

ORIGINAL ARTICLE

The difference of allergic reaction on hand sanitizer gel and liquid among nurses at RSU Karsa Husada Batu

Lilah Adilah^{a*}

^a Department of Nursing, STIKes Maharani Malang, JL. AKORDION TIMUR SELATAN NO.8B, MOJOLANGU, KEC. LOWOKWARU, KOTA MALANG, JAWA TIMUR 65141

* Corresponding Author: lillahadilah2@gmail.com

ARTICLE INFORMATION

Article history

Received

Revised

Accepted

Keywords

Hand Sanitizer Gel and Liquid, Hand Washing, Allergic Reaction, Nurses

ABSTRACT

Introduction: The program to improve the hand hygiene of health workers has been declared by WHO through a patient safety program that sparked the Global Patient Safety Challenge "clean care is safe care". Hand hygiene practice, health workers may use the gel or liquid form of hand sanitizer with alcohol-based ingredients. However, alcohol is flammable, causing dryness and irritation of the skin on repeated use and increases the risk of viral infections that trigger inflammation of the digestive tract. **Objectives:** Researcher would like to find any difference on allergic reaction between the use of hand sanitizer gel and liquid form which were commonly used by nurses at RSU Karsa Husada Batu during hand hygiene practice.

Methods: The research design used is a survey research with a cross sectional approach where the researcher observes the research subjects using a check list and questionnaire, with a sample of 80 respondents. The data analysis used non-parametric statistics Mc-Nemar test.

Results: The results of the Mc-Nemar Test showed a p value of $0.033 < 0.05$ which means that the use of hand sanitizer gel and liquid has a significant difference in the allergic reaction among nurses.

Conclusions: Hand sanitizer in gel or liquid form were safe as long as use correctly and properly, also selecting a type of hand sanitizer must be matched with the individual skin

Journal of Nursing is a peer-reviewed journal published by the School of Nursing at the Faculty of Health Science, University of Muhammadiyah Malang (UMM), and affiliated with the Indonesia National Nurse Association (INNA) of Malang.

This journal is licensed under the [CC-BY-SA](https://creativecommons.org/licenses/by-sa/4.0/)

Website: <http://ejournal.umm.ac.id/index.php/keperawatan>

E-mail: journal.keperawatan@umm.ac.id

1. Introduction

Infectious diseases are still a health problem in the world, including in Indonesia, The Law Number 44 concerning hospitals states that "Every patient has the right to security and safety while in treatment at the hospital". One of them is the Prevention and Control of Infections (PPI) and Health Care Associated Infections (HAIs) with a broader understanding not only in hospitals but also in other health care facilities, and not limited to infections in patients, but also infections in health workers acquired during patient care (Masloman et al., 2015).

According to WHO report the incidence of HAIs occurred in 15% of all hospitalized patients in 2016. HAIs are the cause of around 4 – 56% of causes of neonatal death, with an incidence rate of around 75% occurring in Southeast Asia and Sub-Saharan Africa (WHO, 2016). Based on the results of a 2014 survey of HAIs at United States hospitals, the incidence of HAIs reached 722,000 in the acute care unit and 75,000 patients with HAIs died while hospitalized (CDC, 2016). Moreover, according to the Ministry of Health (2011) the incidence of infection in hospitals around 3-21% (average 9%) or more than 1.4 million patients were hospitalized around the world. In Indonesia, the HAIs reach 15.74%, far above developed countries, which range from 4.8 – 15.5%. Urinary tract infection (UTI) is one of the most common infections, which is around

40% of all infections that can occur in hospitals each year (Sapardi et al., 2018). In younger population some infectious disease such as diarrhea, typhoid fever and helminthiasis become the leading issues related with hand hygiene practice (Ruhyanuddin, 2017; Purwandari & Ardiana, 2019). Moreover, ensure that patients do not contract infections as a result of attending a health care facility for assessment, examination, or treatment become prior in providing patient safety and quality (Sukaesi, 2016).

A program to improve hand hygiene for health workers has been declared by WHO through a patient safety program which sparked the Global Patient Safety Challenge "clean care is safe care". WHO also launched Save Lives: Clean Your Hands with a strategy of 5 moments of hand hygiene (My Five Moments for Hand hygiene), namely before contact with patients, before carrying out aseptic procedures, after exposure to patient body fluids, after contact with patients, after contact with the environment around the patient" (WHO, 2015). Efforts to prevent nosocomial infections that can be carried out by health workers are to increase their ability to apply standard precautions with the main components which is one of the most effective methods for preventing transmission of pathogens related to health services by practices the hand hygiene. Hand hygiene effective to prevent infections that are transmitted through hands by removing dirt and debris and inhibiting or killing microorganisms on the skin which may obtained from contact between the patient and the environment. Failure to perform hand hygiene properly and correctly is a major cause of nosocomial infections and the spread of multi-resistant microorganisms in health care facilities (Hidayah & Ramadhani, 2019). The 3M implementation by washing hands in 6 steps or using a hand sanitizer, wearing a 3 layers cloth mask or using a medical mask, while performing a social distancing were able to reduce the level of the spread of infectious disease such as Covid-19 (Ariyanto, 2022).

Health workers who are most vulnerable to infection transmission are nurses because they accompany patients 24 hours a day, thus taking a significant role in contributing to the prevention of nosocomial infections (Fauzia et al., 2014). Based on research conducted by Amelia (2014) in data collection from whole age groups in some countries from North America and Western Europe from 1966 to 2007, the prevalence of the DKA (Allergic Contact Dermatitis) was found to be at least positive for one type of allergen. varies from 12.5% to 40.6%. The highest prevalence of allergens are allergies to the nickel, thimerosal and aroma mixtures. The prevalence of allergy to nickel varies from about 7% of the US population with work-related DKA. The incidence of DKA in Palembang General Hospital for the period January 1 2009 to June 30 2012 was 3.1% with a total of 861 cases. The highest incidence of DKA occurred in the 48-55 year age group with 167 people (19.4%), followed by the 40-47 year age group (17.9%), the 16-23 year age group (15.4%), the 56-63 (11.5%), age group 64-71 years (9.6%), age group 24-31 years (8.9%), age group 32-39 years (6.2%), group aged 8-15 years (3.5%), 0-7 years (3.3%), age group 72-79 years (3.3%), and the lowest was in the age group 80-87 years (1.0 %). The comparison between men was 332 people (38.6%) and women 529 people (61.4%). The three most common allergens are detergents (33.2%), cosmetics (21.7%) and jewelery (9.2%). DKA is most common at the age of 48-55 years. Women more often than men. The most common allergens are detergents, cosmetics, and jewelry. And the results of research conducted on students and employees of Prince Sattam Bin Abdulaziz University, Saudi Arabia in June 2020 showed that 34.8% of the population experienced irritant contact dermatitis after using alcohol-based hand sanitizers during the COVID-19 pandemic (Alsaidan et al., 2020).

The hand sanitizers uses in hand hygiene were known to be effective and efficient in time than using soap and water so that many people are interested in using it. Compare to the soap and water hand hygiene, the advantages of hand sanitizers gel and liquid are relatively quick in kill germs, related to the alcohol compounds (ethanol, propanol, and isopropanol) with a concentration of \pm 60% to 80% and phenol groups (chlorhexidine and triclosan). The compounds

contained in hand sanitizers works by denaturing and coagulating the germ cell proteins. However, if an alcohol-based hand sanitizer used excessively and continuously it can result an irritation and burning feeling on the skin. Because considering the basic ingredients of the antiseptic are alcohol and triclosan which are chemicals. It is still necessary to wash hands with soap and water every time after 5-10 times rather than using hand sanitizer. Also, hand sanitizers that contain only alcohol as the active ingredient have a limited residual effect compared to hand sanitizers that contain a mixture of alcohol and an antiseptic such as chlorhexidine (Ministry of Health, 2011). However, alcohol is flammable, causes dryness and irritation of the skin on repeated use and also increases the risk of viral infections that trigger inflammation of the digestive tract.

The preliminary study conducted at RSU Karsa Husada Batu from January 2019 to December 2019 showed the hand hygiene compliance in the inpatient room reached only 60% of the minimum standard of compliance hand hygiene for nurses which should have been achieved minimum standard of 80%. Meanwhile, from January 2020 to August 2020, 65% of the staff's compliance with hand washing in the inpatient room was obtained. Additionally, based on observations made by researchers on February 2020 in one of the inpatient rooms there were 6 nurses on duty, the researchers saw that 5 out of 6 nurses in the inpatient room did not apply 5 moment and 6 step hand washing in accordance with PPI standards (Infection Prevention and Control) implemented in the hospital properly. Based on the explanation above, researcher would like to find any difference on allergic reaction between the use of hand sanitizer gel and liquid which were used by nurses at RSU Karsa Husada Batu during hand hygiene practice.

2. Methods

This research was a cross-sectional approach and quantitative research design using observational methods. The data of demographic information and allergic reaction collected using checklists and questionnaires. The population in this study were 100 nurses who working at the inpatient ward at RSU Karsa Husada Batu and about 80 respondents recruited using probability sampling of simple random sampling.

The research variables used in this study are including the use of hand sanitizer gel (a) and hand sanitizer liquid (b) as independent variables and for the dependent variable is the manifestation of an allergic reaction. In this study the instruments used were observation sheets and questionnaires. Data analysis techniques of univariate analysis described using tabulation and for bivariate analysis the form of non-parametric statistical statistical tests Mc Nemar's test were used.

3. Results and Discussion

3.1 Respondent demographic characteristics

The demographic characteristics of the respondents in this study are presented in the following table:

Table 1. Characteristics of respondents based on hand sanitizer allergies

Indicator		Allergic Reaction to Hand Sanitizer			
		YES		NO	
		N	%	N	%
Age	17-25	3	10%	0	0%
	26-35	24	80%	36	72%
	36-45	2	7%	14	28%
	>45	1	3%	0	0%
Total		30	100%	50	100%
Education level	D3	18	60%	32	64%
	S1	12	40%	18	36%

Total		30	100%	50	100%
Length of work	1-10 years	23	77%	30	60%
	11-20 years	6	20%	20	40%
	> 20 years	1	3%	0	0%
Total		30	100%	50	100%

The table above shows the most nurses with hand sanitizer allergies reaction were at the age of 26-35 years old, graduated from Diploma education, and the participant who have been working in RSU Karsa Husada batu for one to ten years. [Kristianingsih, Winarni & Kustyorini \(2022\)](#) mentioned in their publication that the length of work influences the performance of nurses, which mean the longer the length of work, the more nurses to exposed with the use of gel or liquid hand sanitizer. This was in line with a study in Japan, it is found that the older the nurses and the more days per month spent on practical work will resulted a hand eczema higher than those with healthy skin ([Šakić et al, 2022](#)).

2. Allergic characteristics on gel form

Allergy characteristics of hand sanitizer gel on the skin include itching, heat, rash, cracking, dryness, lesions, blisters, and thickening presented in the following table:

Table 2. Allergy reactions to Hand Sanitizer Gel

Indicator		Allergic reaction to Hand Sanitizer	
		Yes	No
		N	%
Itchy	Yes	15	19%
	No	65	81%
	Total	80	100%
Hot	Yes	12	15%
	No	68	85%
	Total	80	100%
Redness	Yes	13	16%
	No	67	84%
	Total	80	100%
Cracking	Yes	19	24%
	No	61	76%
	Total	80	100%
Dry skin	Yes	41	51%
	No	39	49%
	Total	80	100%
Lesion	Yes	7	9%
	No	73	91%
	Total	80	100%
Blister	Yes	1	1%
	No	79	99%
	Total	80	100%
Thickening	Yes	9	11%
	No	71	89%
	Total	80	100%
Skin rash	Yes	16	27%
	No	64	73%
	Total	80	100%

Based on table 2 above, it shows the criteria for an allergic reaction in the use of hand sanitizer gel showed a mild allergic reaction, skin blistered by 1% (N=1), 9% experienced lesions (N = 7), 11% skin thickening (N=9), 15% experienced of elevated of temperature in the hand (N=12), 27% skin rash (N=16), 19% itching (N=15), and 24% skin cracking or rupture (N=19),

while those who entered the criteria for moderate allergies, namely experiencing dryness as much as 51% (N=41).

Based on the results of data analysis many respondents showed mild allergic reaction and prefer in using hand sanitizer gel because it is less likely to experience allergic reactions and resulting a cold reaction in their skin during hand hygiene. It is related with the glycerine which can moisturize the skin of the hands, strengthen the protective layer of the skin, speed up wound healing, prevent infection of the skin, and protect the skin from infection in the composition of hand sanitizer gel. However, the gel type of hand sanitizers can increase the time to kill bacteria 30 seconds longer than liquid hand sanitizers so it is very good for keeping hands clean longer throughout the day because the gel maintains the moisturizer of the skin better than liquid form.

In line with the findings of the study, many hand sanitizers come from alcohol or ethanol which are mixed together with a thickening agent, for example carbomer, glycerine, and make it look like jelly foam to make it easier to use. This gel has become popular because it is easy and practical to use without the need for water and soap. This sanitizing gel is a convenient alternative for people (Asngad et al., 2018). People generally like the use of hand sanitizer in gel form because it causes a cold feeling on the skin and dries easily. The gel preparation material that is commonly used is carbopol 94, because it has high stability and low toxicity, so it can increase the effectiveness of using the gel as an antibacterial. This is in accordance with the results of research by Astuti, et al (2015).

3. Allergy Characteristics on Liquid/Liquid Hand Sanitizer form

Characteristics of hand sanitizer liquid allergy on the skin including itching, heat, rash, cracking, dryness, lesions, blisters, and thickening are presented in the following table:

Table 3. The characteristics of allergy on liquid form of hand sanitizer

Indicator		Allergic reaction on liquid form	
		Yes	No
		N	%
Itchy	Yes	13	16%
	No	67	84%
	Total	80	100%
Hot	Yes	17	21%
	No	63	79%
	Total	80	100%
Redness	Yes	11	14%
	No	69	86%
	Total	80	100%
Cracking	Yes	24	30%
	No	56	70%
	Total	80	100%
Dryness	Yes	49	61%
	No	31	39%
	Total	80	100%
Lesion	Yes	11	14%
	No	69	86%
	Total	80	100%
Blister	Yes	3	4%
	No	77	96%
	Total	80	100%
Thickening	Yes	11	14%
	No	69	86%

			Allergic reaction on liquid form	
			Yes	No
			N	%
Skin rash	Total		80	100%
		Yes	34	57%
		No	46	43%
Total			80	100%

Based on table 3 above, the respondents showed an allergic reaction to using liquid hand sanitizer which is a mild allergic reaction, namely 4% blistering, 14% rash, 14% lesion, 14% thickening, 16% itching, 21% heat, 30% rupture, while which is a moderate allergic reaction in the form of dry skin with a percentage of 61%.

Based on the results of data analysis, it can be seen that the advantage of using hand sanitizers made from liquid/liquid is one of the ingredients, namely chlorhexidine which can fight infections caused by bacteria, is effective in dealing with various manifestations of inflammation and in killing bacteria faster, less than 15 seconds from contact with the skin and more dries quickly when used. While the drawback is that it evaporates faster and runs out in its use. Only the majority choose to use liquid/liquid hand sanitizers because they feel the heat more often.

According to the Center for Disease Control (CDC), hand sanitizers are divided into two, containing alcohol and not containing alcohol. Hand sanitizers with an alcohol content between 60-90% have a good anti-microbial effect compared to those without alcohol content. However, if your hands are really dirty, whether by soil, air or other things, washing your hands using water and soap is more recommended because hand washing gels, both alcohol and non-alcoholic based, effectively kill germs, this gel cannot clean hands or other organic materials [Irnawati, Sulistyanto, & Arifin \(2021\)](#). In addition, to reduce the accumulation of emollients on the hands after repeated use of hand sanitizers, it is still necessary to wash hands with soap and water every time after 5-10 times using hand sanitizers. Finally, hand sanitizers that contain only alcohol as the active ingredient have a limited residual effect compared to hand sanitizers that contain a mixture of alcohol and an antiseptic such as chlorhexidine [\(Rasidy, 2006\)](#). However, alcohol is flammable, causes dryness and irritation of the skin on repeated use and also increases the risk of viral infections that trigger inflammation of the digestive tract. Therefore an idea emerged to utilize natural ingredients that can reduce the risk of digestive disorders [\(Cahyani, 2014\)](#).

4. Hypothetical analysis

After obtaining data from the use of hand sanitizer gel and liquid on allergic reactions to hand washing, these results were then tested using the McNemar Test as follows:

	Signifikansi
McNemar Test	0,033

The results of the analysis using the Mc-Nemar test show a p value of 0.033 where the p value is less than 0.05 (p value (0.033) <0.05) which means that the use of hand sanitizer gel and liquid has a significant difference in allergic reactions among inpatient ward nurses at RSU Karsa Husada Batu.

Based on the results of data analysis, the use of liquid hand sanitizers more than a week resulting 4-61% allergies, cracks, dryness, lesions, blisters and thickening of the skin. The highest

data is 61% experiencing dry allergic reactions on the skin of the hands. From the data above, it can be concluded that the effectiveness of hand sanitizer liquid is in terms of time, it is faster to kill bacteria and viruses in less than 15 seconds, but it is more likely to experience allergic skin reactions after using it.

Acute irritant dermatitis or skin rash is one of the reactions that arise can change the skin into reddish or brown in colour and possibly causing swelling and hot. Some in severe reaction resulting a papules, vesicles, and pustules. Strong irritant dermatitis occurs after one or several times of application with strong irritant ingredients, resulting in damage to the epidermis which results in skin inflammation. Acidic and alkaline chemicals that are harsh in factory industrial use will cause acute irritation. Chronic irritant dermatitis occurs when the skin comes in direct contact with irritants that are not too strong, such as soaps, detergents and antiseptic solutions. Symptoms of acute dermatitis include dry, cracked, red, swollen and hot skin. Normal saline can be used and effective for wound treatment on people with dermatitis atopic (Wahyuni, 2014).

Allergic Contact Dermatitis Allergic Contact Dermatitis (DKA) is a skin disorder that occurs in a person who is sensitive to materials that have allergenic properties. Allergic contact dermatitis accounts for approximately 20% of all contact dermatitis. Allergic contact dermatitis is something that arises after making external contact through a toxic process. Causes of allergic contact dermatitis include strong acids and bases, and organic solvents. A feeling of heat, pain or itching that is complained of by sufferers after a while of making contact with the material which is the symptom (Sularsito & Soebaryo, 2018).

5. Conclusion

Based on the results of the research and the description of the discussion in the previous chapter, it can be concluded that, both handsanitizer gel and liquid have their own advantages and disadvantages, scientifically both were equally effective to kill the bacteria as long as they are used correctly and properly. The nurses need to also applied the hand sanitizer to the sidelines of the fingers and under the nails. The most important element in selecting a hand sanitizer is suitable for the individual skin.

The use of liquid form of hand sanitizers showed a higher risk in developing the skin allergies reaction than the gel form of hand sanitizers. The use of liquid/liquid hand sanitizers causes chronic irritant dermatitis, namely allergies, cracks, dryness, lesions, blisters and thickening of the skin. Meanwhile, hand sanitizer gel causes allergies, heat, itching and rashes on the skin.

Most hand sanitizer allergies were showed at the age of participant between 26-35 years old, graduated from Diploma education, and to the nurses who have been working for one to ten years at the inpatient facilities at RSU Karsa Husada Batu. Lastly the study also concluded that the use of hand sanitizer gel and liquid showed a significant difference in the allergic reaction among the nurse at RSU Karsa Husada Batu in practice the hand hygiene.

Ethics approval and consent to participate

The study has been declared ethically appropriate within reference No. 072/1073/102.6/2021 by Health Research Ethics Committee RSU Karsa Husada Batu.

Acknowledgments

Author thank to RSU Karsa Husada for valuable support in data collection.

References

- Ana Rida Diana, Ii, B A B (2012). Hidup, Perilaku Hand Sanitizer Gel Dan Spray hal 13-33. http://eprints.poltekkesjogja.ac.id/751/7/4_BAB_II.pdf
- Alsaidan, Mohammed Saud .Aisha H. Abuyassin, Zahra H. Alsaheed, Saqer H. Alshmmari, Tariq F. Bindaaj, and Alwa'ad A. Alhababi. (2020). The Prevalence and Determinants of Hand and Face dermatitis during COVID-19 Pandemic: A Population-Based Survey. <https://www.hindawi.com/journals/drp/2020/6627472/>
- Ariyanto, M. (2022). STUDI LITERATUR: IMPLEMENTASI PROTOKOL KESEHATAN (MEMAKAI MASKER, MENJAGA JARAK DAN MENCUCI TANGAN) DALAM MENCEGAH PENULARAN COVID-19 (Doctoral dissertation, Universitas Muhammadiyah Malang).
- Asngad, et al. (2018). Kualitas Gel Pembersih Tangan (Handsantizer) dari Ekstrak Batang Pisang dengan Penambahan Alkohol, Triklosan dan Gliserin yang Berbeda Dosisnya. <http://journals.ums.ac.id/index.php/bioeksperimen/article/download/6888/4121>
- Astuti Palupi, Briliana Nur Rohima, Syarah Rysty, Ulupi Rina Hapsari (2015). Decreasing of hand colonization and sterility of refill antiseptic in Dr. Yap Eye Hospital, Yogyakarta. <https://journal.ugm.ac.id/bik/article/view/69972>
- Azwar S. (2011). Sikap Dan Prilaku Dalam: Sikap Manusia Teori Dan Pengukurannya. Yogyakarta: Pustaka Pelajar.
- Bappenas. (2013). Planning Guidelines for the National Movement Program for the Acceleration of Nutrition Improvement in the Context of the First Thousand Days of Life (1000 HPK Movement). Jakarta: National Development Planning Agency.
- Bastien, S., Kajula, L., & Muhwezi, W. (2011). A review of studies of parent-child communication about sexuality and HIV / AIDS in sub-Saharan Africa. *Reproductive Health*, Vol. 8, p. 25. <https://doi.org/10.1186/1742-4755-8-25>
- BKKBN. (2014). Report on the Performance of Government Agencies of the 2014 National Population and Family Planning Agency (BKKBN). Jakarta.
- BPOM, (2019). Badan Pengawasan Obat dan Makanan. Jakarta: <http://www.pom.go.id/>
- Cahyani, V.R. (2014). Petunjuk Praktikum Mikrobiologi Pangan. Universitas Sebelas Maret: Surakarta.
- Cherie, N. (2018). Parent-Adolescent Communication about Sexual and Reproductive Health and Associated Factors among Preparatory School Students in Haiyk Town, North East Ethiopia. *Research in Medical & Engineering Sciences*, 5 (2). <https://doi.org/10.31031/rmes.2018.05.000606>
- Citra Kunia putri dan trisna insan Noor, (2013). Pengaruh Diseminasi Dokter Kecil Tentang Penggunaan Hand Sanitizer Gel dan Spray Terhadap Penurunan Angka Kuman Tangan Siswa SDN Demakijo Gamping Sleman. Skripsi. Poltekkes Kemenkes Yogyakarta. http://eprints.poltekkesjogja.ac.id/1215/6/6_CHAPTER_4.pdf
- Cohen, D.E. 2018, Fourth Edition *Dermatology*, Elsevier, United States, accessed 13 April 2021, Available at: <https://www.clinicalkey.com/#!/content/book/3-s2.0-B9780702062759000155>
- CDC. 2016. *Infection Control: Standards for Nursing Practice*, 15 februari 2016. http://s3.amazonaws.com/EliteCME_WebSite_2013/f/pdf/ANCCGA08ICI17.pdf
- Desiyanto, A.F. & Djanah, S.N. (2013). Efektifitas Mencuci Tangan Menggunakan Cairan Pembersih Tangan Antiseptik Terhadap Jumlah Angka Kuman. 7, 2
- Dessie, Y., Berhane, Y., & Worku, A. (2015). Parent-adolescent sexual and reproductive health communication is very limited and associated with adolescent poor behavioral beliefs

- and subjective norms: Evidence from a community based cross-sectional study in Eastern Ethiopia. *PLoS ONE*, 10 (7). <https://doi.org/10.1371/journal.pone.0129941>
- Dharma, K. K. (2011). *Metodologi Penelitian Keperawatan: Panduan Melaksanakan Dan Menerapkan Hasil Penelitian*. Jakarta: Trans Info Media.
- Dwi Widiyaningsih, Dwi Suharyanta.(2020). *Promosi Dan Advokasi Kesehatan*. Yogyakarta: CV Budi Utama.
- Enie Novieastari, Kusman Ibrahim, Sri Ramdaniati, Deswani Deswani. (2019). *Fundamentals of Nursing Vol 1- 9th Indonesian Edition - Google Books*. Jakarta: Hooi Ping Che.
- Ernawati. E. (2014). *Penerapan Hand hygiene Perawat di Ruang Rawat Inap Rumah Sakit*. 28, 1.
- Fanta, M., Lemma, S., Gamo, G., & Meskele, M. (2016). Factors associated with adolescent & parent communication of reproductive & health issues among high school and preparatory students in Boditi town, Southern Ethiopia: a cross-sectional study. *Patient Intelligence, Volumes 8*, 57–70. <https://doi.org/10.2147/pi.s97838>
- Fonacier, L., Bernstein, D. I., Pacheco, K., Holness, D. L., Blessing-Moore, J., Khan, D., Lang, D., Nicklas, R., Oppenheimer, J., Portnoy, J., Randolph, C., Schuller, D., Spector, S., Tilles, S., & Wallace, D. (2015). Contact Dermatitis: A Practice Parameter-Update 2015. *Journal of Allergy and Clinical Immunology: In Practice*, 3(3), S1–S39. doi.org/10.1016/j.jaip.2015.02.009
- Germany, P., & Constantine, NA (2010). Demographic and Psychological Predictors of Parent-Adolescent Communication About Sex: A Representative Statewide Analysis. *Journal of Youth and Adolescence*, 39 (10), 1164–1174. <https://doi.org/10.1007/s10964-010-9546-1>
- Gupta, S. K., Monika, & Gupta, V. (2016). An Overview of Airborne Contact Dermatitis. *Air & Water Borne Diseases*, 5(1), 4–6. <https://doi.org/10.4172/2167-7719.1000128>
- Hand Sanitizer Gel & Spray, Mana yang Lebih Ampuh Cegah Virus?. <https://health.detik.com/berita-detikhealth/d-5049576/hand-sanitizer-gel--spray-mana-yang-lebih-ampuh-cegah-virus>.
- Hapsari, et. All. (2018). Knowledge of Surveillance Officers on Identification of Healthcare-associated Infections in Surabaya. <https://e-journal.unair.ac.id/JBE/article/download/8613/5369>
- https://www.academia.edu/23115286/Pedoman_Pencegahan_dan_Pengendalian_Infeksi_di_Rumah_Sakit_dan_Fasilitas_Pelayanan_Kesehatan_lainnya
- <https://id.wikipedia.org/wiki/Infeksi>
- Irnawati, I., Sulistyanto, B. A., & Arifin, M. (2021, December). Manajemen Keperawatan Pencegahan Covid-19, Menjaga Imunitas Saat Puasa pada Non Communicable Disease dan Pengobatan Gratis. In *Prosiding Seminar Nasional Kesehatan (Vol. 1, pp. 885-896)*.
- Kristianingsih, Winarni & Kustyorini (2022). Length of work improves nurse performance. <https://ejournal.umm.ac.id/index.php/keperawatan/article/view/20634/11083>
- Kajula, LJ, Sheon, N., Vries, H. De, Kaaya, SF, & Aarø, LE (2014). Dynamics of parent-adolescent Communication on sexual health and HIV / AIDS in Tanzania. *AIDS and Behavior*, 18 (SUPPL. 1), S69-74. <https://doi.org/10.1007/s10461-013-0634-6>
- Litchman G, Nair PA, Atwater AR, Bhutta BS. Contact Dermatitis. 2021 Feb 7. In: *StatPearls [Internet]*. Treasure Island (FL): StatPearls Publishing; 2021 Jan-. PMID: 29083649.
- Manu, AA, Mba, CJ, Asare, GQ, Odoi-Agyarko, K., & Asante, RKO (2015). Parent-child communication about sexual and reproductive health: Evidence from the Brong Ahafo region, Ghana. *Reproductive Health*, 12 (1). <https://doi.org/10.1186/s12978-015-0003-1>
- Masloman, Anugrah Pradana, G. D Kandau,Ch. R. Tilaar. (2015). Analisis Pelaksanaan Pencegahan dan Pengendalian Infeksi di Kamar Operasi RSUD Dr Sam Ratulangi Tondano. <https://ejournal.unsrat.ac.id/v3/index.php/jikmu/article/view/7440/6984>

- Mathur, P. (2010). Hand Hygiene: back to the basics of infection control. New Delhi: Indian J Med Res. 2011 Nov; 134 (5).
- Mekonen, MT, Dagne, HA, Yimam, TA, Yimam, HN, & Reta, MA (2018). Adolescent-parent communication on sexual and reproductive health issues and associated factors among high school students in Woldia town, northeastern Ethiopia. Pan African Medical Journal, 31, 35. <https://doi.org/10.11604/pamj.2018.31.35.13801>
- Ministry of Health. Indonesia. (2011). Diarrhea condition in Indonesia. Jakarta: Kementerian Kesehatan RI
- Fauzia, Neila, Anis Ansyori, Tuti Hariyanto. (2014). Kepatuhan Standar Prosedur Operasional Hand Hygiene pada Perawat di Ruang Rawat Inap Rumah Sakit. <https://jkb.uib.ac.id/index.php/jkb/article/view/526>
- Nur Hidayah, Nur Fadhliah Rahmadhani, 2019. Kepatuhan Tenaga Kesehatan Terhadap Implementasi Hand Hygiene di Rumah Sakit Umum Daerah Haji Kota Makasar. <https://jurnal.stikes-yrsds.ac.id/index.php/JMK/article/view/236>
- Nursalam. (2015). manajemen keperawatan: aplikasi dalam praktek keperawatan profesional (edisi 5). Jakarta: Salemba medika.
- Nursalam. (2016a). Metodologi Penelitian Ilmu Keperawatan: Pendekatan 60 Praktis (edisi 4). Jakarta: Salemba medika.
- Nurachmah, E., Afyanti, Y., Yona, S., Ismail, R., Padang, JT, Suardana, IK, ... Kusuma Dharma, K. (2018). Mother-daughter communication about sexual and reproductive health issues in Singkawang, West Kalimantan, Indonesia. Enfermería Clínica, 28, 172–175. [https://doi.org/10.1016/S1130-8621\(18\)30061-5](https://doi.org/10.1016/S1130-8621(18)30061-5)
- Notoatmodjo, Soekidjo, 2014. Metodologi Ilmu Kesehatan. Jakarta: Penerbit Rineka Cipta.
- Notoatmodjo, Soekidjo, 2016. Metodologi Penelitian Kesehatan. Jakarta: Penerbit Rineka Cipta.
- Oktaviani.J. (2018). Jurnal Berkala Epidemiologi Volume 6 Nomor 2 (2018). <https://sinta.unud.ac.id/uploads/wisuda/1202116022-3-bab%202.pdf>
- Priyono, 2016. metode penelitian kuantitatif. Sidoarjo: Zifatama Publishing. Rokhman, Wahibur.
- Patricia A. Potter, et al.(2019). Essentials for Nursing Practice - E-Book. [https://books.google.co.id/books?id=wDtRDwAAQBAJ&pg=PA249&dq=\(CDC,+2009\)+hand+sanitizer&hl=id&sa=X&ved=2ahUKEwiMusKdhprtAhVKzTgGHay_DJIQ6AEwAHoECAYQAg](https://books.google.co.id/books?id=wDtRDwAAQBAJ&pg=PA249&dq=(CDC,+2009)+hand+sanitizer&hl=id&sa=X&ved=2ahUKEwiMusKdhprtAhVKzTgGHay_DJIQ6AEwAHoECAYQAg)
- Purwandari, R., & Ardiana, A. (2013). Hubungan antara perilaku mencuci tangan dengan insiden diare pada anak usia sekolah di Kabupaten Jember. Jurnal Keperawatan, 4(2).
- Rasidy, G. (2006). Manfaat Penggunaan Antiseptik Kombinasi Alkohol Chlorhexidine Gluconate-Emolien Dibandingkan Dengan Chlorhexidine Gluconate Terhadap Jumlah Bakteri Pada Tangan Perawat Di Perinatologi. ICU Anak, NICU RSCM.
- RI Ministry of Health. (2018). InfoDATIN Data and Information Center Ministry of Health RI: Adolescent Reproductive Health Situation. Jakarta.
- Ruhyannuddin, F. (2017). The impact of hand washing on the incident of diarrhea among school-aged children at the District of Malang. Jurnal Keperawatan, 8(1).
- Šakić, F., Babić, Ž., Franić, Z., & Macan, J. (2022). Characteristics of hand eczema in final-year apprentice nurses during the COVID-19 pandemic. Contact dermatitis, 86(2), 98-106.
- Shiferaw, K., Getahun, F., & Asres, G. (2014). Assessment of adolescents 'communication on sexual and reproductive health matters with parents and associated factors among secondary and preparatory schools' students in Debremarkos town, North West Ethiopia. Reproductive Health, 11 (1), 2. <https://doi.org/10.1186/1742-4755-11-2>
- Sukaesi, I. (2016). Factors Analyze on the Performance of Nurses in the Implementation of Patient Safety. Jurnal Keperawatan, 7(1).
- Sularsito, S.A. & Djuanda, S. 2013, Ilmu Penyakit Kulit dan Kelamin : Dermatitis, 6th edn, Badan Penerbit FKUI, Jakarta.

- Sularsito, S.A. & Soebaryo, R.W. 2018, Ilmu Penyakit Kulit dan Kelamin : Dermatitis Kontak, 6th edn, Badan Penerbit FKUI, Jakarta.
- Sugiyono.(2016). Metode Penelitian Kuantitatif, Kualitatif dan R&D. Bandung: PT Alfabet
- Taddele, M., Jara, D., & Hunie, A. (2018). Level of Parent Adolescent Communication on Sexual and Reproductive Health Issues and Associated Factors among Debre Markos Preparatory School Students, in Debre Markos Town, East Gojjam, Zone, Ethiopia. *Universal Journal of Public Health*, 6 (4), 203–209. <https://doi.org/10.13189/ujph.2018.060406>
- Wahyuni, T. D. (2014). Pembersihan Luka Dermatitis Atopik dengan Cairan Normal Salin. *Jurnal Keperawatan*, 5(1).
- World Health Organization. (2010). WHO Guideline on Handhygiene in Health care (Advanced Draft) tahun 2006 WHO/EIP/SPO/QPS/06.2 [cited 2006: Available at: http://premierinc.com/safety/topics/gui_delines/downloads/whohand-hygiene-guidelines.pdf.
- World Health Organization. (2015). Word Hand Hygiene Day. Save Live: Clean Your Hands. <https://www.who.int/campaigns/world-hand-hygiene-day>
- Wulansari, Nadya Treesna Parut, Anselmus Aristo. (2019). Pengendalian Jumlah Angka Mikroorganisme Pada Tangan Melalui Proses Hand Hygiene. <https://jurnal.undhirabali.ac.id/index.php/mp3/article/view/694Z>.
- Irnawati. (2019). BERKARYA BERSAMA DI TENGAH COVID-19. <https://books.google.co.id/books?id=YE4CEAAAQBAJ&pg=PA258&dq=pengertian+hand+sanitizer&hl=id&sa=X&ved=2ahUKEwjRiInV2ZjtAhW763MBHYueAzkQ6AEwAHoECAQQAg>
- Yohannes, Z. (2015). Factors Associated with Parent-Adolescent Communication on Sexual and Reproductive Health Issues Among Secondary and Preparatory School Students in Mekelle City, North Ethiopia. *Science Discovery*, 3 (6), 55. <https://doi.org/10.11648/j.sd.20150306.13>