Whitepaper 2022

Promoting hand hygiene with behavioral change

How to successfully create a sustained behavior

Executive summary

In this whitepaper three scientists present a strategic model to change hand hygiene behavior. The model includes the components of system change, education, reminders and feedback to result in cultural change. This model can be relevant regardless of it being implemented in, for example, hospitals, food processing, kindergartens or at home.

Topics discussed: How can large groups of people be motivated to perform hand hygiene? We take a close look at the model, where each of the steps of the model are described including evidence-based studies on changing hand hygiene behavior, and how to perform hand hygiene. As part of the description, we provide a mini training on correct hand hygiene methods.

Introduction

Our hands are fantastic! They are one of the primary means through which we experience connection to the world and to other humans. When we interact with people and objects with our hands, we not only experience the sensation of touch, but we also transfer substances (oils, dirt, perfumes, microorganisms) between the two touching surfaces. Usually this exchange is not problematic, and sometimes beneficial—consider the scent of a loved one lingering on your skin for a short while. However, transfer of microorganisms between hands and hands, or hands and surfaces, is one of the mechanisms through which diseases can be transmitted.

Although we all know that hand hygiene can help to keep us healthy, many of us need help to know how and when to appropriately clean our hands. It is also common that knowledge alone is not enough: we know that we should be diligent about hand hygiene, but in practice we do it less often or less carefully than we should.

A behavioral modification model can help overcome these difficulties. By working with the components of system change, training, reminding and feedback individuals or organizations can drive cultural change to create a sustained new normal where correct hand hygiene is performed a higher percentage of the time.

This paper will discuss each aspect of the behavioral change cycle as it applies to hand hygiene. It will include evidence-based information on the need for correct hand hygiene behavior, educational material that is relevant to hand hygiene training, thoughts about how to drive behavioral change through reminders and feedback, as well as evidence that this cycle can create cultural change.

Societal need

Hand hygiene in the community

Many different stakeholders have an interest in helping groups of people to perform correct hand hygiene at appropriate times. Normally you do not get ill when you have bacteria or viruses on the skin of your hands. But it is more common than you might think that you put fingers in your mouth, eyes, or nose and at that point the pathogens, the microbes that can cause disease, might infect you. You may also transfer the pathogens to food you eat or other people. Therefore, properly timed hand hygiene can help break a chain of infection.

There is strong evidence that good hand hygiene can reduce illness in settings with high incidence of infection, such as child-care centers, dormitories etc.

Hand washing promotion reduces diarrhea episodes in both child-care centers in high-income countries and among communities living in low and middle-income countries by about 30%. The included trials do not provide evidence about the long-term impact of the interventions.[1]

It is more difficult to show the effectiveness of hand hygiene amongst adults in prosperous communities, in part because adults are less often ill which makes gathering statistically sound data much more prohibitive. Nevertheless, healthcare authorities universally recommend good hand hygiene as one of the important tools for controlling the spread of disease. For example, one expert states:

The effectiveness of hand hygiene against influenza virus infection and transmission in the community setting is difficult to determine based on the available evidence. In light of its proven effectiveness in other settings, there is no compelling evidence to stop using good hand hygiene practice to reduce the risk of influenza infection and transmission in the community settings.[2]

Hand hygiene in healthcare settings

Patient safety is a priority of any healthcare system, and one of the most effective measures is hand hygiene. For this, it is important that healthcare workers have correct adherence and perform the technique properly. Otherwise, the incidence of nosocomial infections can increase, with consequent complications.[3]

Hand hygiene is, despite its simplicity, still poorly practiced in many healthcare facilities around the world. Adherence with hand hygiene best practices has an average of 59.6% in intensive care units up to 2018, and there are significant differences between high-income and low-income countries (64.5% vs 9.1%). Studies systematically reviewing different periods, found average adherence to be around 40%.[4]

A balanced view on hygiene

Hand hygiene is very important – but at the same time it is important to have a sound and balanced view on hygiene. The human skin, covering our whole body, contains microorganisms that are persistent. They are living on our skin and recent research has shown more and more benefits with these microbes. We need them to stay healthy. The many good bacteria help the skin to stay healthy and protect us from the unwanted that can cause skin irritation and infections.

The composition of microbes on skin is called the skin microflora or the microbiota. These are the same thing, which are a population of hundreds of different species. We know some about the bacteria but there are also viruses and other microbes in this composition, and we know less about them. Normally we do not want or need to bother at all about these microorganisms but for example when preparing food, we do not want to transfer too many microorganisms since they also spoil food, and the surgeon does not want to bring any microorganisms into the wound when he/she is operating.

Some people are very afraid of all bacteria. This is not rational but understandable. We know what pathogens can cause but it is very important not to be paranoic. To wash hands too much with harsh products is not healthy and can destroy the skin and the healthy microflora. Hands with wounds will harbor more unwanted bacteria compared to hands with healthy skin in balance.[6]

Therefore, the total number of handwashes during the day is not the most important measure of hand hygiene quality. Rather, the focus should be on performing hand hygiene at the times when it is needed to help prevent transmission or infection.

It is important to keep the skin on hands healthy, including the beneficial skin microflora. Soaps should be mild and hand sanitizers as gentle as possible. If the skin is cracked or irritated, studies have shown more bacteria on these hands including more pathogens.[6] Therefore, it is recommendable, despite a choice of mild soap and thoroughly hand drying, to use skin lotion to smooth, moisturize and prevent skin irritation.

Why a behavior change model is needed

As far as known, simply telling a population that hand hygiene is important will not be sufficient to cause a change in hand hygiene behavior. **Significant behavior changes can only be produced by a deliberate program combining several of the elements of improving the pre-requisites for performing hand hygiene, education on the need for hand hygiene, and reminders and feedback on quality of hand hygiene. The most successful models combine all of these elements as exemplified in the World Health Organization's (WHO) program for multimodal compliance improvement strategies**.[5] In the most ideal cases, the strategy will result in cultural changes and increases in intrinsic motivation to perform hand hygiene. In most cases, however, a one-time program will not result in lasting change. Continuing effort will be required to maintain initial gains and to stabilize the hygiene culture.

The changes in hand hygiene behavior of the general public during the early months of the COVID-19 pandemic show the change stages in action:

1. **Pre-requisites:** Access to hand hygiene materials such as soap, water and paper towels or hand sanitizer are necessary to perform hand hygiene. During the initial opening-up stages of the pandemic, we saw an unprecedented installation of hand sanitizing stations in shops and public places.

2. **Education:** At the beginning of the pandemic, many adults had not received any new information on hand hygiene since early childhood. In response to the public health emergency, many health authorities, providers and suppliers produced high quality information on when, why and how to clean hands.

3. **Remind and communicate:** A new habit takes time to form and should be reinforced during the early stages. Most public places used blanket signage to remind employees and visitors to take infection control precautions including handwashing. Many also placed posters demonstrating correct handwashing technique in restrooms.

4. **Feedback:** To internalize a new behavior, it is useful to receive feedback on how well and how often the behavior is performed over time (compare the use of a fitness watch to increase exercise behavior). This is often the most difficult component of the model to implement well. We speculate that most individual feedback during COVID-19 was provided in closed groups of people.

5. **Cultural change:** Ideally, over the course of time, a new behavior will stop being externally driven by outside forces and become either part of the culture of a group and/or intrinsically motivated within the individual. The desire to avoid infection with SARS-CoV-2 was of course an unusually strong motivating force. We saw large improvements in self-reported hand hygiene frequency which were sustained over a long time period after the initial information campaigns.

Pre-requisites

The pre-requisites are rather self-explanatory. System change means having the right infrastructure, equipment and resources available to perform hand hygiene.

- **Make hand hygiene easier**
- **Restrooms should be clean, easily accessible, and well-stocked**
- **Supplement restrooms with handwashing stations if needed**
- **Provide hand sanitizer in areas where water is not readily accessible**
- **Hand sanitizer dispensers can also nudge hygiene behavior in situations where hygiene is desirable, but when a trip to the restroom is unlikely, like at reception desks or airport boarding gates**
- **Easy, efficient, and hygienic drying must be available. Dry hands transfer fewer bacteria**

Train and educate

The following section includes examples of the type of content hand hygiene training might include. It covers the areas of why, when and how to clean hands which is a prerequisite for a successful program. The training should focus on helping people to perform hand hygiene correctly and at appropriate times. It may also be helpful to understand some basics of how hand hygiene affects disease transmission.

This type of content is primarily aimed at members of the general public. Healthcare professionals will be expected to have a higher level of baseline knowledge, and to follow clinical protocols which will not be discussed here.

Why to wash hands

Washing your hands properly with soap and water can help prevent the spread of the germs (like bacteria and viruses) that cause infectious diseases. Many people believe that the goal of handwashing should be to remove all bacteria from the hands. This is something of a misconception. There are two types of bacteria found on the hands: normal flora which live on the skin and transient flora which are acquired by touching other surfaces and which are carried on the hands for brief periods. In most circumstances, it is this transient flora which is responsible for causing infection. In contrast, normal skin flora is important for your health.

When you wash your hands with soap and water followed by drying with a paper towel, you will physically remove bacteria and dirt from your hands. Washing and drying will remove most of the transient flora. Normal skin flora is relatively unaffected by handwashing with non-medicated soap. An ordinary handwash is fully sufficient to help break chains of infection, and handwashing is always a good choice for hand hygiene.

Hand sanitizers work a bit differently. They do not remove anything from the hands. Instead, they kill bacteria on the hands. Sanitizers are a complement to handwashing, especially when access to soap and water is limited. Sanitizers can kill both potential disease-causing bacteria and the healthy skin flora on the hands. Sanitizers need to come in direct contact with germs in undiluted form to work effectively and are therefore appropriate for use on hands that are dry and look clean.

When to wash hands

While there is no clear evidence indicating the best handwashing frequency for disease prevention,[7] more frequent hand hygiene tends to be a good strategy to improve health. For example, Fricke et al. showed that non-pharmaceutical interventions designed to reduce transmission of COVID-19, including handwashing, also reduced influenza.[8]

However, the strategy of washing more often also has drawbacks in terms of time, resource-use and potentially sore skin. Therefore, a more sophisticated strategy is to try to increase handwashing frequency at times when it is likely to interrupt a chain of infection. It is beneficial to interrupt both transmission of microorganisms (person-to-person or person-to-object) and to interrupt transfer of microorganisms from the hands to a part of the body which increases the risk of infection (eyes, nose, mouth, wounds).[9]

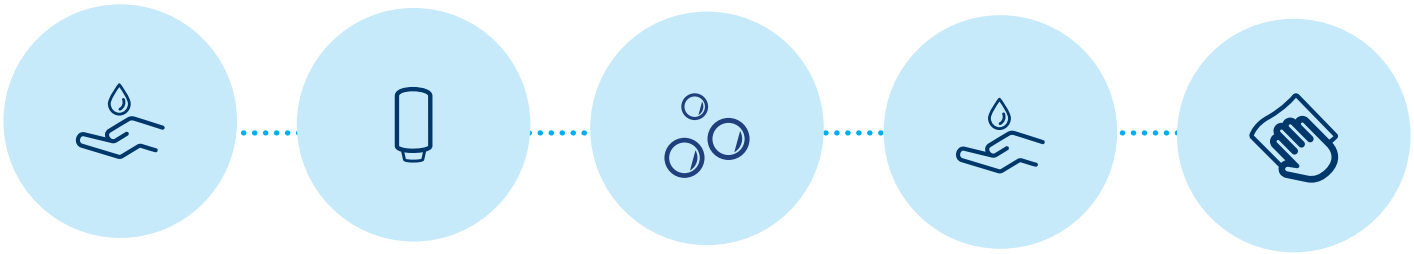
For the general public, some good times to wash hands include:

Interrupting chains of infection

- **When you move from one place to another, especially after being in a crowd**
- **After using the toilet**
- **Before and after contact with a sick person**

Interrupt transfer of microorganisms into the body

- **Before preparing food**
- **Before handling contact lenses**
- **Before treating a cut or sore**



How to perform hand hygiene (including drying)

It makes a difference how you wash your hands. **A complete handwash includes initial rinse, scrubbing with soap for 20-30 seconds, rinsing thoroughly, and not to forget drying with a clean paper towel**.

Every stage of the process is important for achieving a good result

- The initial rinse will remove loose soil and it is easier to spread soap over wet hands than dry.
- Scrubbing carefully with soap will release bacteria compared to only water.[10] How long you wash and how you rub the hands will influence the amount of dirt and bacteria that are removed. WHO recommends a procedure for how to do it right so that every part of the hand is cleaned.[11]
- Rinsing removes dirt and bacteria along with the soap lather. It is important to rinse thoroughly since it is at this stage that bacteria are actually removed from the skin and because soap residues can cause skin irritation.
- Drying removes additional loose debris on the skin which has been loosened by washing. Drying also reduces transfer of bacteria to and from the skin when other surfaces are touched[12] and prevents a humid environment from encouraging the growth and reproduction of bacteria.

Sometimes it will be appropriate to use hand sanitizer instead of handwashing. To sanitize hands correctly, apply a palmful of sanitizer into your cupped hands and rub until dry. To achieve good results, it is important to use enough hand sanitizer to keep hands moist for the entire time listed on the product label. It is also important to rub every surface of the hand. It is common to miss one or more areas of the hands when rubbing.[13] WHO has a recommended procedure which can be followed to ensure that no areas of the hands are missed.[11]

Hand washing versus hand sanitizing?

Washing with soap and water, followed by drying is always an appropriate choice for hand hygiene.

Hand sanitizers are a good complement to handwashing, especially when soap and water are not available, but they should not entirely replace handwashing since they do not remove dirt from the hands. There are special situations particularly in medical settings where hand sanitizers are required. Healthcare workers, for example, need to perform hand hygiene so many times per day that washing would take too much time and be tougher on the skin compared to disinfection with ethanol.

Ethanol based sanitizers are safe, effective, and commonly used. Handwashing or sanitizing with alcohol will reduce the number of bacteria on the hands by similar amounts.[14] Ethanol will kill most bacteria, but it could be less efficient for some types of viruses.[15] However, when you have viruses on your hands, washing with soap, water and drying is a very reliable and efficient procedure.[16]

Feedback and culture change

Hand hygiene improvement campaigns have been conducted with many different target groups including children, military recruits, the general public, food-service workers, etc. Hand hygiene interventions for healthcare workers are the most well-studied, closely followed by interventions with young children.

Evidence shows that interventions based purely on training or other one-time intervention can have a brief positive effect on hand hygiene compliance, but that the improvement is of short duration. Lasting improvement requires ongoing work using multimodal strategies with a goal towards cultural change which allows compliance improvements to become more self-sustaining.

A study demonstrated that a multimodal intervention could increase hand hygiene in nursing homes. Adherence to hand hygiene guidelines increased significantly during the intervention and remained higher 6 months after the intervention but remained suboptimal.[17]

It is difficult to find strong evidence that a specific type of compliance intervention will have a strong effect. Evidence is weak for the efficacy of any specific type of intervention, perhaps because the design of hand hygiene intervention studies varies widely in terms of the interventions tested and the type of follow-up method.

Nevertheless, well-designed intervention programs have succeeded in producing improvements, at least in the short term. A Cochrane review of hand hygiene interventions among healthcare workers in a variety of settings found at least low-quality evidence that multimodal interventions can improve both compliance and reduce colonization or infections.[18]

Another Cochrane review examined hand hygiene education programs in child-care centers (predominantly in high income countries) as well as hospital and community-based settings (in lower income communities). The included studies varied widely in the style of intervention from mostly passive education (posters) to intensive behavior change efforts. Some of the studies in low and middle-income countries also included provision of soap. The evidence for increased handwashing after intervention is weak (this data was also not always collected), but one study did show large increases in frequency—from 3 to 7 times daily. Other studies showed increased handwashing behavior at appropriate times such as before eating. The indirect evidence of behavioral change was much stronger: handwashing interventions were shown to prevent between 25-33% of diarrhea episodes in the study groups.[1]

A second systematic review of community-based hand hygiene interventions found that the timing of an intervention could be critical. The authors concluded "the data suggest that proactive hand hygiene promotion interventions, i.e., regardless of the identification of infected cases, can improve health outcomes upon implementation of such a program, in contrast to reactive interventions in which the program is implemented after (household) index cases are identified".[19]

A recent study evaluating feedback efforts in hand hygiene adherence concluded that "individual feedback was preferable to group feedback".[20]

Studies show that effective prevention of infections is possible also in child-care centers, and this can benefit both the families and the staff. A program including handwashing training for staff, children and parents was implemented. Clear hygiene routines for diaper change and regular cleaning of toys were also part of the program. The result showed that sick leave was significantly reduced.[21]

It seems reasonable to conclude that the success of any given program is dependent on circumstances of a particular institution and exact details of the intervention set up. It is probably the case that successful interventions will use elements of the multimodal strategy for compliance improvement and will need to be tailored to the individual circumstances of the setting.

Conclusions

The importance of proper handwashing in maintaining health and well-being has been known for some time. For an equally long time, it has been a challenge to motivate large groups of people to perform appropriate hand hygiene.

We have shown here that by combining many different strategies, it is possible to improve both hand hygiene and health outcomes.

Authors

Ulrika Husmark, PhD:
Ulrika is a microbiologist who obtained her PhD in 1993. She worked for 10 years at the Swedish Research Institute (RISE) in the areas of hygiene and food microbiology. Over the past 20 years Ulrika has been working with hygiene and microbiology in relation to hygiene and health products at Essity. At present she is a Senior Scientist in Hygiene and Microbiology in the Research Department.

Gudrun Schneider, PhD:
Gudrun studied microbiology with a PhD focus on new antimicrobial compounds isolated from fungi. Because of her interest in antibiotic related topics, she continued her studies in pharmacy and obtained her license as a Pharmacist ("Approbation"). Gudrun has experience working in the field of chronic wound care and is trained as a wound care expert in accordance with the protocols of the Chronic Wound Association in Germany (ICW). In her current role at Essity, she is a Senior Product Safety Specialist where her work focuses on the protection of delicate or breached skin against external contamination.

Carolyn Berland, PhD:
Carolyn received her doctorate in biological physics from MIT and worked briefly as a researcher. She quickly decided that she would be happier working at something that made a more immediate impact – so she moved to industry. Her career at Essity has moved from a pure research function, linked to microbiology, to a more applied R&D position with a main focus on hand hygiene. Today Carolyn is a Global Brand Innovation Manager working on securing the creation of a best-in-class soap and sanitizer offer. The common theme has always been hand hygiene whether it's developing products to make hand hygiene better or in helping to get the hygiene message out to customers and internal stakeholders.

References

1. Ejemot-Nwadiaro RI, Ehiri JE, Arikpo D, Meremikwu MM, Critchley JA. Hand-washing promotion for preventing diarrhoea. Cochrane Database Syst Rev. 2021 Jan 6;12(1):CD004265. doi: 10.1002/14651858.CD004265.pub4. PMID: 33539552; PMCID: PMC8094449.

2. Moncion K, Young K, Tunis M, Rempel S, Stirling R, Zhao L. Effectiveness of hand hygiene practices in preventing influenza virus infection in the community setting: A systematic review. Can Commun Dis Rep. 2019 Jan 3;45(1):12-23. doi: 10.14745/ccdr.v45i01a02. PMID: 31015816; PMCID: PMC6461122.

3. Martos-Cabrera MB, Mota-Romero E, Martos-García R, Gómez-Urquiza JL, Suleiman-Martos N, Albendín-García L, Cañadas-De la Fuente GA. Hand Hygiene Teaching Strategies among Nursing Staff: A Systematic Review. Int J Environ Res Public Health. 2019 Aug 22;16(17):3039. doi: 10.3390/ijerph16173039. PMID: 31443355; PMCID: PMC6747325.

4. [WHO I] Global report on infection prevention and control, World Health Organization, 2022: https://www.who.int/publications/i/item/9789240051164

5. [WHO II] WHO multimodal improvement strategy https://www.who.int/publications/m/item/who-multimodal-improvement-strategy.

6. Rocha LA, Ferreira de Almeida E Borges L, Gontijo Filho PP. Changes in hands microbiota associated with skin damage because of hand hygiene procedures on the health care workers. Am J Infect Control. 2009 Mar;37(2):155-9. doi: 10.1016/j.ajic.2008.04.251. PMID: 19249642.

7. Xun Y, Shi Q, Yang N, Yang N, Li Y, Si W, Shi Q, Wang Z, Liu X, Yu X, Zhou Q, Yang M, Chen Y. Associations of hand washing frequency with the incidence of illness: a systematic review and meta-analysis. Ann Transl Med. 2021 Mar;9(5):395. doi: 10.21037/atm-20-6005. PMID: 33842616; PMCID: PMC8033386.

8. Fricke LM, Glöckner S, Dreier M, Lange B. Impact of non-pharmaceutical interventions targeted at COVID-19 pandemic on influenza burden - a systematic review. J Infect. 2021 Jan;82(1):1-35. doi: 10.1016/j.jinf.2020.11.039. Epub 2020 Dec 3. PMID: 33278399; PMCID:

9. Vardoulakis S, Espinoza Oyarce DA, Donner E. Transmission of COVID-19 and other infectious diseases in public washrooms: A systematic review. Sci Total Environ. 2022 Jan 10;803:149932. doi: 10.1016/j.scitotenv.2021.149932. Epub 2021 Aug 27. PMID: 34525681; PMCID: PMC8390098.

10. Burton M, Cobb E, Donachie P, Judah G, Curtis V, Schmidt WP. The effect of handwashing with water or soap on bacterial contamination of hands. Int J Environ Res Public Health. 2011 Jan;8(1):97-104. doi: 10.3390/ijerph8010097. Epub 2011 Jan 6. PMID: 21318017; PMCID: PMC3037063.

11. [WHO III] World Health Organization: How to Handwash? https://www.who.int/docs/default-source/patient-safety/how-to-handwash-poster.pdf?sfvrsn=7004a09d_2

12. Patrick DR, Findon G, Miller TE. Residual moisture determines the level of touch-contact-associated bacterial transfer following hand washing. Epidemiol Infect. 1997 Dec;119(3):319-25. doi: 10.1017/s0950268897008261. PMID: 9440435; PMCID: PMC2809004.

13. Taylor LJ. An evaluation of handwashing techniques-2. Nurs Times. 1978 Jan 19;74(3):108-10. PMID: 622335.

14. Khairnar MR, G A, Dalvi TM, Kalghatgi S, Datar UV, Wadgave U, Shah S, Preet L. Comparative Efficacy of Hand Disinfection Potential of Hand Sanitizer and Liquid Soap among Dental Students: A Randomized Controlled Trial. Indian J Crit Care Med. 2020 May;24(5):336-339. doi: 10.5005/jp-journals-10071-23420. PMID: 32728325; PMCID: PMC7358852.

15. Kampf G. Efficacy of ethanol against viruses in hand disinfection. J Hosp Infect. 2018 Apr;98(4):331-338. doi: 10.1016/j.jhin.2017.08.025. Epub 2017 Sep 5. PMID: 28882643; PMCID: PMC7132458.

16. Savolainen-Kopra C, Korpela T, Simonen-Tikka ML, Amiryousefi A, Ziegler T, Roivainen M, Hovi T. Single treatment with ethanol hand rub is ineffective against human rhinovirus--hand washing with soap and water removes the virus efficiently. J Med Virol. 2012 Mar;84(3):543-7. doi: 10.1002/jmv.23222. PMID: 22246844.

17. Teesing, G., et al (2020). Increased hand hygiene compliance in nursing homes after a multimodal intervention: A cluster randomized controlled trial (HANDSOME). Infection Control & Hospital Epidemiology, 41(10), 1169-1177. doi:10.1017/ice.2020.319

18. Gould DJ, Moralejo D, Drey N, Chudleigh JH, Taljaard M. Interventions to improve hand hygiene compliance in patient care. Cochrane Database of Systematic Reviews 2017, Issue 9. Art. No.: CD005186. DOI: 10.1002/14651858.CD005186.pub4.

19. Veys K, Dockx K, Van Remoortel H, Vandekerckhove P, De Buck E. The effect of hand hygiene promotion programs during epidemics and pandemics of respiratory droplet-transmissible infections on health outcomes: a rapid systematic review. BMC Public Health. 2021 Sep 25;21(1):1745. doi: 10.1186/s12889-021-11815-4. PMID: 34563144; PMCID: PMC8467175.

20. Granqvist K, Ahlstrom L, Karlsson J, Lytsy B, Andersson AE. Learning to interact with new technology: Health care workers' experiences of using a monitoring system for assessing hand hygiene - a grounded theory study. Am J Infect Control. 2022 Jun;50(6):651-656. doi: 10.1016/j.ajic.2021.09.023. Epub 2021 Oct 2. PMID: 34610392.

21. Uhari M, Möttönen M. An open randomized controlled trial of infection prevention in child day-care centers. Pediatr Infect Dis J. 1999 Aug;18(8):672-7. doi: 10.1097/00006454-199908000-00004. PMID: 10462334