



HAND HYGIENE HABIT AND PATHOGENS FOUND IN MEDICAL STUDENTS

HÁBITO DE HIGIENE DE MANOS Y PATÓGENOS HALLADOS EN ESTUDIANTES DE MEDICINA

Nicanor Domínguez-Navarrete^{1,a}, Sara Palomino-Berrios^{1,a}, Carolina Cucho-Espinoza^{1,a}, Kelly Alarcón-Oré^{1,b}, Jossian Valencia-Pillaca^{1,b}

ABSTRACT

The objective was to know the hand hygiene habits of medical students; as well as the bacterial population resident in the palm of the hands. An observational, descriptive cross-sectional study was carried out. Likewise, a hand hygiene behavior survey was carried out on 100 students, and a microbiological culture of the palmar surface was carried out on 33 other students. Regarding hygiene habits, 74% showed an appropriate attitude. The hygiene attitude was appropriate in 41.3% and 46% in relation to the prevention of contagion. The following pathogenic microorganisms were isolated: S.aureus with 20 cases (60.6%), P. aeruginosa, Enterobacter and S.viridans, one in each case. Therefore, workshops or dissemination campaigns should be organized to raise awareness and modulate hand hygiene habits in students.

Key words: Hand Hygiene; Bacteria; Hand Disinfection (source: MeSH NLM).

RESUMEN

El objetivo fue conocer los hábitos de higiene de manos de los estudiantes de medicina; así como la población bacteriana residente en la palma de las manos. Se llevó a cabo un estudio observacional, descriptivo de tipo transversal, y se realizó una encuesta sobre la conducta de higiene de manos a 100 alumnos, y a otros 33 alumnos se les realizó cultivo microbiológico de la superficie palmar, el instrumento fue validado por juicio de expertos. En relación a los hábitos de higiene, el 74% mostró una actitud apropiada. La actitud a la higiene fue apropiada en el 41,3% y 46% en relación a la prevención de contagio. Se aislaron los siguientes microorganismos patógenos: S.aureus con 20 casos (60,6%), P. aeruginosa, Enterobacter y S.viridans, uno en cada caso. Deben organizarse talleres o campañas de difusión para concientizar y modular los hábitos de higiene de manos en los alumnos.

Palabras clave: Higiene de las manos; Bacterias; Desinfección de las Manos (fuente: DeCS BIREME).

¹ Facultad de Medicina Humana, Universidad Ricardo Palma, Lima-Perú.

^a Clinical Pathologist.

^b Medical student.

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INTRODUCTION

In most countries, greeting is characterized by shaking hands with the speaker, looking at him/her in the face, which is a sign of courtesy and mutual respect. Our hands, which are designed to protect and help us in multiple daily activities, are exposed to be contaminated by microorganisms that constitute the hand's commensal microbiome.

The skin containing hair follicles is the most populated by microorganisms. There are amounts between 1×10^3 to 1×10^4 bacteria per cm^2 of skin; and *Staphylococcus epidermidis* and *Propionibacterium acnes* are mentioned as the most frequent⁽¹⁾. In these hairy areas, the existence of mechanisms that promote an environment with antimicrobial activity are described, such as: acid pH, peptides presence and long chain fatty acids and lipids, according to Ng LSY et al.⁽²⁾; unlike the palm zone, where the resident bacterial population can reach up to 1×10^6 , according to Bolon MK⁽³⁾.

The importance of hand hygiene, in order to avoid the transmission of infectious diseases, dates back to the year 1840, with Oliver Wendel Holmes. This habit becomes essential when there is a possibility of the presence of pathogenic strains, such as: *Escherichia coli*, *Salmonella* spp., *Shigella* spp., *Staphylococcus aureus*, *Vibrio cholerae*, *Pseudomonas* spp., *Streptococcus pyogenes*, *Streptococcus agalactiae*, *Clostridium* spp., among others⁽³⁾. Hand hygiene in health care workers is an extremely important chapter, since this population is exposed to be infected by microorganisms from patients, and thus to be passive carriers of them (cross-transmission); apart from self-contamination. Therefore, the habit formation of hand hygiene in physicians should begin in the pre-clinical cycles of their formation.

The objective of this study is to know the habits of medicine students, who study pre-clinical cycles, in relation to hand hygiene. For which, a survey has been prepared, and cultures of the palm surface will be carried out to know the resident bacterial population, as well as the presence of pathogenic strains.

STUDY

An observational, descriptive and cross-sectional study was carried out. Students from a pre-clinical cycle course of the "Manual Huamán Guerrero" Medicine School of the Universidad Ricardo Palma in Lima, Peru (FAMURP) voluntarily participated in

the study. With a census, a nine-question survey was conducted on a population of 100 university students to know about their hand hygiene behavior. On the other hand, 33 students participated in a microbiological culture of the palm surface.

The survey consists of nine questions related to: a) hand hygiene habit; b) attitude towards hand hygiene; and c) measures for prevention of hand contagion; each section with three questions respectively. The responses were grouped into three categories: 1) inadequate, 2) poor and 3) appropriate (Table 1). The validation of the survey used was carried out through three experts criteria, physicians specialized in microbiology; all of them with more than five years of experience in the area.

On the other hand, cultures of the palm surface of 33 students, who agreed to participate in the procedure, were carried out. The samples were taken before the start of laboratory or library practices. The only restrictive requirement was to have washed their hands up to an hour before. The samples were randomly taken on six different days. The samples were taken with a swab moistened in saline, which was rubbed on the palm surface. Then, it is cultured on a Petri dish, with tripticase soy agar and blood. The cultures were incubated for 48 hours at 37°C. Then, the number of colonies developed was counted and isolated microorganisms were identified. The data were analyzed using the statistical program Stata v14 by frequencies and percentages.

The study was carried out after the application of informed consent to the participants. Likewise, the data were treated with the strictest confidentiality; and the study project was approved by FAMURP.

FINDINGS

The survey was conducted on 100 students. Regarding hygiene habits it was found that: the daily frequency of washing hands is appropriate in 70%, poor in 27% and inadequate in 3%. In the question related to hand hygiene after toilet use, it is observed that: the behaviour is appropriate in 88%, poor in 10% and inadequate in 2%. In relation to the habit of washing hands before eating food, it is observed that: it is appropriate in 64%, poor in 35% and inadequate in 1% (Table 2)

In the questions related to the attitude towards hand hygiene, it is observed that: the behaviour of not consuming food in street stands, is considered as an appropriate attitude in 28%, 64% do it sometimes,



and 8% of students do it frequently (inappropriate). The attitude of washing hands when arriving home is appropriate in 65%, poor in 32% and inadequate in 3%. In the attitude of bringing the hand to the mouth or nose, 64% do it occasionally, 27 % do it frequently and 9% declare to do it always, considered as inadequate attitude (Table 2).

The questions related to the prevention of contagion through hands, it can be seen that: the use of topical antibacterial drugs is appropriate in 31%, poor in 40% and inadequate in 9%. The prevention of contagion, related to the nails maintenance, is appropriate in 63%, poor in 20% and inadequate in 17%. The use of gloves, as a preventive measure in laboratory tasks, is appropriate in 44%, poor in 50% and inadequate in 6% (Table 2).

In the 33 palm cultures, it is seen that: A) None of the cases processed presented cultures with less than nine colonies. B) Four samples developed a number

of colonies in the range of 10 to 99. C) Twenty samples developed a number of colonies in the range of 100 to 999. And D) Nine samples showed abundant development, considered uncountable or greater than 1,000 colonies (Figure 1)

The identification of isolated pathogenic bacteria reports that: *Staphylococcus aureus* is the most prevalent microorganism, with 20 isolates (60.6%), followed by *Hemolytic staphylococcus* with 8 samples (24.2 %); being a total of 28 isolates (84.8%) for the *Staphylococcus* genus. Isolation was obtained for each of the following strains: *Pseudomonas aeruginosa*, *Enterobacter* and *Streptococcus viridans* (3.0% for each strain). In six samples (18.1%) *Candida* yeasts were isolated. It is relevant to remark that two pathogenic bacteria were together in 9 samples (27.2 %), as well as bacteria considered as potential pathogens were not isolated in five samples (15.1 %) (Table 3).

Table 1. Questions about hand hygiene behavior in pre-clinical cycle students of a Peruvian school of medicine

Questions	Answers		
	Inadequate	Poor	Appropriate
Hygiene habit			
Number of times you wash your hands	None	1 to 3	More than 4
Do you wash your hands after toilet use?	Never	Sometimes	Always
Do you wash your hands before eating?	Never	Sometimes	Always
Attitude towards hygiene			
Do you eat food in street stands?	Always	Sometimes	Never
Do you wash your hands when getting home?	Never	Sometimes	Always
How often do you bring your fingers to your mouth and nose?	Always	Frequently	Occasionally
Contagion prevention			
Antibacterials use for hands	Never	Sometimes	Always
How often do you cut your nails?	Occasionally	Monthly	Weekly
Do you use gloves in lab?	Never	Obligation	Always

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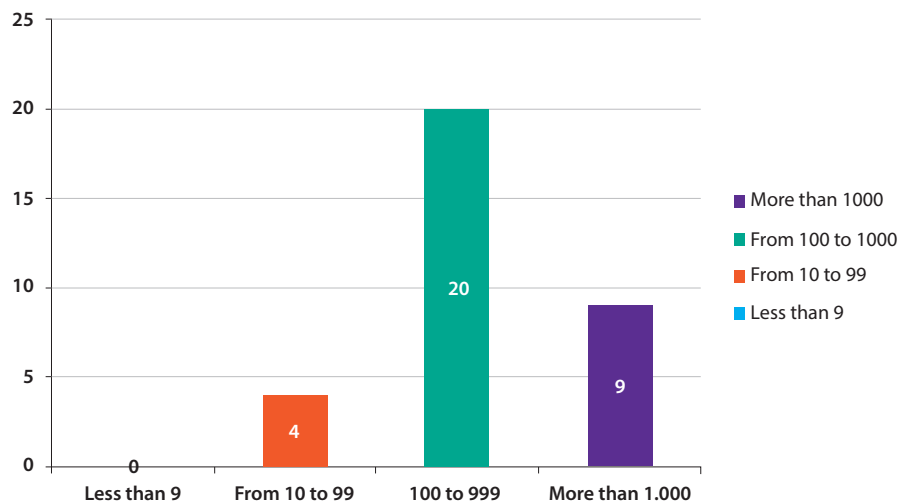
**Table 2.** Results of the hand hygiene survey in pre-clinical cycle students of a Peruvian school of medicine.

	Behavior		
	Inadequate	Poor	Appropriate
Hygiene habit			
Washing frequency per day	3 (3%)	27 (27%)	70 (70%)
After toilet use	2 (2%)	10 (10%)	88 (88%)
Before food	1 (1%)	35 (35%)	64 (64%)
Hygiene attitude			
Eating in street stands	8 (8%)	64 (64%)	28 (28%)
When getting home	3 (3%)	32 (32%)	65 (65%)
Hand to mouth/nose	9 (9%)	27 (27%)	64 (64%)
Contagion prevention			
Use of antibacterials (*)	9 (9%)	40 (40%)	31 (31%)
Nail care	17 (17%)	20 (20%)	63 (63%)
Glove use in laboratory	6 (6%)	50 (50%)	44 (44%)

(*20 unanswered surveys)

Table 3. Pathogenic microorganisms isolated in 33 palm samples of pre-clinical cycle students of a Peruvian school of medicine.

Microorganisms with pathogenic capacity	Number	%
<i>Staphylococcus aureus</i>	18	60.5
<i>Staphylococcus haemolyticus</i>	8	24.2
<i>Viridans streptococci</i>	1	3.0
<i>Pseudomonas aeruginosa</i>	1	3.0
Enterobacter	1	3.0
Yeast (<i>Candida</i> spp.)	6	18.1
Double pathogen	9	27.2
No pathogen	5	15.1



Graphic 1. Distribution of the number of colonies in palms culture of pre-clinical cycle students of a Peruvian school of medicine.

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DISCUSSION

An accepted concept is that hands are carriers of microorganisms, and participate in the transmission of infectious diseases, especially gastrointestinal ones^(4,5). The issue is more important when it comes to health care workers^(2,6). Our population of pre-clinic students is precisely the right one to raise awareness of the risk of exposing their patients (intra-hospital infection) and themselves to the acquisition of an infectious process if the hand hygiene protocol isn't complied, according to Repam⁽⁷⁾.

The sample for the survey is representative, because it is equivalent to 90% of the students of the course academic cycle. It can be seen that a third of the survey respondents do not have the habit of washing their hands more than three times a day. It is also worrying to reveal that more than half of the students do not meet the requirement to do practical laboratory work with gloves.

It is more worrying when we add up the inappropriate behaviour of the 300 answers, and see that only 58 of them have picked the appropriate answer. Therefore, it is necessary to point out the need to constantly disseminate the hand hygiene habit, so that this attitude is part of their routine scheme⁽⁸⁻¹³⁾.

The prevalence of the *Staphylococcus* genus in hands is confirmed, as stated in the literature⁽²⁾. The possibility that one of these strains is beta lactamase-producing and/or has genes that encode resistance to various antibiotics is high, which increases the serious risk if infected.

The isolation of two bacteria with pathogenic capacity makes us think that the quality of hand hygiene of these students is very low; and if they infect third parties, the severity of the process increases.

The presence of *Streptococcus viridans* in a sample suggests that the student has coughed in front of his hands, or his/her fingers have entered the mouth, and no proper hand hygiene has not been performed. Since this microorganism is a natural oropharynx inhabitant.

Candida yeasts were isolated from six students. As this microorganism is usually commensal in feces or external genitalia, it is likely that these students have not washed their hands for several hours, or have recently used the toilet services without washing their hands at the end.

The presence of Gram-negative bacteria in three students is worrying, because these bacteria are feces inhabitants, therefore, they are the results of high risk of contamination and bad hand hygiene habit.

It is important to remark that saprophytic bacteria have only been isolated in five cases. Finding that was expected, and we interpreted it as an appropriate hand hygiene habit.

The limitations of this study lie in its non-probabilistic sampling, which would imply the results non-representativity regarding the pre-clinical student population.



CONCLUSIÓN

The answers to the hand hygiene survey, as well as the evidence of pathogenic germs in the hands palms, force us to organize workshops or campaigns

to raise awareness and control the hand hygiene habits of academic pre-clinical cycles students, so that these attitudes will be part of their habit routine schema.

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Correspondence: Nicanor Domínguez-Navarrete.

Address: Calle Enrique Oliveros 268 San Borja, Lima 41 Perú

Telephone number: +51 998886405

E-mail: ndominguez38@yahoo.com

BIBLIOGRAPHIC REFERENCES

- Cedric Mimms. Medical Microbiology. Mosby Ltd.; 3er edición; 2004
- Ng LSY, Teh WT, Ng SK, Eng LC, Tan TY. Bacterial contamination of hands and the environment in a microbiology laboratory. *J Hosp Infect.* 2011;78(3):231-3. DOI: 10.1016/j.jhin.2011.01.025
- Bolon MK. Hand Hygiene: An Update. *Infect Dis Clin North Am.* 2016;30(3):591-607. DOI: 10.1016/j.idc.2016.04.007
- Staniford LJ, Schmidtke KA. A systematic review of hand-hygiene and environmental-disinfection interventions in settings with children. *BMC Public Health.* diciembre de 2020;20(1):195. DOI: 10.1186/s12889-020-8301-0
- Ataee RA, Ataee MH, Mehrabi Tavana A, Salesi M. Bacteriological Aspects of Hand Washing: A Key for Health Promotion and Infections Control. *Int J Prev Med.* 2017;8:16. DOI: 10.4103/2008-7802.201923
- Sun L, Lin H, Lin J, He J, Deng A, Kang M, et al. Evaluating the transmission routes of hand, foot, and mouth disease in Guangdong, China. *Am J Infect Control.* 2016;44(2):e13-14. DOI: 10.1016/j.ajic.2015.04.202
- Yousef RHA, Salem MR, Mahmoud AT. Impact of implementation of a modified World Health Organization multimodal hand hygiene strategy in a university teaching hospital. *Am J Infect Control.* 2020;48(3):249-54. DOI: 10.1016/j.ajic.2019.07.019
- Fisher D, Pereira L, Ng TM, Patlovich K, Teo F, Hsu LY. Teaching hand hygiene to medical students using a hands-on approach. *J Hosp Infect.* 2010;76(1):86-7. DOI: 10.1016/j.jhin.2010.04.007
- Graf K, Chaberny IF, Vonberg R-P. Beliefs about hand hygiene: a survey in medical students in their first clinical year. *Am J Infect Control.* 2011;39(10):885-8. DOI: 10.1016/j.ajic.2010.08.025
- Zomer TP, Erasmus V, van Empelen P, Looman C, van Beeck EF, Tjon-A-Tsien A, et al. Sociocognitive determinants of observed and self-reported compliance to hand hygiene guidelines in child day care centers. *Am J Infect Control.* 2013;41(10):862-7. DOI: 10.1016/j.ajic.2012.11.023
- Vishwanath R, Selvabai AP, Shanmugam P. Detection of bacterial pathogens in the hands of rural school children across different age groups and emphasizing the importance of hand wash. *J Prev Med Hyg.* junio de 2019;60(2):E103-8. DOI: 10.15167/2421-4248/jpmh2019.60.2.1186
- Bakarman MA, Baig M, Malik AA, Gazzaz ZJ, Mostafa MM, Zayed MA, et al. Hand hygiene knowledge and attitude of medical students in western Saudi Arabia. *PeerJ.* 2019;7:e6823. DOI: 10.7717/peerj.6823
- Salati SA, Al Kadi A. Hand Hygiene Practices in Medical Students: A Follow-Up Study. *International Scholarly Research Notices [Internet].* 2014 [citado 30 de enero de 2021];1-5. DOI: https://doi.org/10.1155/2014/591879

