



Behavior on hand hygiene practices of companions in inpatient wards*

Comportamento sobre prática de higiene das mãos de acompanhantes em enfermarias de internação

Maria Fabiana de Sena Neri¹, Nelson Miguel Galindo Neto², Cynthia Lima Sampaio¹, Luis Angel Cendejas Medina¹, Livia Moreira Barros³, Joselany Áfio Caetano¹

Objective: this study aimed to evaluate the hand hygiene routine of companions in inpatient units. **Methods:** it was an observational study with 50 companions, aged over 18 years and with clear language. A questionnaire and observation of hand hygiene moments were used. For analysis, descriptive statistics was applied. **Results:** the use of liquid soap ($p=0.939$), alcohol-based hand gel ($p=0.939$), collective use towel ($p=0.939$), disposable towels ($p=0.939$), higher frequency after going to the bathroom ($p<0.000$) and in health institutions ($p<0.000$) were verified. Nurses were presented the highest hand hygiene rates ($p<0.000$). Prevalent hygiene after visiting the patient ($p<0.000$) or viral outbreaks ($p<0.000$). Hand hygiene education provided by family ($p=0.253$) and caregivers ($p=0.024$). **Conclusion:** the main practices comprised hand hygiene after using the toilet and after contact with dirt or sick people. Furthermore, use of alcohol-based hand gel and disposable towels for hand hygiene before eating and after using public transport.

Descriptors: Health Promotion; Patient Escorts; Patient Safety; Hand Hygiene.

Objetivo: avaliar a rotina de higiene das mãos de acompanhantes em unidades de internação. **Métodos:** estudo observacional, com 50 acompanhantes, maiores de 18 anos com linguagem clara. Utilizaram-se de questionário e observação dos momentos de higiene das mãos. Para análise, utilizou-se da estatística descritiva. **Resultados:** evidenciou-se uso de sabão líquido ($p=0,939$), gel alcoólico ($p=0,939$), toalha de uso coletivo ($p=0,939$), papel descartável ($p=0,939$), maior frequência depois de usar banheiro ($p<0,000$) e em instituições de saúde ($p<0,000$). Os enfermeiros eram os que mais higienizavam as mãos ($p<0,000$). Higiene preponderante após visita ao paciente ($p<0,000$) ou em surtos virais ($p<0,000$). Educação sobre higienização das mãos realizada pela família ($p=0,253$) e cuidadores ($p=0,024$). **Conclusão:** as principais práticas foram: lavagem das mãos depois do uso de banheiro e após contato com sujidades ou doente. Ademais, uso do álcool-gel e toalhas descartáveis na higiene das mãos antes das refeições e depois de usar transporte público.

Descritores: Promoção em Saúde; Acompanhante de Paciente; Segurança do Paciente; Higiene das Mãos.

*Extracted from the dissertation "Tecnologia educacional em higienização das mãos com cuidadores: fundamentada no modelo de promoção da saúde de Nola Pender", Universidade Federal do Ceará, 2018.

¹Universidade Federal do Ceará. Fortaleza, CE, Brazil.

²Instituto Federal de Educação, Ciência e Tecnologia de Pernambuco. Campus Pesqueira, PE, Brazil.

³Universidade Estadual Vale do Acaraú. Sobral, CE, Brazil.

Corresponding author: Maria Fabiana de Sena Neri
Rua Gonçalves Dias, 1400. Parque Albano. CEP: 61645-350. Caucaia, CE, Brazil. E-mail: mfabisn@gmail.com

Introduction

Hands are the main vehicles for dissemination of healthcare-related infections. Every day, in hospital institutions, preventive measures are observed to provide guidance on the importance of hand hygiene to prevent cross-contamination. Nevertheless, most of these actions are directed to the participation of health professionals, thus suggesting the need to include patients and companions in preventive activities. Considering that companions often contribute to the care and handling of patients, there is urgent need to encourage hand hygiene practices.

Among the strategies performed to promote hand hygiene by companions, there are informational sites and multimedia material⁽¹⁾, television, leaflets, and education provided by health professionals⁽²⁾. Nonetheless, few studies report the frequency and practice of hand hygiene of companions. Measuring these markers requires observation of the care environment, in which the opportunities, indication, and action of hand hygiene are effectively performed or not by companions.

Behavioral observation contributes to research on hand hygiene routine, since self-applied questions alone are not enough to gauge it⁽³⁾ and, in this scenario, understanding the circumstances of care is essential to clarify it⁽⁴⁾. Therefore, this study is justified for enabling the understanding of the constancy with which companions who cooperate in wards clean their hands, thinking about the moments during the care, as well as the infrastructure and supplies.

Evidence of hand hygiene behavior of companions is relevant for assessing the possible risks and self-care ability of companions of hospitalized patients, from the perspective of controlling and/or reducing healthcare-related infections.

Thus, this study had the following guiding question: What are the self-reported and observed behaviors of companions on hand hygiene practice? Therefore, it aimed to evaluate the hand hygiene routine of companions in inpatient units.

Methods

It was an observational study that used closed questions and observation for data collection, conducted from November 2017 to January 2018, in two medical clinic units of a teaching hospital in Fortaleza, Ceará, Brazil.

During the research, the target audience was composed of 60 companions, who were approached individually and explained that their participation would occur by filling in the instrument and through observation; however, they were not informed about the observation period and the instrument to be used during this moment.

Inclusion criteria of the participants were: companion aged over 18 years who stayed at the hospital at least twice a week and with preserved verbal language. Exclusion criteria were non-return of the completed self-administered questionnaire and return of the questionnaire in the first stage of data collection.

It was a convenience sample consisting of the companions who met the inclusion and exclusion parameters. To determine the final number of participants were considered: 95% confidence interval and 0.4 dispersion measure; the average monthly occupancy of inpatient units in the first half of 2018, according to data from the Management Application for University Hospitals; maximum estimation error of 0.05; the finite population correction factor, considering the distribution of hospital beds available in the wards, actual occupation, and isolation units, resulting in a total sample of 50 companions.

For data collection, two instruments were used. One self-applied⁽⁵⁾, containing variables related to hand hygiene behavior (before eating, after using the toilet, and what do I usually use to wash and dry my hands); the intention of hand washing (it is necessary, not important); the practice of handwashing (how does handwashing occur in our society and in my personal environment); the sense of potential risk for infection and personal experiences of infection; the instruction on hand hygiene; the perception of the

importance of hand hygiene; and the hand hygiene training needs. These variables reflect the performance of self-efficacy, that is, the ability to perform and maintain hand hygiene, which were noted by personal perception through open-ended questions, according to Likert-type scales⁽⁶⁾, from the lowest to the highest frequency of hand hygiene practice with a score ranging from 1 to 6.

The other instrument was used during observation, supported by the five guidelines for hand hygiene management: before touching a patient, before aseptic procedures, after body fluid exposure, after touching a patient, and after touching patient surroundings. Nevertheless, this study contemplated only four moments, excluding "before aseptic procedures", since it does not constitute a moment performed by companions.

Thus, the four moments approached were: before touching a patient, after body fluid exposure, after touching a patient, and after touching patient surroundings⁽⁷⁾. These moments were conducted by two previously trained students of the extension project. The training took place with reading, explanation, and implementation of the instrument in units different from the one in study, through pilot study, each student performed the research with five companions to verify the proper application of the instrument.

Companions were evaluated during 64 hours over a period of 16 days. Only two companions were observed per room, with an approximated stay of two hours for each observation, regardless of the observation shift. The observation time is justified because it represents the average length of stay of patients in the clinics where data collection occurred.

It is worth mentioning that, due to the constant manipulation of patients by the companions, the 120 minutes in which the daily observation occurred were enough to emerge the need for hand hygiene. The recommended interval for the permanence of each observation moment was intended to reduce the Hawthorne effect, based on other research⁽⁸⁾, aiming to

directly measure this effect in the observation of hand hygiene practice.

In order to reduce this consequence, a relevant inconvenience of the observations conducted, the companions, through informed consent, were informed that they would be observed regarding hand hygiene during participation in patient care, without specifying the exact moment of observation. Given the evident behavioral change in some companions on hand hygiene, as a result of the observations, 15 companions were excluded.

In the analysis, the Chi-square test was applied to verify the association between the products frequently used for hand hygiene. If the test presented a p-value lower than the desired significance level of 0.05, the association between the most commonly used hand washing and drying products would be rejected.

Additionally, the Wilcoxon test was applied to single samples, which is based on ranks of the obtained values, an alternative to the test of mean differences, since there was no data normality. The hypotheses of the unicausal test are: H0, median found equal to 4.00; and H1, median found greater or different than 4.00. If the test presents a p-value lower than the desired significance level of 0.05, the median value found will be greater than the suggested value of 4.00. It is worth highlighting that the median was defined based on empirical study⁽⁹⁾.

The research was conducted according to the required ethical standards, being approved by the Research Ethics Committee of the Federal University of Ceará, according to protocol nº 2,412,806/2017, and Certificate of Presentation for Ethical Appreciation nº 76242017,0,0000,5054.

Results

Most of the companions investigated were female, aged between 26 and 30 years, coming from the interior of the state, single, with eight years of formal

education, and Catholics. Of the sample, 37 were relatives, as daughter or spouse, 26 had their own income, 24 had no income, and five were hired and paid companions.

The care period ranged from three to ninety days in inpatient units. In the study group, 36 reported previous experience as companions. Additionally, in this sample, regarding occupations, 28 were employed, primarily as farmers.

Table 1 – Association between products frequently used by companions for hand washing and drying

Frequently used handwashing products	Most commonly used hand drying supplies				p*
	Personal use towels	Collective use towels	Disposable papers and others	Total	
	n (%)	n (%)	n (%)	n (%)	
Water	1 (2.0)	2 (4.0)	2 (4.0)	5 (10.0)	
Liquid soap	11 (22.0)	15 (30.0)	5 (10.0)	31 (62.0)	
Alcohol-based gel	4 (8.0)	5 (10.0)	2 (4.0)	11 (22.0)	0.939
Others	1 (2.0)	1 (2.0)	1 (2.0)	3 (6.0)	
Total	17 (34.0)	23 (46.0)	10 (20.0)	50 (100.0)	

*Chi-square test

The most used product for hand hygiene was liquid soap (62.0%) and alcohol-based hand gel (22.0%). The product often used for hand drying was generally the collective use towel (46.0%) and personal use towel (34.0%). According to p=0.939, there was no association between the most used supplies for hand washing and drying.

Table 1 reveals the results obtained from the hand washing and drying supplies, highlighting the situation that companions often used handwashing liquid soap, and there was no significant association between the use of this antiseptic for hand washing and the towel for hand drying. In this context, it is necessary to advise on the effectiveness of alcohol-based gel, since this input is available in each ward, the correct practice, because washing hands and then using, for example, the towel provided to the patient, would not be satisfactory.

Table 2 – Difference among the medians, according to the hand hygiene moments of the companions

Items/Answers	Mean ± Standard Deviation	Median*	p†
General behavior			
Before eating	5.34 ± 1.18	6	<0.000
After using the toilet	5.88 ± 0.63	6	<0.000
After using public transport	4.72 ± 1.48	6	<0.000
After touching surfaces that seem dirty	5.40 ± 1.19	6	<0.000
After touching a sick person	5.38 ± 1.37	6	<0.000
Behavior in Inpatient Wards			
Personally, I wash my hands in healthcare institutions	5.46 ± 1.16	6	<0.000
Next time I am in a health institution, I believe I'll wash my hands	5.79 ± 0.84	6	<0.000

*Median reference 4.00; †Wilcoxon Signed-rank Test

Companions performed hand hygiene more often after using the toilet (p<0.000), after touching surfaces that seem dirty (p<0.000), and these participants believed they would continue to perform hand hygiene when returning to a healthcare facility (p<0.000). Regarding the Wilcoxon test, the null hypothesis was rejected in all cases, that is, the median value was higher than 4.00, the value suggested by the specialist.

Table 3 – Difference among the medians according to personal experiences regarding risks and knowledge involving hand hygiene of the companions

Variables	Mean ± Standard Deviation	Median*	p†
Self-efficacy behavior			
Physicians	5.50 ± 1.15	6	<0.000
Nurses	5.54 ± 1.05	6	<0.000
Other health professionals	4.94 ± 1.49	6	0.000
Patients	4.15 ± 1.81	4.5	0.323
Family and visitors	4.21 ± 1.85	4	0.253
More frequent hand hygiene situations			
Influenza virus	5.32 ± 1.27	6	<0.000
Gastrointestinal diseases	5.31 ± 1.35	6	<0.000
Epidemics	5.17 ± 1.38	6	<0.000
After visiting a sick person	5.55 ± 1.12	6	<0.000
Guidance on hand hygiene			
Family	4.64 ± 1.81	6	0.024
Friends	2.18 ± 1.57	1	-
Elementary School Teachers	4.62 ± 1.84	6	0.044
High School Teachers	4.03 ± 1.89	4.5	0.562
Higher Education Professors	3.76 ± 1.98	4	0.811
Media	3.84 ± 2.12	5	0.826
Physicians	3.61 ± 2.29	4	0.982
Health Professionals	3.84 ± 2.18	4	0.878

*Median reference 4.00; †Wilcoxon Signed-rank Test

Companions considered that nurses presented the highest hand hygiene rates ($p < 0.000$) and that the crucial situations to perform hand hygiene occurred after visiting the sick patient ($p < 0.000$) or in the occurrence of influenza viruses ($p < 0.000$). It was also identified that guidance on hand hygiene was predominantly provided by family members ($p = 0.253$) and health professionals ($p = 0.878$). Regarding the Wilcoxon test, in most cases, the null hypothesis was rejected, in other words, the median value was higher than the value suggested by the specialist.

Discussion

Among this study limitations, there was the fact that it was performed in a single institution, as well as the non-participation of companions of segregated patients, who might be more vulnerable to healthcare-associated infections, since the access to isolation wards was not allowed. In addition, the survey was conducted based on self-administered questionnaires in which the respondents' misunderstandings, misinformation, or errors could not be filtered. The study presents the impossibility of calculating predictive measures that favor better care practices, besides not being possible to determine the causality of non-compliance to hand hygiene by companions.

Hand washing behavior of the companions reflected the need for greater attention to hand hygiene in health care settings, especially the use of liquid soap. Companions' lack of knowledge about the effectiveness of alcohol-based hand gel for preventing infections may be related to its recent introduction in health institutions. In 2010, the National Health Surveillance Agency regulated that health institutions in Brazil would use alcohol-based products – liquid or gel – for hand hygiene in health institutions across the country⁽¹⁰⁾.

In a study with companions of children in daycare, their hands were washed more frequently when paper towels were available, compared to tissue to-

wels, revealing odds ratio (OR) of 1.47 and Confidence Interval (CI) of 1.00-2.16, or combination of paper and tissue towels (OR: 2.13; 95% CI: 1.32-3.44), inferring that the health of companions of daycare children can be improved. For this purpose, interventions should consider environmental determinants such as number and type of towel dispensers⁽¹¹⁾. In a similar context to this study, in which most of the companions used a shared towel in the hand cleaning process, few used disposable towels for hand drying.

Regarding the moments of hand hygiene, handwashing after using the toilet was the highlight, followed by after touching dirt surfaces or sick people. Both handwashing behavior after using the toilet and handwashing during a visit to a hospitalized patient can be influenced by household behavior and the availability of more easily visible sinks or display of informational posters. These features were associated with better adherence to handwashing⁽¹²⁾.

Research demonstrates as indicators for monitoring healthcare-associated infections the replacement of degraded furniture and appropriate number of people performing cleaning/disinfection⁽¹³⁾. Therefore, the permanence of degraded furniture and the absence/inadequacy of the cleaning and disinfection process of hospital surfaces may increase hand contamination, when companions, patients, visitors, or health professionals touch these surfaces and do not wash their hands before touching the patient.

Digital devices can be contaminants of etiologic agents that cause infectious diseases. Clean hands reduce this risk potential⁽¹⁴⁾. As well as the collection, transportation, cleaning, and shared use of dirty surfaces and contaminated utensils seem to be associated with high levels of risk of disease transmission⁽¹⁵⁾.

Reduced association of hand hygiene behavior of companions before eating and after using public transport may represent a risk of infection when handling the patient, either by not washing their hands when leaving public transport, entering the ward and touching the patient, or helping the patient to eat.

Eating and food preparation are critical food-related handwashing situations⁽¹⁶⁾. Handwashing practice is essential to prevent diseases caused by contact with bacterial and fungal microorganisms present in bus handles and seats⁽¹⁷⁾.

Companions believe that they will clean their hands more frequently during the subsequent visit to a health facility, as they are currently taking care of a patient. In another study, relatives of patients perceived the habit of hand hygiene as something “you must always do”, understanding this care as fundamental, regardless of the patient’s situation⁽⁶⁾.

Among the psychosocial factors that affect hand hygiene practice, the most important predictor of handwashing frequency was self-efficacy ($p < 0.001$), followed by action planning ($p < 0.001$) and remembering ($p < 0.001$)⁽¹⁸⁾.

In this research, subjects believed that they wash their hands in healthcare institutions more than patients and less than health professionals. In research on the health education needs of transplant patients and the competence of primary companions, hand hygiene was among the least understood aspects of health education. Significant positive correlations were observed between the level of knowledge in health education and the care competence of primary companions⁽¹⁹⁾.

This study associated the increased frequency of hand hygiene with the presence of events such as visiting a patient in the event of influenza, gastrointestinal diseases, and epidemics. An intervention study to evaluate hand hygiene compliance of companions and children, as well as the incidence of gastrointestinal and respiratory infections in children, concluded that these actions can be used as outcome measures⁽¹¹⁾.

Effective hand hygiene of companions in this study was mainly influenced by family and interaction with health professionals, which may reduce infection transmission in families and health institutions with companions of hospitalized patients.

Health education positively affects the effecti-

veness of self-management and should be performed according to the needs, knowledge, and competence of patients and their companions⁽¹⁹⁾.

Moreover, patient empowerment is defined as a process in which patients/family companions understand their own role and receive the knowledge and skills of health professionals in an environment that encourages their participation⁽²⁰⁾.

A multifactorial intervention that emphasized the use of alcohol-based hand antiseptics at home reduced the transmission of gastrointestinal and respiratory diseases within families. Hand antiseptics and multifaceted educational messages can play a significant role in improving hand hygiene practices within the home environment⁽³⁾.

For family members, factors that affect perceptions include prior hand hygiene information and previous hospitalizations for the patient. Increased hand cleaning supplies and behavior can improve infection control in healthcare facilities⁽¹¹⁾.

Conclusion

In this study, higher rates of hand hygiene after using the toilet and after touching dirty surfaces or a sick person, attention to the more frequent use of alcohol-based hand gel and disposable towels in hand hygiene before eating, and after using public transport revealed hand hygiene behaviors of companions in inpatient units.

Collaborations

Neri MFS, Galindo Neto NM, Barros LM and Caetano JA contributed to the project design, data analysis, drafting of the article, relevant critical review of the intellectual content, and final approval of the version to be published. Sampaio CL and Medina LAC collaborated with the drafting of the article and relevant critical review of the intellectual content.

References

- Costa TL, Souza OMV, Carneiro HA, Chiquito Netto C, Pegoraro-Krook MI, Dutka JCR. Multimedia material about velopharynx and primary palatoplasty for orientation of caregivers of children with cleft lip and palate. *CoDAS*. 2016; 28(1):10-6. doi: dx.doi.org/10.1590/2317-1782/20162014126
- Foà C, Tura GA, Camelli C, Silingardi R, Malavolti M, Kuenzer E, et al. Hand hygiene in health care settings: the citizens' point of view. *Acta Biomed*. 2017; 88(1S):40-53. doi: http://doi.org/10.23750/abm.v88i1 -S.6283
- Alzaher AA, Almudarra SS, Mustafa MH, Gosadi IM. The importance of hand hygiene education on primary schoolgirls' absence due to upper respiratory infections in Saudi Arabia. A cluster randomized controlled trial. *Saudi Med J*. 2018; 39(10):1044-9. doi: http://doi.org/10.15537/smj.2018.10.23344
- Andreotti JT, Ferreira AM, Pinto AMAC, Rigotti MA, Frota OP, Barcelos LS. Avaliação dos serviços: instrumento de avaliação de centros de material e esterilização. *Rev Pre Infec Saúde*. 2017; 3(3):1-8. doi: https://doi.org/10.26694/repis.v3i3.6580
- Costa DM, Lopes LKO, Tipple AFV, Castillo RB, Hu H, Deva AK, et al. Effect of hand hygiene and glove use on cleanliness of reusable surgical instruments. *J Hosp Infect*. 2017; 97(4):348-52. doi: http://doi.org/10.1016/j.jhin.2017.06.018
- Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process*. 1991; 50(2):179-211. doi: doi.org/10.1016/0749-5978(91)90020-T
- Agência Nacional de Vigilância Sanitária. Manual de referência técnica para a higiene das mãos: para ser utilizado por profissionais de saúde, formadores e observadores de práticas de higiene das mãos [Internet]. 2015 [citado 2019 abr 13]. Disponível em: https://www20.anvisa.gov.br/segurancadopaciente/index.php/publicacoes/item/manual-de-referencia-tecnica-para-a-higiene-das-maos
- Kurtz SL. Measuring and accounting for the Hawthorne effect during a direct overt observational study of intensive care unit nurses. *Am J Infect Control*. 2017; 45(9):995-1000. doi: 10.1016/j.ajic.2017.03.022
- Neri MFS. Tecnologia educacional em higienização das mãos com cuidadores: fundamentada no modelo de promoção da saúde de Nola Pender. Dissertação (Mestrado em Enfermagem) - Universidade Federal do Ceará [Internet]. 2018 [citado 2019 ago. 13]. Disponível em: http://www.repositorio.ufc.br/bitstream/riufc/33370/1/2018_dis_mfsneri.pdf
- Agência Nacional de Vigilância Sanitária. Nota Técnica nº 01/2018 GVIMS/GGTES/ANVISA: orientações gerais para higiene das mãos em serviços de saúde [Internet]. 2018 [citado 2019 abr 13]. Disponível em: http://portal.anvisa.gov.br/documents/33852/271858/Nota+t%C3%A9cnica+n%C2%BA+01-2018+GVIMS-GGTES-ANVISA/ef1b8e18-a36f-41ae-84c9-53860bc2513f
- Horng LM, Unicomb L, Alam MU, Halder AK, Shoab AK, Ghosh PK, et al. Healthcare worker and family caregiver hand hygiene in Bangladeshi healthcare facilities: results from the Bangladesh National Hygiene Baseline Survey. *J Hosp Infect*. 2016; 94(3):286-94. doi: https://doi.org/10.1016/j.jhin.2016.08.016
- Neo JRJ, Sagha-Zadeh R. The influence of spatial configuration on the frequency of use of hand sanitizing stations in health care environments. *Am J Infect Control*. 2017; 45(6):615-9. doi: https://doi.org/10.1016/j.ajic.2017.01.033
- Lopes LP, Pio DPM, Pereira FMV, Meneguetti MG, Freitas JP, Gir E. Prevalence of oxacillin/methicillin-resistant *Staphylococcus aureus* isolated in the nursing staff. *Rev Rene*. 2018; 19:e32478. doi: doi.org/10.15253/2175-6783.20181932478
- Oliveira DB, Bombana CC, Rodrigues GAG, Parussolo L. Caracterização de *Staphylococcus aureus* isolados da barra de mão de carrinhos e alças de cestas de supermercados. *Rev Ciênc Farm Básica Apl [Internet]*. 2015 [citado 2019 abr. 10]; 36(3):407-12. Disponível em: seer.fcfa.unesp.br/rcfba/index.php/rcfba/article/view/341
- Steinert MEP, Hardoim EL, Castro MPPRP. De mãos limpas com as tecnologias digitais. *Rev Sustinere*. 2016; 4(2):233-52. doi: https://doi.org/10.12957/sustinere.2016.25055
- Seimetz E, Mosler HJ, Boyayo AM. The influence of contextual and psychosocial factors on hand-washing. *Am J Trop Med Hyg*. 2016; 94(6):1407-17. doi: https://doi.org/10.4269/ajtmh.15-0657

17. Edmunds KL, Elrahman SA, Bell DJ, Brainard J, Dervisevic S, Fedha TP, et al. Recommendations for dealing with waste contaminated with Ebola virus: a hazard analysis of critical control Points approach. *Bull World Health Organ.* 2016; 94(6):424-32. doi: <https://doi.org/10.2471/BLT.15.163931>
18. Vaidotas M, Yokota PK, Marra AR, Camargo TZ, Victor Eda S, Gysi DM, et al. Measuring hand hygiene compliance rates at hospital entrances. *Am J Infect Control.* 2015; 43(7):694-6. doi: <https://doi.org/10.1016/j.ajic.2015.03.008>
19. Xie J, Ming Y, Ding S, Wu X, Liu J, Liu L, et al. Rising Need for Health Education Among Renal Transplant Patients and Caregiving Competence in Care Providers. *Prog Transplant.* 2017; 27(2):180-6. doi: <https://doi.org/10.1177/1526924817699962>
20. Zellmer C, Blakney R, Van Hoof S. Impact of sink location on hand hygiene compliance for *Clostridium difficile* infection. *Am J Infect Contr.* 2015; 43(4):387-9. doi: <http://dx.doi.org/10.1016/j.ajic.2014.12.016>