influenzae* type b in very high numbers (Donald & Coker, 1957).

Turk (1963) observed, in the orphan home he investigated, that there was always a time lag, often of 2 to 3 months, and sometimes longer, between the arrival into the home and the demonstration of type b in the nasopharynx of the new entrants. This observation, suggesting that even where the carriage rate of this serotype was high the transmission of this serotype to susceptibles did not occur readily was made in the present study also. Of the seven children that were promoted from group I to II during the period of my study apparently only two became carriers of this serotype within 6 weeks of residence in the new group. The others did not seem to have acquired this serotype although nearly all of them had been in this group for 2 to almost 6 months when the study was concluded. These observations suggest that in ordinary open communities, where contact between carriers and susceptibles is not so common or so prolonged as it was in these orphanages and where the carriage rate of this serotype is very much lower,

the transmission of *H. influenzae* type b from one household to another must be a very rare event.

I am grateful to Professor E. Nnochiri for having read the draft manuscript and to Mrs F. Mulira for permission to swab the children in Sanyu Babies Home.

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