



ELSEVIER

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major article

Face touching: A frequent habit that has implications for hand hygiene



Yen Lee Angela Kwok MBBS, MPH, MHM, PhD, Jan Gralton BSc (Hons), PhD, Mary-Louise McLaws DipTropPubHlth, MPHlth, PhD*

School of Public Health and Community Medicine, UNSW Medicine, UNSW Australia, Sydney, NSW, Australia

Key Words:

Face touching
Self-inoculation
Medical students
Hand hygiene compliance

Background: There is limited literature on the frequency of face-touching behavior as a potential vector for the self-inoculation and transmission of *Staphylococcus aureus* and other common respiratory infections.

Methods: A behavioral observation study was undertaken involving medical students at the University of New South Wales. Their face-touching behavior was observed via videotape recording. Using standardized scoring sheets, the frequency of hand-to-face contacts with mucosal or nonmucosal areas was tallied and analyzed.

Results: On average, each of the 26 observed students touched their face 23 times per hour. Of all face touches, 44% (1,024/2,346) involved contact with a mucous membrane, whereas 56% (1,322/2,346) of contacts involved nonmucosal areas. Of mucous membrane touches observed, 36% (372) involved the mouth, 31% (318) involved the nose, 27% (273) involved the eyes, and 6% (61) were a combination of these regions.

Conclusion: Increasing medical students' awareness of their habituated face-touching behavior and improving their understanding of self-inoculation as a route of transmission may help to improve hand hygiene compliance. Hand hygiene programs aiming to improve compliance with before and after patient contact should include a message that mouth and nose touching is a common practice. Hand hygiene is therefore an essential and inexpensive preventive method to break the colonization and transmission cycle associated with self-inoculation.

Crown Copyright © 2015 Published by Elsevier Inc. on behalf of the Association for Professionals in Infection Control and Epidemiology, Inc. All rights reserved.

Infections may be transmitted by self-inoculation. Self-inoculation is a type of contact transmission where a person's contaminated hands makes subsequent contact with other body sites on oneself and introduces contaminated material to those sites.^{1,2} Although the literature on the mechanisms of self-inoculation of common respiratory infections (eg, influenza, coronavirus) is limited,^{3–5} contaminated hands have been reported as having potential to disseminate respiratory infections.⁶ *Staphylococcus aureus* is carried in the nasal mucosa in approximately 25% of the community^{7,8} and, may be self-inoculated, via face touching, by individuals who are frequently exposed to potential carriers in both the community and health care settings.^{9,10}

During the influenza A (H1N1) pandemic, face-touching behavior in the community was commonly observed with individuals touching their faces on average 3.3 times per hour.¹¹ In the health care setting, frequent face touching, particularly during periods of seasonal endemicity or outbreak, has the theoretical potential to be a mechanism of acquisition and transmission.¹ However, quantifying the role of face touching in the spread of respiratory infections or *S aureus* colonization is difficult for several reasons. First, such a study would require enrollment, screening, and prospective follow-up of a large population to identify a significant causal link. Second, the study would need to observe transmission occurring in community settings, rather than in isolation or under laboratory conditions, which would be ethically challenging. Finally, there are likely to be confounding factors, such as virulence of pathogens, varying susceptibility of the study population, and effects of modes of transmission other than hand to face contamination, that cannot easily be controlled.

A self-inoculation event may occur if a health care worker (HCW) fails to comply with hand hygiene after patient contact

* Address correspondence to Mary-Louise McLaws, Level 3, School of Public Health and Community Medicine, UNSW Medicine, UNSW Australia, Sydney, NSW 2052, Australia.

E-mail address: m.mclaws@unsw.edu.au (M.-L. McLaws).

Conflicts of interest: An unfunded project and the authors declared have no conflict of interest.

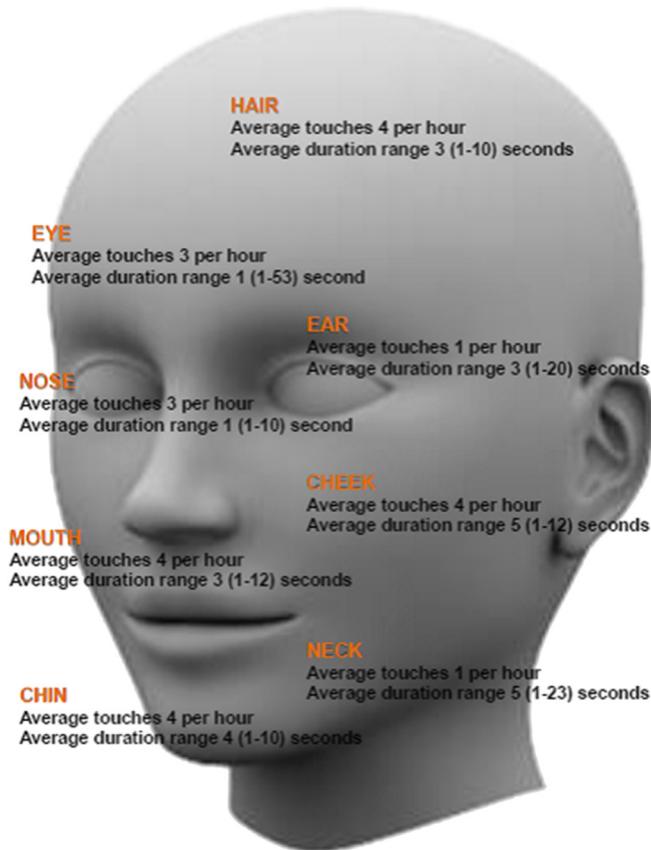


Fig 1. Average number of face touches observed in a 60-minute period.

(moment 4)¹² or after contact with the contaminated environment of the patient's zone (moment 5) (Fig 1) and makes subsequent physical contact with susceptible sites on their own bodies. To better understand the dynamic between face touching and the implications for hand hygiene among clinicians, we explored the prevalence of face-touching behavior in medical students.

METHODS

In May 2010, a behavioral observation study was undertaken involving phase 3 medical students at the University of New South Wales (UNSW). Ethical approval was obtained from the UNSW Human Research Ethics Committee prior to the commencement of the study. The student cohort had completed a one 4-hour infection control course in the previous 12 months. The infection control course included education on hand hygiene, aseptic technique, standard precautions, and transmission-based precautions. The same student cohort attended two 2-hour lectures unrelated to infection control, on 2 separate occasions. One week before the 2-hour lecture commenced, students were informed that a behavioral observation study was being conducted during the lecture and required the students to be videotaped while they listened to the lecture. Students were not informed about which behaviors were under observation to blind them from the aims of the study; this was necessary to minimize the potential for a change in behavior as a result of being observed.¹³ To participate in the study, students were instructed to move to a marked area on the left side of the lecture theatre and complete a participant consent form. To opt out of the study, students were instructed to move to the right side of the lecture theatre outside of the videotape recording range. Students

were also informed that they could withdraw from the study once recording commenced by simply moving to the other side of the theatre. All participants consented prior to videotape recording.

A digital videotape recording was made of the consenting participants and was viewed by investigators to record the face-touching behavior of every participant. For the purposes of precision, the digital recording was viewed multiple times after the lectures had taken place by 1 researcher (Y.L.A.K.). A standardized scoring sheet was used to tally the frequency of hand-to-face contacts, the area of the face that was touched, whether a mucosal area (eyes, nose, mouth) or nonmucosal area (ears, cheeks, chin, forehead, hair) was touched, and the time in seconds of each contact. Descriptive statistics were performed to determine the frequency and duration of touches per hour using SPSS version 21 for Windows (SPSS Inc, Chicago, IL).

RESULTS

A total of 26 students were observed making 2,346 touches to the face over 240 minutes. Of the face touches, 56% (1,322/2,346) involved nonmucosal regions, whereas 44% (1,024/2,346) involved contact with mucosal membranes. Of the 1,322 nonmucosal membrane touches, most involved the chin (31%; 409/1,322), followed by the cheek (29%; 383/1,322), hair (28%; 369/1,322), neck (8%; 104/1,322), and ear (4%; 57/1,322). Of the 1,024 touches involving a mucosal membrane region, 36% (372/1,024) involved the mouth, 31% (318/1,024) involved the nose, 27% (273/1,024) involved the eyes, and 6% (61/1,024) involved a combination of the mucosal membranes.

During an average hour participants touched their face 23 times (median, 29.0 times; LQ (lower quartile), 42.2; UQ, 108.2; range, 4-153). The average duration of mouth touching was 2 seconds (median, 1 second; LQ, 3.0; UQ (upper quartile), 24.0; range, 1-12 seconds), the average nose touching duration was 1 second (median, <1 second; LQ, 0.09; UQ, 1.2; range, 1-10 seconds), and the average eye touching duration was 1 second (median, <1 second; LQ, 3.0; UQ, 11.5; range, 1-5 seconds).

DISCUSSION

Hands are considered a common vector for the transmission of health care-associated infections^{7,14,15} and have been implicated in the transmission of respiratory infections.^{11,14} Good hand hygiene before and after patient contact is imperative to prevent transmission of infection. This is particularly so during the symptomatic or asymptomatic prodromal stages of infections when patients shed infectious material.¹⁶ In particular, clinicians caring for infectious pediatric patients with high shedding concentrations^{17,18} may be at risk of acquiring an infection if they have a high level of face-touching behavior.¹⁹

S aureus is a common pathogen prevalent in both community and health care settings. Colonization of the nasal mucous membranes with *S aureus* is common and ranges from 20%-30% in health care and community settings.⁷ Nose touching was common among our participants. This finding supports the importance of hand hygiene as a means of preventing occupationally acquired colonization with *S aureus* from patients or the contaminated environment.^{8,10,20,21} *S aureus* can survive for up to 5 years on hard surfaces, and no obvious role has yet been attributed to colonized staff.⁷ When mixed with hospital dust, *S aureus* can still survive for >1 year until it is picked up from the environment.^{22,23} Contaminated hands may act as a vector, transmitting the bacteria from a contaminated surface to the HCW's nasopharynx via face touching. High hand hygiene compliance before and after patient contact should reduce the likelihood of transferring pathogens through

self-inoculation and in turn prevent inoculation of patients.^{10,24,25} Pathogens found on stethoscopes have also been recovered from physician's hands.²⁶ Given the habitual face-touching behavior observed in our study, it is possible that the inoculation of stethoscopes and other contaminated medical equipment may have been the result of inoculation from nose touching to hands and subsequently to the stethoscope. Given the frequency of face-touching behavior observed in this study, clinicians must practice hand hygiene before and after using such equipment to ensure that patient equipment is kept clean prior to use.

Given the high frequency of mouth and nose touching observed, 4 times per hour on average for mouth touching and 3 times per hour on average for nose touching, performing hand hygiene is an essential and inexpensive preventive method for breaking the colonization and transmission cycle. Models of infection transmission and comparison of transmission efficiency of self-inoculation against other transmission routes are required to further expand our knowledge on the role of face touching for self-inoculation. Meanwhile, raising awareness that face-touching behavior is common and is a possible vector in self-inoculation could result in HCWs accepting the message that hand hygiene before and after patient contact is an effective method of reducing colonization and infection transmission for themselves and their patients.

Acknowledgments

We thank Professor Gary Velan for providing us access to the UNSW medical students prior to his lecture and to Professor William Rawlinson for providing recording equipment.

References

- Nicas M, Best D. A study quantifying the hand-to-face contact rate and its potential application to predicting respiratory tract infection. *J Occup Environ Hygiene* 2008;5:347–52.
- Di Giuseppe G, Abbate R, Albano L, Marienelli P, Angelillo I. A survey of knowledge, attitudes and practices towards avian influenza in an adult population of Italy. *BMC Infect Dis* 2008;8:36.
- Winther B, McCue K, Ashe K, Rubino J, Hendley J. Environmental contamination with rhinovirus and transfer to fingers of healthy individuals by daily life activity. *J Med Virol* 2007;79:1606–10.
- Gwaltney J, Hendley J. Transmission of experimental rhinovirus infection by contaminated surfaces. *Am J Epidemiol* 1982;116:828–33.
- Gu J, Zhong Y, Hao Y, Zhou D, Tsui H, Hao C, et al. Preventive behaviors and mental distress in response to H1N1 among University students in Guangzhou China. *Asia Pac J Public Health* 2012;4:1–13.
- American Society for Microbiology. American Society for Microbiology Survey reveals that as many as 30 percent of travelers don't wash hands after using public restrooms at airports (September 2003). Available from: <http://www.asm.org/index.php/asm-press-releases/press-releases-archive/92-newsroom/press-releases/1807-american-society-for-microbiology-survey-reveals-that-as-many-as-30-percent-of-travelers-don-t-wash-hands-after-using-public-rest-rooms-at-airports>. Accessed March 1, 2014.
- Wertheim H, Melles D, Vos M, Van Leeuwen W, Van Belkum A, Verbrugh H, et al. The role of nasal carriage in *Staphylococcus aureus* infections. *Lancet Infect Dis* 2005;5:751–62.
- Munckhof W, Nimmo G, Schooneveldt J, Schlebusch S, Stephens AJ, Williams G, et al. Nasal carriage of *Staphylococcus aureus* including community-associated methicillin-resistant strains, in Queensland adults. *Clin Microbiol Infect* 2009;15:149–55.
- Dancer S. Importance of the environment in methicillin-resistant *Staphylococcus aureus* acquisition: the case of a hospital cleaning. *Lancet Infect Dis* 2008;8:101–3.
- Rongpharpi S, Hazarika N, Kalita H. The prevalence of nasal carriage of *Staphylococcus aureus* among healthcare workers at a tertiary care hospital in Assam with special reference to MRSA. *J Clin Diagn Res* 2013;7:257–60.
- Macias A, Torre A, Moreno-Espinosa S, Leal P, Bourlon M, Palacios G. Controlling the novel A (H1N1) influenza virus: don't touch your face! *J Hosp Infect* 2009;73:280–91.
- Sax H, Allegranzi B, Uckay I, Larson E, Boyce J, Pittet D. 'My five moments for hand hygiene': a user-centered design approach to understand, train, monitor and report hand hygiene. *J Hosp Infect* 2007;67:9–21.
- Last J. A dictionary of epidemiology. 2nd ed. New York (NY): Oxford University Press. Accessed February 2, 2014. <http://www.ebooks.com/537605/dictionary-of-epidemiology/porta-miquel/>; 2008.
- Pittet D, Allegranzi B, Sax H, Dharan S, Pessoa-Silva C, Donaldson L, et al. Evidence-based model for hand transmission during patient care and the role of improved particles. *Lancet Infect Dis* 2006;6:641–52.
- Gebreyesus A, Gebre-Selassie S, Mihert A. Nasal and hand carriage rate of methicillin resistant *Staphylococcus aureus* (MRSA) among healthcare workers in Mekelle hospital, North Ethiopia. *Ethiop Med J* 2013;51:41–7.
- Centers for Disease Control and Prevention. Clinical signs and symptoms of influenza: influenza prevention & control recommendations. Available from: www.cdc.gov/flu/professionals/acip/clinical.htm. Accessed March 1, 2014.
- Petola V, Waris M, Osterback R, Susi P, Ruuskanen O, Hyypää T. Rhinovirus transmission within families with children: incidence of symptomatic and asymptomatic infections. *J Infect Dis* 2008;19:382–9.
- Petola V, Waris M, Osterback R, Susi P, Hyypää T, Ruuskanen O. Clinical effects of rhinovirus infections. *J Clin Virol* 2008;43:411–4.
- Thomas Y, Boquete-Suter P, Koch D, Pittet D, Kaiser L. Survival of influenza virus on human fingers. *Clin Microbiol Infect* 2014;20:58–64.
- Rohde R, Denham R, Brannon A. Methicillin resistant *Staphylococcus aureus*: carriage rates and characterization of students in a Texas University. *Clin Lab Sci* 2009;22:176–84.
- Monto A. Studies of the community and family: acute respiratory illness and infection. *Epidemiol Rev* 1994;16:351–73.
- Crossley K, Archer G. The staphylococci in human disease. 1st ed. New York (NY): Churchill Livingstone; 1997.
- French G, Otter J, Shannon K, Adams N, Watling D, Parks M. Tackling contamination of the hospital environment by methicillin-resistant *Staphylococcus aureus* (MRSA): a comparison between conventional terminal cleaning and hydrogen peroxide vapor decontamination. *J Hosp Infect* 2004;57:31–7.
- Garbutt C, Simmons G, Patrick D, Miller T. The public hand hygiene practices of New Zealanders: a national survey. *N Z Med J* 2007;120:U2810.
- Elder NC, Sawyer W, Pallerla H, Khaja S, Blacker M. Hand hygiene and face touching in family medicine offices: a Cincinnati Area Research and Improvement Group (CARInG) network study. *J Am Board Fam Med* 2014;27:339–46.
- Longtin Y, Schneider A, Tschopp C, Renzi G, Gayet-Ageron A, Schrenzel J, et al. Contamination of stethoscopes and physicians' hands after a physical examination. *Mayo Clin Proc* 2014;89:291–9.