INCIDENCE OF TUBERCULOSIS CASES IN CONTACTS
A SIMPLE MODEL

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Introduction

Contact examination* is not recommended as a routine procedure for case finding in the District Tuberculosis Programme (DTP), under which only the chest symptomatics attending the general dispensaries and tuberculosis clinics on their own are investigated for tuberculosis. The rationale for not including contact examination as a routine casefinding measure are reported to be that prevalence rate of tuberculosis among the contacts is not much higher than in general population and¹,² at the time an index case is diagnosed from a household a second case may not be found in the same household³,⁴. Further, the procedure is shown to be highly costly for a clinic considering the return.¹ Contacts also, are not found to be a readily available group for casefinding activity, contrary to popular belief. However, though more prevalence cases cannot be diagnosed by contact examination, it is possible that by keeping the household contacts, as a group, under surveillance, future incidence of cases in the community can be substantially prevented. The present paper throws some light on this question.

A model situation has been created (figure) by using hypotheses derived from various studies conducted in India, designed to answer the question. The hypotheses used in the figure (under B) have been numbered in brackets and could be linked with those given under Section A. References have been cited under A to indicate the source for the hypotheses.

Material and methods

Hypotheses used in this report

I. (a) 40% of a community of both sexes and of all ages are infected at a point of time².
(b) Population aged 5 years and above constitute 85% of the population².

II. The prevalence rate of cases is 4 per thousand in a population aged 5 years and above³.

III. (a) The average number of contacts in the household is five³,⁶.
(b) There is only one prevalence case in a household at any given point of time³.

IV. Of the infected in a community at any point of time 2% only are in the case households⁷.

V. (a) About 40% of the non-infected population in a contact household are infected per year (Urban area of Madras city).
(b) Alternatively, such infection rate is 20.4% (rural areas of Bangalore district⁹).

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* Contact: Members of the household of a case diagnosed for the first time (“index case”) in the household.
VI. 2.1% of the newly infected develop into tuberculosis cases in a year\textsuperscript{10}, (i.e., seven times of the incidence rate among previously infected).

VII. Of the previously infected persons (infected for more than a year), 0.3% per year develop sputum positive disease\textsuperscript{10}.

VIII. In the general population aged 5 years and more, new cases occur at the rate of 0.13% per year\textsuperscript{10}.

Most of the above hypotheses are on the basis of studies conducted in South Indian rural communities except the report by Kamat et al\textsuperscript{8}, where the infection rates among...
the contacts were from Madras city. The annual incidence rate of infection among the contacts of about 40%, as observed by the latter, was an estimate rather on high side, but still it is used here to give the highest values to the possible incidence from contacts. Situation, with an alternative value of 20.4% as observed by NTI in rural areas, is also presented.

Observations and Discussion

Description of the model

Let a general population of 100,000 be considered. At the current rate of prevalence of cases (II) there would be 340 cases of tuberculosis among 85,000 persons aged 5 years and over in this population (Ib). In the households of these 340 index cases it is assumed that there will be 1700 household contacts, at 6 members (i.e., 5 contacts) per household (III a, b).

Of the 100,000 persons about 40% (I a) will be infected i.e., 400,000 people (excluding 340 cases, infected number = 39660). Of these infected 2% are expected to be found in the contact households (IV) (i.e. 793 are previously infected among contacts).

In other words, of 1,700 household contacts, 793 are already infected and at 0.3% annual rate of incidence of cases among previously infected (VII), about two cases are expected to arise from this group.

Of the remaining 907 people not infected (1700—793), 63 are expected to be infected within a year at the annual incidence rate of infection of 40% (V a). At the alternative incidence of infection rate of 20.4% observed in rural areas of India (V B), 185 persons are likely to be newly infected. At the annual incidence rate of new cases at 2.1% per year (VI), 8 or 4 cases are likely to arise in a year's time. Depending on which of the two rates of incidence of infection is applied. Combining the new cases arising from the previously infected among the contacts (preceding para) and those arising from the newly infected persons among them, the maximum number of cases would be 2+8=10; or alternatively 2+4= 6.

At an incidence rate of 0.13% per year (VIII) among those aged 5 years and over it is expected that 111 cases would arise in a year in the population under study. Thus of the 111 cases arising in the community in a year, 101 or 105 cases (91.0/94.6%) arise from those who are not contacts, depending on the rate of incidence of infection, whether 40% or 20.4% is applied. It is interesting to observe that the rate of incidence of infection among the contacts is not so much relevant in deciding the extent of the proportional contribution of cases from the contacts group to cases arising in the general population.

Conclusion

The proportional contribution of new cases from the contact group to the total incidence cases from the entire community is so small, that even if all the contacts are kept under surveillance, BCG vaccinated or placed on chemoprophylaxis, still over 90% of incidence cases cannot be prevented from occurring. This is apart from the fact that keeping them under surveillance will be highly costly and is an operational problem of considerable magnitude.

It is known that incidence of cases among the contacts is the highest during the first year of their follow up after the index case is detected from the house. So, if the contacts are followed up for considerable number of years, one should expect progressively mounting number of contacts to be kept under surveillance, yield of cases from such a group dwindling with time. Consequently, cost of detection of a case from the contacts would be progressively higher and higher, directly proportional to the number of
years they are kept under surveillance. If the purpose of contact examination is not so much for immediate detection of cases from among them, as to follow them up to prevent incidence cases from them or to detect occurrence of such cases early, large number of contacts have to be followed up for a very long time at considerable cost and the number progressively increasing with time. This defeats the purpose of selective case finding, being uneconomical and generally unrewarding, be it to detect prevalent cases, or to prevent the occurrence of new cases from the group in future.

References


5. Indian Council of Medical Research: Tuberculosis in India—A Sample survey, 1955-58. ICMR Special Report Series No. 34, 1959


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