Common Cold
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Transmission of colds

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Abstract

Rhinorrhea, nasal congestion, and sore throat herald the beginning of the cold season for both children and adults. Although the common cold is a self-limited infection, there are no effective treatments presently available and complications, missed time from work and school, and overall discomfort are not insignificant. Understanding how infections are transmitted may lead to interventions to reduce rates of infection. In order to establish a route of transmission, certain conditions must be met. The virus must be produced and shed at the site of infection. The virus must be deposited in the environment and be able to survive there. The virus must then be able to reach the portal of entry. Finally, interruption of the proposed route of transmission must reduce the incidence of infection under natural conditions. Applying this framework, there is clear evidence in both experimental and home settings that colds can be transmitted *via* self-inoculation. A small amount of evidence is available relating to large and small particle aerosol transmission. Because rhinovirus is responsible for half of all colds, it has been used as the model to understand how virus is transmitted from one person to another in experimental settings. Rhinovirus has been shown to infect *via* self-inoculation following hand-to-hand contact with contaminated hands or hand-to-surface contact with contaminated objects in the environment. Similarly, there is convincing evidence that the self-inoculation method of cold virus transmission occurs in the home environment, where colds are most often transmitted. Aerosol transmission has been studied in the experimental setting and may provide another, albeit less common, method for transmission of rhinovirus infection. As more is understood about the transmission of cold viruses, effective methods to interrupt transmission may be devised.

Introduction

Rhinorrhea, nasal congestion, and a sore or scratchy throat are the unmistakable hallmarks that herald the onset of the common cold. This viral, self-limited upper respiratory tract infection affects both children and adults. Although a number of viruses may produce the symptoms of the common cold, the majority of colds (50% of those in children and adults) are caused by human rhinovirus. Rhinovirus is not normally found in the upper respiratory tract but is acquired by transmission from one person to another. Viral transmission commonly occurs in the home, and children are the primary reservoir [1].

Because rhinoviruses are the most frequent cause of colds, they have been used to study the mechanisms involved in transmission of the common cold. Rhinovirus deposited in the nose, either directly or by way of the nasolacrimal duct from the eye, is carried by mucociliary clearance to the nasopharynx, which is the initial site of rhinovirus infection [2]. Subsequently, rhinovirus infection may spread anteriorly to infect the nasal mucosa [3]. Rhinovirus replication occurs in only a small number of nasal epithelial cells, as demonstrated by studies using *in situ* hybridization of nasal biopsy specimens [4, 5]. Rhinovirus can be recovered from nasal secretions of infected individuals for 5–7 days, but viral shedding in the nasopharynx may persist for 2–3 weeks [3]. In addition, rhinovirus has also been shown to replicate in the lower respiratory tract [6].

It is clear that rhinovirus is shed from the site of infection in the nose, but the means of transmission of rhinovirus from one person to another have been more difficult to determine. Transmissions *via* small particle aerosol, large particle aerosol, and self-inoculation have all been proposed. Virus in a small particle aerosol, produced from the lungs by coughing, would have to be inhaled and reach the lungs in order to transmit infection (Fig. 1). Large particle aerosols, such as the large droplets of saliva expelled during a sneeze, would have to land directly on the eyes or nose, or on a surface to be picked up on the hands for self-inoculation to transmit infection (Fig. 2).

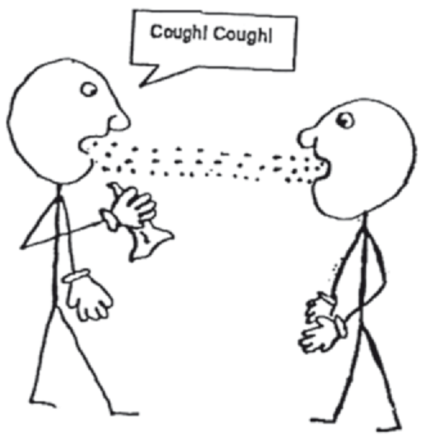

Figure 1. Small particle aerosol transmission (drawings Figures 1–3: With friendly permission of Elizabeth L. Pappas).

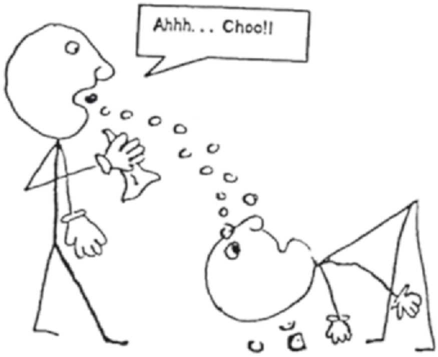

Figure 2. Large particle aerosol transmission.

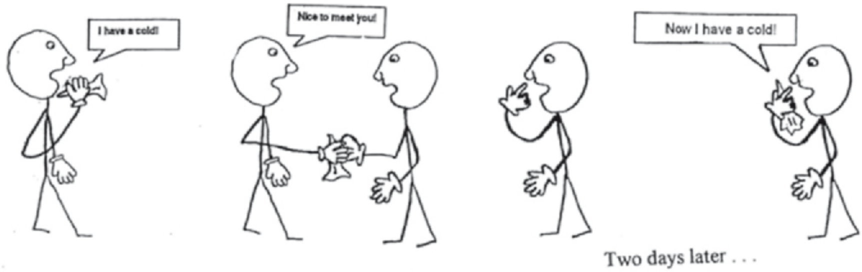

Figure 3. Hand-to-hand with self-inoculation.

Hand-to-hand or hand-to-surface-to-hand transfer with self-inoculation would deposit rhinovirus directly into the nose or eyes from which infection of the nasopharynx could result (Fig. 3).

In order to understand viral transmission, a series of postulates have been developed that must be met to establish that viral transmission occurs *via* the proposed route (Tab. 1). According to this algorithm, the virus must be produced and shed at the site of infection, it must be deposited in the environment and able to survive there, and it must be able to reach the portal of entry, namely the eyes or nose for rhinovirus. Finally, to establish that viral transmission actually occurs *via* a route, interruption of the proposed route must reduce the incidence of infection. This review focuses on deposition of virus in the environment, transfer of virus to the portal of entry, and interruption of transmission.

Table 1. Framework for establishing transmission routes of rhinovirus*

1.	Virus must be produced in the infected host at the site of infection
2.	Virus must be present in secretions or tissues shed from the site of infection
3.	Virus must be deposited in the environment and must be able to survive there
4.	Virus deposited in the environment must reach the portal of entry
5.	Interruption of the proposed route of transmission must reduce the incidence of infection

*Adapted from Gwaltney and Hendley [7]

Virus must be deposited in the environment and able to survive (Tab. 2)

Rhinovirus has been found on the hands of about 40% of naturally infected individuals [7]. From the hands, rhinovirus may be transmitted directly to another person's hand or be deposited on a surface by an infected individual where it may survive for several days [8]. In one study, 35% of surfaces tested in hotel rooms used by adults infected with rhinovirus were contaminated with rhinovirus RNA, including door handles, pens, light switches, TV remote controls, faucets, and telephones [8]. Rhinovirus has been recovered with cell culture for 3 hours after deposit on non-porous surfaces such as plastic, formica, stainless steel, and certain hard synthetic fabrics, but it was not recovered from porous materials such as tissues or cotton cloth after 3 hours [9].

Several studies have demonstrated the feasibility of hand-to-surface-to-hand transfer of rhinovirus. In one study, touching surfaces and objects contaminated with rhinovirus RNA during the course of normal daily activities effectively transferred viral RNA to the fingertips in 47% (28/60) of trials [8]. Transfer was more efficient for surfaces contaminated for only 1 hour, where 60% (18/30) of the trials had positive virus transfer. After 18 hours, transfer decreased to 33% (10/30) [8]. In another experiment, infectious rhinovirus was effectively transferred from contaminated smooth surfaces after normal handling to the hands of 64% (14/22) of volunteers; the contaminated surfaces included table tops and pens [10]. Hand-to-surface-to-hand transfer seems to be a feasible method for transfer of rhinovirus during normal daily activities.

Hand-to-hand contact is one effective method of transferring rhinovirus. Rhinovirus can survive on human skin for 1–2 hours during normal use while studying or eating [9]. In one study, rhinovirus was recovered from the hands of 40% (10/25) of volunteers who had hand-to-hand contact with the contaminated hands of infected donors [11]. In another study, rubbing of inoculated skin resulted in transfer of rhinovirus to the fingers of 42% (16/38) of volunteers [10]. In married couples, the likelihood of rhinovirus infection in the susceptible spouse was directly related to the presence of

Table 2. Virus must be deposited in the environment and be able to survive there

Deposited in the environment:
• Rhinovirus can be recovered for up to 3 hours on non-porous surfaces; rhinovirus survives on human skin for 1–3 hours [9]
• Rhinovirus is found on about 40% of hands of adults with natural rhinovirus infection [7]
• Rhinovirus is found on 35% of surfaces of hotel rooms used by adults infected with rhinovirus [8]
Hand-to-surface-to-hand transfer:
• Rhinovirus transferred to the fingertips used to touch hotel objects contaminated with rhinovirus in 47% of trials; 60% of transfers were positive for surfaces contaminated only 1 hour earlier, and 33% for surfaces contaminated 18 hours earlier [8]
• Rhinovirus was recovered from the hands of 64% of volunteers who handled contaminated objects [10]
• Respiratory syncytial virus (RSV) could be recovered from an average of 2.4 surfaces tested per hospital room that had been occupied by an infant infected with RSV. Nine volunteers became infected, 5 cuddlers and 4 touchers (self-inoculation); none of the sitters (small particle aerosol) became infected [18]
Hand-to-hand transfer:
• Rhinovirus can be recovered from 40% of volunteers who had hand-to-hand contact with the contaminated hands of infected donors [11]
• Rhinovirus was recovered from the fingers of 42% of volunteers who rubbed skin contaminated with rhinovirus [10]
• In married couples, the likelihood of rhinovirus transmission is directly related to the presence of rhinovirus on the nose/hands of the infected spouse [12]
Aerosol transmission:
• Airborne rhinovirus was not detected when experimentally infected volunteers were housed in a room with an air sampler capable of testing 82% of the air in the room [13]
• Picornavirus RNA detected in 32% of air sampling filters from three office buildings; frequency of viral detection correlated with amount of outside ventilation [14]
• Recirculation of air on airline flights did not increase the risk for cold symptoms in passengers [15]
• Rhinoviruses do not circulate well among adults at work at an insurance company [16]
• Rhinovirus can be recovered from only 1/13 sneezes and 0/8 coughs [9]
• Rhinovirus can be detected in a mask after talking, coughing, breathing [17]

rhinovirus on the hands and in the nose of the infected spouse [12]. It is clear that rhinovirus can be effectively transferred from hand to hand.

Other studies have examined deposition and survival of rhinovirus in the air. Experimentally, rhinovirus can remain infectious in small particle aerosols and volunteers can be infected by exposure to them [7], but this has not been shown to occur commonly in natural settings. In one air sample study, experimentally infected volunteers were housed in a room with an air sampler capable of testing 82% of the air in the room, but no rhinovirus was detected [13]. In another air sample study, picornavirus RNA was detected in 32% of air sampling filters from three office buildings, and the frequency of viral detection correlated with the amount of outside ventilation employed [14]. In a natural setting, there was no evidence that recirculation of air during commercial plane flights increased the risk for cold symptoms in passengers [15]. In a study of rhinovirus infection in insurance company employees working in a large room, it was found that rhinoviruses did not circulate well at work [16]. Finally, evaluation of simulated sneezes and coughs of adults with natural rhinovirus colds showed that rhinovirus could be recovered from only 1/13 sneezes and 0/8 coughs [9]; neither of these aerosol-producing behaviors were effective in producing rhinovirus-laden aerosols. A more recent study, using a mask placed closely over the nose and mouth, demonstrated the presence of rhinovirus RNA by PCR analysis after coughing, talking, and breathing, but this may have been due to close contact with the mask and not necessarily due to aerosolization [17].

In a study of another common cold virus, respiratory syncytial virus (RSV), transmission *via* close contact with large droplets or self-inoculation after touching contaminated surfaces has been demonstrated. In this study, volunteers were assigned to be "cuddlers" and care for infants with RSV, "touchers" who touched surfaces in the infant's room while the infant was out of the room, and sitters who sat in the room with an infected infant. When surfaces in the environment were tested, RSV could be recovered from an average of 2.4 surfaces tested per room. Nine volunteers became infected, 5 cuddlers and 4 touchers; none of the sitters became infected. This provides evidence that RSV can be transmitted by self-inoculation (touchers) and not by small particle aerosols (sitters). It is unclear what role large particle aerosol may play in transmission of RSV [18].

Other factors may also influence the survival and transmissibility of cold viruses, including climate and human behavior. Cold viruses in temperate climates move through the community in a predictable and orderly fashion. It begins with an increase in rhinovirus in September after the children return to school. Late October and November herald the onset of parainfluenza, followed by RSV and coronaviruses in the winter months. Influenza peaks in late winter, and rhinovirus has a secondary peak thereafter, while adenovirus remains constant throughout. Because these cold viruses occur in the community at different times, environmental conditions and population characteristics (school attendance, crowding indoors) may affect the survival of these viruses in the environment and their subsequent transmission [19]. In summary, rhinovirus is commonly present on the hands of infected individuals and on the objects that they use in daily activities and can be readily transferred from hands and objects to the hands of susceptible hosts, thus providing a readily available method of rhinovirus transfer from one person to another. Rhinovirus may be present in aerosols, but the frequency of expulsion of viable virus into the air with coughs and sneezes is not clear. Likewise, RSV may be present on surfaces and transmit infection to susceptible individuals following deliberate self-inoculation, but not *via* small particle aerosol. Other factors, such as human behavior and climate, may also play a role in cold virus survival and transmission.

Virus deposited in the environment must reach the portal of entry (Tab. 3)

For infection to occur, rhinovirus must be deposited on the nasal epithelium. This may occur by inoculation of the conjunctiva followed by transfer *via* the nasolacrimal duct or direct inoculation of the nose [3]. Oral inoculation through prolonged kissing [20] or direct inoculation under experimental conditions transmitted infection infrequently [9, 10]. Rhinovirus on hands (fingertips) of a susceptible individual can be transferred to his/her own nose or eyes *via* self-inoculation. Humans are known to frequently touch their own eyes and nose [9], making transfer of rhinovirus from an individual's hands to his/her own eyes and nose a likely possibility, while oral inoculation is not sufficient.

Studies have demonstrated that rhinovirus deposited on the hands can successfully transmit infection. In one study, rhinovirus dried on the fingers was self-inoculated by volunteers onto their own nasal or conjunctival mucosa, resulting in infection in 36% (4/11) of volunteers [9]. In another study, 73% (11/15) of volunteers who had brief, 15-second hand-to-hand contact with the contaminated hands of infected donors followed by touching their own eyes and nose became infected [7]. Finally, in a study of hand-to-hand contact between volunteers and infected donors, 60% (6/10) of the recipient volunteers became infected after touching their own eyes and

Table 3. Virus deposited in the environment must reach the portal of entry

- Oral inoculation through prolonged kissing [20] or direct inoculation transmitted infection infrequently [9, 10]
- Humans frequently touch their eyes and nose [9]
- Rhinovirus dried on the fingers which are then placed in the eyes or nose results in infection in 36% of volunteers [9]
- In volunteers who had brief hand-to-hand contact with contaminated hands and then touched their own eyes and nose, 73% became infected [7]
- Hand-to-hand contact between volunteers and infected donors resulted in infection in 60% of volunteers after they touched their own eyes and nose [11]
- Handling coffee cup handles contaminated with rhinovirus transmitted infection to 50% of recipients; handling plastic tiles contaminated with rhinovirus transmitted infection to 56% of recipients [21]
- None of the volunteers playing poker with objects used by rhinovirus-infected volunteers became infected [22]

nose [11]. These experimental studies provide evidence for the feasibility of hand-to-hand with self-inoculation transmission of rhinovirus.

Other studies have evaluated whether rhinovirus deposited on surfaces can effectively transmit infection. In one study, handling coffee cup handles contaminated with rhinovirus by infected donors followed by self-inoculation resulted in infection of 50% (5/10) of recipients; handling plastic tiles contaminated with rhinovirus transmitted infection to 56% (9/16) of recipients [21]. In contrast, volunteers who played poker with the chips and other objects previously used by individuals infected with rhinovirus did not become infected [22]. It is unclear why infection did not occur in this situation in the same way that it did in the experiment with the tiles and the coffee cups. Because transfer to fingertips is more efficient if the objects or surfaces are touched and handled soon after rhinovirus deposit, hand-to-surface-to-hand transmission may not be as efficient a method of transfer as hand-to-hand transfer.

In summary, in experimental settings rhinovirus is frequently deposited in the environment (on hands or on objects used by infected individuals) and can be transferred to susceptible hosts with resultant infection following deliberate self-inoculation. Transfer appears to be more efficient if the objects have been recently contaminated. Rhinovirus is not transmitted from person to person *via* oral inoculation.

Interruption of the proposed route of transmission must reduce the incidence of infection (Tab. 4)

To establish that transmission of rhinovirus has occurred *via* any particular route, one must be able to demonstrate that disruption of the route can reduce the incidence of infection. In one study in which the hand self-inoculation route was interrupted, volunteers wearing gloves were exposed to infected individuals across a small table while the infected individuals sang, coughed, sneezed, and talked loudly (large and/or small particle aerosol exposure); infection occurred in 8% of the volunteers [23]. Separation of susceptible volunteers from infected individuals across a greater distance while being housed together for 3 days across a double-wire mesh (small particle aerosol exposure) resulted in no infections [23]. These results suggest that small particle aerosol transmission is an infrequent method of rhinovirus transmission.

In different experiments using the poker transmission model, Dick et al. [22] devised methods to interrupt hand self-inoculation transmission using restraints to allow comparison of rates of transmission *via* aerosol alone or by any route. In this study, volunteers wore collar restraints designed to interrupt transmission *via* self-inoculation because the collar prevented them from touching their eyes or nose. They were exposed to infected individuals while playing poker. Five of six restrained players were infected, compared

Table 4. Interruption of the proposed route of transmission must reduce the incidence of infection

- Only 8% of uninfected volunteers became infected after exposure across a small table to rhinovirus-infected individuals who were singing, coughing, sneezing, and talking loudly; when separated by a greater distance, none became infected [23]
- In volunteers playing poker with rhinovirus infected individuals, 67% of those volunteers with restraints to prevent self-touching of the eyes and nose became infected, compared to 56% of unrestrained volunteers [22]
- In volunteers whose hands were pretreated with iodine who had hand-to-hand contact with the contaminated hands of rhinovirus-infected donors and who then touched their own eyes and nose, 60% of the untreated volunteers became infected while only 10% of the iodine treated volunteers became infected; furthermore, rhinovirus could be recovered from the hands of only 11% of the iodine-treated group, compared with 40% of the untreated group [11]
- Rhinovirus suspended in cell culture media passed through commercial tissues 26/27 times, but passed through only 1/18 times when the tissues were treated with a combination of malic acid, citric acid, and lauryl sulfate [24]
- 83% of those who blew their nose without a tissue had rhinovirus recovered from their hands, compared with 42% of those using commercial tissues, and only 3% of those using treated tissues (malic acid, citric acid, and lauryl sulfate) [25]
- Rhinovirus was transferred to fingertips of recipients after brief contact with donor fingers which were contaminated with virus from 95% of donors who used no tissue to blow their nose, from 27% of those who used commercial tissues and from 0% of those who used treated tissues; likewise, 50% of the recipients in the no-tissue group became infected after touching their own eyes and nose, compared with 13% of those in the commercial tissue group and 0% of those in the treated tissue group [25]

to 6/6 control volunteers who were unrestrained [22]. They then placed arm-braces on volunteers as another method of interrupting transmission *via* self-inoculation and found that only 1/6 of the restrained volunteers became infected, compared with 5/6 of the unrestrained volunteers. In a second group of arm-braced volunteers, they found that 4/6 of the restrained volunteers became infected, compared with 1/6 of the unrestrained volunteers. Taken all together, 67% (12/18) of the unrestrained players became infected, as compared with 56% (10/18) of the restrained players, suggesting that infection can occur *via* aerosol transmission [22].

In order to examine transmission *via* self-inoculation, practical interruption strategies to block the self-inoculation process were examined. A study using iodine was carried out to assess transmission by self-inoculation [7]. In this study, donors contaminated their hands and then had hand contact with susceptible volunteers who wore masks. The susceptible volunteers were divided into two groups; the hands in the treatment group were treated with iodine, while the control group received no hand treatment. Both groups then tried to self-inoculate their own eyes and nose. In the no treatment group, 60% (6/10) of the susceptible volunteers became infected; only 10% (1/10) in the iodine-treated group became infected [7]. Additionally, rhinovirus was recovered from 10/25 (40%) of the hand rinses from the control group and from only 3/27 (11%) of hand rinses from the iodine-treated group. In this experimental model, the interruption of the self-inoculation method of transfer clearly resulted in a decreased incidence of infection, consistent with the effectiveness of this method of transmission for rhinovirus.

In other studies, infected donor volunteers have used antiviral tissues in the attempt to interrupt transmission. In one study, rhinovirus suspended in cell culture medium passed through commercial tissues 26/27 times, but virus passed through only 1/18 times when the tissues contained a combination of malic acid, citric acid, and lauryl sulfate [24]. In another study, use of these treated tissues by experimentally infected adults reduced viral contamination of the fingers; 83% of those who blew their nose without a tissue had rhinovirus recovered from their fingers, as compared to 42% of those using commercial tissues and only 3% of those using the treated tissues [25]. Transmission of rhinovirus after brief finger-to-finger contact, when the donor fingers were contaminated with virus, demonstrated viral transfer from 95% of those who used no tissues, 27% from those who used commercial tissues, and 0% from those who used the treated tissues. Finally, recipients rubbed their fingers into their own eyes and noses; 50% of the recipients in the no-tissue group became infected, as compared to only 13% of recipients in the commercial tissue group and 0% of those in the antiviral tissue group. Taken together, these studies demonstrate that transmission can be interrupted by interrupting hand-to-hand transfer of rhinovirus with use of virucidal tissues by infected subjects. The effectiveness of virucidal tissue use may be limited by improper use and disposal, especially when tissues are used by young children.

Interruption of cold transmission in the home environment (Tab. 5)

Although studies in the experimental setting suggest that hand-to-hand, hand-to-surface-to-hand, and aerosol transmission of rhinovirus may occur, less information is available about cold transmission in the home where rhinovirus and other cold viruses are usually acquired. In the experimental setting, interruption of self-inoculation by treatment of the hands of the recipient with iodine to impair the infectivity of rhinovirus is effective in decreasing both transfer from hand to hand and infection after deliberate self-inoculation [11]. Determining how to interrupt transmission in the home setting is a more difficult proposition. In the best evaluation to date [7], careful definitions of exposure, respiratory infection, and secondary infection were employed to evaluate transmission in the home. Application of 2% aqueous iodine to the fingertips of mothers was tested as a means of interrupting transmission to reduce secondary infection in the mothers in the home. Mothers were instructed to apply 2% aqueous iodine or brown

Table 5. Cold transmission in the home/school

- No decrease in absenteeism due to respiratory illness in the classrooms using alcohol-based hand sanitizers and quaternary ammonium wipes compared with classrooms utilizing normal cleaning practices [27]
- No decrease in the incidence of secondary respiratory illness in families using alcohol-based hand sanitizers [28]
- Use of virucidal tissues in the home reduced secondary transmission in the home by 32% compared to placebo tissues [29]
- Use of 2% aqueous iodine applied every 3–4 hours to the fingertips of mothers after the onset of respiratory symptoms in a family member significantly reduced secondary respiratory illness in the home [7]

placebo to their fingertips upon awakening and every 3–4 hours thereafter at the onset of respiratory symptoms in a family member. A respiratory infection was defined as either two respiratory symptoms occurring on the same day or one symptom occurring on two consecutive days. A secondary case (in the mother) was defined as respiratory symptoms beginning at least 2 days and not more than 7 days after onset of respiratory symptoms in the index case. The study was conducted in the fall over 4 years; in the iodine-treated mothers, 6–8% of exposures resulted in secondary illness, compared with 15–26% in the control group. When the results from all 4 years were combined, only 4/58 (7%) of exposures in the iodine-treated group resulted in infection, compared with 16/79 (20%) in the control group [7]. When the results were adjusted for maternal immunity to rhinovirus, only 4/32 (12.5%) of the iodine-treated mothers experienced secondary infection, compared to 16/44 (36%) of the control group. This small study provides convincing evidence that the interruption of self-inoculation can decrease transmission in the home environment. The practical application of this method of interruption of transmission is limited, however, as iodine applied to the hands is drying and stains the hands brown.

Other studies in the natural environment have evaluated the use of alcohol-based hand sanitizers and gels as a method to decrease transmission of the common cold. One study based on a self-report of illness and frequency of hand sanitizer use suggested that use of alcohol-based hand gels may decrease secondary transmission of respiratory infections in families [26]. In a study of school children by the same investigators, classrooms using alcohol-based hand sanitizer and quaternary ammonium wipes to disinfect school surfaces were compared to classrooms using normal hand washing and cleaning procedures. There was a decrease in absenteeism due to gastrointestinal illness in the intervention group, but there was no difference in absenteeism due to respiratory illness [27]. In a third study of the effect of hand sanitizer use in the home [28], the overall rate of secondary respiratory illness did not decrease with hand-sanitizer use. The lack of effect of alcohol-based hand sanitizers on the rate of secondary illness in the home may be due to the fact that alcohol does not impair rhinovirus infectivity, or that aerosol transmission occurs commonly [28]. Under any circumstances, the use of alcohol-based hand gels does not appear to be an effective mechanism for reducing cold transmission in the natural environment.

The use of virucidal tissues as a method to interrupt cold virus transmission in the home environment has shown a modest effect. Use of virucidal tissues reduced secondary transmission in the home by 32% compared to placebo tissues [29]. Unfortunately, the effectiveness of virucidal tissues for interrupting transmission is dependent on proper use and disposal of such tissues by the family member who already is infected, something which young children may not be able to do effectively and routinely.

In summary, the home studies available provide a small but significant body of evidence demonstrating that interrupting the self-inoculation route reduces the transmission of colds in the home. The use of aqueous iodine and of virucidal tissues has been shown to reduce secondary illness when used in the home environment. The use of alcohol-based hand gels did not reduce the rate of secondary respiratory illness in the home. Because alcohol does not inactivate rhinovirus (responsible for up to 50% of colds) this result does not disprove self-inoculation as the predominant method of transmission; aerosol transmission provides an alternative explanation. Interruption of aerosol transmission has not been attempted either in experimental settings or in the home environment.

Conclusion

From the currently available evidence analyzed within a framework [7] for establishing viral transmission, in the experimental setting rhinovirus can be transmitted from person to person through self-inoculation after contact with the contaminated hands of others or with contaminated objects. Interruption studies in the home environment utilizing iodine and virucidal tissues have demonstrated a decrease in secondary transmission consistent with self-inoculation as a method of cold virus transmission in the home. Interruption of transmission *via* aerosols has not been studied. Prevention of secondary transmission may be the most effective means of reducing the misery of the common cold. It seems likely that effective and practical methods of interruption of transmission of colds in the home can be developed.

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