Occasional Review

Are telephones an infection hazard?

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A recent newspaper article¹ suggested that there is a serious cross-infection hazard in using public telephones. In fact, it gave the impression that there is a danger of contracting any, or all, of the diseases listed in the table. That this caused alarm was apparent from subsequent readers' letters. I had three inquiries from occupational health doctors who had been asked to advise on the subject as the article had made it an issue in their own industries.

Diseases alleged in newspaper article as possible consequences of using public telephones

Food poisoning, diarrhoea, and vomiting	Urinary and genital infections
'Flu, colds, and cold sores	Gangrene, possibly
Acne, red runny eyes, and boils and sores	Yeast infections of eyes, skin, and nails
Wound infection	and sore mouths in babies
Sore throats and mouths	(Hepatitis and TB thrive in similar conditions to yeasts)

This is not the first time that fears have been expressed about the telephone handset as a possible vehicle for the transfer of infection from one user to another. Alexander Graham Bell invented the telephone in 1876, and, as early as 1905, the annual report of the medical officer of health for the City of London,² Dr William Collingridge, contains an account of an investigation by Dr E E Klein in the early years of the century in response to fears about this risk. Since then the subject has been raised intermittently, usually in the lay press. These articles have tended to be alarmist and unbalanced. This paper is prompted by the continuing interest in the subject and by the need to put the matter in perspective.

The risk in perspective

Bacteria and viruses abound in nature, and many of these organisms are harmless to man. Moreover, many organisms that may be harmful to man are regularly exchanged from one person to another without causing obvious trouble. It is necessary for a microbial challenge to be delivered by a suitable route to produce an infection, and even then the challenge must be sufficiently large and of suitable quality (depending on the organism), and it must also be delivered to a suitably susceptible host before there is a likelihood of starting infection. Our hands, noses, and mouths, the working surfaces of our kitchens and shops, door handles, lavatory facilities, etc, all regularly carry a large variety of organisms that include potential pathogens to man. In this context telephones are no exception. The real question is not whether handsets can sometimes be contaminated by bacteria

but whether there is convincing evidence that even an intensively used, unclean telephone represents an outstanding infection hazard that merits public attention.

In fact there are so many other more important and more hazardous sources of infection such as the cross-infection risks of the use of hand-operated lavatories, of lavatory door handles, and of the infective aerosol liberated when a lavatory is flushed. In addition there is the real hazard of touching one's nose (which regularly harbours dangerous staphylococci) and then touching another person: one thinks of a mother caring for her child, the way we shake hands regularly, or the way we pass glasses and crockery to one another at the table or in a public house. There are even infectious hazards in leaning on a post against which a farm animal has rubbed. Life is full of microbial exchanges, and we cannot expect to avoid them or to have every surface disinfected before we handle it.

Size of the telephone network

It is interesting and relevant to look at the present size of the telephone system in Britain. Over 23 million handsets are available for use and from them more than 17 000 million telephone calls are made every year.

The number of public call offices in use is 77 300, these being responsible for about 450 million calls a year. This figure for public call offices does not include pay-phones rented by the owners of organisations who wish to provide telephone facilities for their customers—for instance, shops, public houses, airports, and railway stations. Such pay-phones, which are the responsibility of the renter rather than the Post Office, number about 300 000.

An obvious corollary from these statistics is that any appreciable infection hazard would result in a huge number of cases. With such an extensive "biological trial" constantly proceeding, telephone cross-infection might be expected to be the subject of many important references in publications—if there is a real hazard. In fact, published work on this surprises us by being so scant.

Review of publications

Reference was made above to the study by Klein,² who was the first to investigate the possibility of there being an infection hazard from telephone handsets. He found: "that there is no real risk in the use of the telephone at public call offices and that the alarm that has been raised has no foundation in fact. It is satisfactory to be assured that the use of so valuable a means of communication is without any attendant danger and that the only precaution advisable is the obvious, commonsense one of keeping the mouthpieces clean."

Several other extensive surveys of the bacterial flora of handsets were made during the first part of the century. These earlier references have to be cited with some diffidence, however, in view of the technical improvements made over the past 30 or 40 years. Allan³ reported that tubercle bacilli were isolated from one telephone, and Saelhof⁴ found diphtheria bacilli on one occasion on one telephone. Coulter and Stone⁵ found pneumococci on an unusually high proportion (52%) of telephones studied but during winter and spring only. These findings have not been confirmed or extended by other workers.

Haemolytic streptococci have been found more commonly. This is not surprising, however, as we know that there is an appreciable

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carrier rate among apparently healthy members of the population. In most surveys there is no information on the group of streptococcus concerned and it is therefore difficult to assess the importance of these isolations in terms of potential pathogenicity for man.

The standard reference on this subject is that by R E O Williams,⁶ who studied the mouthpieces and earpieces of 153 telephones in offices and public call offices. No pathogenic bacteria, except *Staphylococcus aureus* and, in one instance, a pneumococcus, were found. The former organism was detected with the same frequency as occurs in the nose and on the skin of normal people. In common with all other workers, Williams found that the predominant organisms were non-pathogenic micrococci, diphtheroids, and viridans streptococci.

In some interesting laboratory studies he also showed that, while both *Staph aureus* and *Streptococcus pyogenes* could survive for several days on telephones, it was only with difficulty that material artificially inoculated into telephone mouthpieces could be dislodged. His overall conclusion, that it was improbable that there is any appreciable risk of infection being transmitted by way of telephones in ordinary use, has never been seriously challenged.

Staphylococcus aureus

As *Staph aureus* is the only potential pathogen found with any regularity (Williams⁶ found it on 7.2% of mouthpieces and 17.6% of earpieces), the importance of its presence merits further consideration. It is true that staphylococci can be transmitted by mediate contact. As described above, however, much more serious exchanges of staphylococci between people occur in everyday life than by the handling of a telephone handset. While one would accept that a virulent staphylococcus may be transmitted from an earpiece to the ear of a susceptible telephone user, one wonders just how often such a challenge is successfully delivered to produce infection.

It is very difficult to initiate staphylococcal lesions simply by transferring small doses of staphylococci on to intact skin. Indeed, it is usually necessary to choose the area of skin carefully, to influence the local vitality of the skin beforehand, and to aid the infection in some other way—for instance, by inserting a stitch or by inoculating cotton dust. If staphylococcal infections could be transmitted more readily by direct contact the staphylococci that many of us carry in our noses and transfer regularly in large numbers to our handkerchiefs, hands, and clothing would pose much more probable infective challenges than the transient staphylococcal flora of our telephone earpieces.

Viruses

Whether telephone handsets play a part in the transfer of viral infection is an open question. No work has been done on the subject. The argument that the telephone has a minor role in comparison with other modes of spread and with other vehicles must apply also to viruses. An additional factor is that most pathogenic viruses survive for much shorter periods than bacteria when not in contact with living cells; this is likely to reduce the risk of cross-infection via the telephone.

New techniques available for identifying and studying viruses might allow investigation of the telephone's role in the transfer of viruses. As that role is unlikely to be important, however, and as there are considerable sampling difficulties, such an investigation would be difficult to justify at present. Quantitative virological information is, therefore, unlikely to become available in the near future.

Need for disinfection

A clear distinction must be drawn between the aesthetic consideration of general cleanliness and a real infection hazard. All handsets should be kept reasonably clean by wiping the mouldings periodically with a soft clean cloth or chamois, slightly moistened with water. In telephone kiosks the standard of cleanliness and hygiene may be low, particularly in those that are used frequently in cities. A particular problem is the small minority of people who believe that kiosks have an auxiliary function as public lavatories. This is a sad commentary on our society rather than evidence that the telephone handset is an important link in the spread of disease. "Vandal" damage of this and other sorts already has to be dealt with on more than 207 000 occasions a year at a cost of £1 275 000; the cost is eventually borne by telephone users themselves. Inevitably a balance has to be struck

between the amount of cleaning carried out and the additional cost that this imposes. In fact public call offices are cleaned regularly, usually about three times a week; this is intended as a general cleaning exercise and is not specifically aimed at preventing cross-infection.

Williams's investigation⁶ included an assessment of the value of "disinfection." One of the groups of telephones he tested was disinfected weekly by a commercial firm. He found that, while the disinfected telephones were cleaner than the others, there was no appreciable difference in the degree of bacterial contamination. Nor did the degree of contamination differ substantially between the day before and the day after disinfection. The scientific evidence suggests, therefore, that what little risk there is of infection from a handset is not reduced by disinfection. In any case a chemical disinfectant that is tolerable to the handset and to the user is unlikely to have a sufficiently strong and persistently lethal effect against all of the likely microbial contaminants.

Conclusion

On neither theoretical grounds nor on the available scientific evidence is there reason for concern about the risk of infection from telephones. There are many other more important and hazardous sources of infection in everyday life. A high standard of call-office cleanliness should certainly be the aim, but there is no clear justification for recommending regular disinfection (as distinct from cleaning) of telephones.

It is right that attention be drawn to possible links in the chain of illness. Nevertheless, if a case is overstated to the general public, who do not have the information on which to form a balanced view, there is unnecessary alarm. This should be avoided.

I thank Professor J G Collee, department of bacteriology, University of Edinburgh, for his invaluable help and advice in the preparation of this paper.

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(Accepted 15 November 1979)

Does vitamin E deficiency occur and, if so, how is it manifested?

Vitamin E is widely distributed in natural foods, and no human case of a primary deficiency has been reported. Deficiency secondary to alimentary malabsorption, manifest by plasma α -tocopherol below 0.5 mg/dl and increased susceptibility of the erythrocytes to haemolysis, has been reported in adults with various gastrointestinal and liver diseases,¹ in children with cystic fibrosis,² and abetalipoproteinaemia.³ Haemolytic anaemia rarely occurs, but deficiency of the vitamin may in part be responsible for the neurological degeneration that occurs in abetalipoproteinaemia. Evidence of deficiency is also not uncommon in premature infants⁴ from a failure to build up the normal stores in the liver. If such an infant is fed for a long time on a formula diet with no supplement of the vitamin a haemolytic anaemia may develop.

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