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Effect of an educational intervention on adherence to hand hygiene among patients undergoing chemotherapy: A quasi-experimental study

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ABSTRACT

This study aimed to investigate the effect of a multifaceted intervention on adherence to hand hygiene among patients undergoing chemotherapy. The paper describes a quasi-experimental study. The patients' adherence to hand hygiene at the times of admission and discharge from the hospital and the incidence of infection after the intervention were measured in the intervention and control groups. In the intervention group, the rate of adherence to hand hygiene was higher than the control group in terms of perception ($p = 0.0001$), performance ($p = 0.0001$), the reason for non-adherence ($p = 0.002$), and the total score for adherence to hand hygiene ($p = 0.0001$). There was no significant difference between the two groups in terms of the incidence of infection ($p = 1$). Implementing the designed multifaceted intervention increased the rate of patients' adherence to hand hygiene in the intervention group, but did not decrease the rate of infection on the inpatient unit. The findings offer support for designing and implementing a multifaceted intervention to enhance hand-washing behaviour of patients.

Keywords: cancer, infection, hand hygiene, multifaceted intervention

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INTRODUCTION

Cancer is a cause of 12% of deaths worldwide and the second leading cause of death in Iran (Abad et al., 2015). In 2021, cancer incidence and mortality rates were an estimated 19.3 million and almost 10.0 million respectively worldwide. The most common cancer diagnoses were breast (2.26 million cases), lung (2.21), and prostate (1.41); the most common causes of cancer death were lung (1.79 million deaths), liver (830,000), and stomach (769,000; Ferlay et al., 2021).

Chemotherapy is one of the most common methods of treatment among cancer patients. The most frequent side effect of this treatment is neutropenia, which increases the risk of infection among these patients. For example, it was reported that the rate of infection in patients with neutropenic cancer was 55.4% (Haverstick et al., 2017). Due to the suppression of the immune system caused by chemotherapy, oncology patients are considered a population that is at high risk of severe episodes of infection (Sung et al., 2021). The increased risk for infection among cancer patients undergoing chemotherapy is almost two times higher than for non-cancer patients (Rusu et al., 2018). If these patients develop a post-chemotherapy infection, it can potentially delay chemotherapy treatment and, in turn, impact the outcomes of cancer treatment (Abad et al., 2015). Post-chemotherapy infections are reported as a major cause of death in cancer patients (Azamjah, 2019; Rusu et al., 2018). Consequently, these patients face a significant risk of hospital-acquired infections, which can increase side effects and increase mortality (Fox et al., 2015).

Nosocomial infection is a subset of infectious diseases that may develop 24 to 72 hours after admission to hospital (Ziaee et al., 2017). It is estimated that 5% to 25% of hospitalized patients acquire nosocomial infections (Birgani & Asadpoor, 2011). The rate of acquired nosocomial infections is 7% in high-resource countries and 10% in low-resource countries (Khan et al., 2017). Common modes of infection spread include syringe contamination; unsterilized surgical equipment; shared use of foodstuffs, such as food and water; and direct transmission of pathogenic agents from one person to another through contact between members of the treatment team and the patient, or from patient to patient. Transmission of pathogenic agents through touching of hands is one of the most common ways of infection spread (Haverstick et al., 2017). In one study, the hands of 39% of the patients were contaminated with at least one pathogenic organism, and 8% were contaminated with two pathogens within 48 hours of admission to the hospital (Pokrywka et al., 2017). Therefore, hand hygiene is seen as a powerful way to prevent the acquisition of pathogens and their transmission from one person to another (Rai et al., 2017).

Hand hygiene is essential in preventing healthcare-associated infections (Lawson et al., 2021). Due to the financial burden of endemic healthcare-associated infections worldwide, and the resulting high mortality rate, prevention is the best strategy to avoid getting an infection (Zimlichman et al., 2013). Hand hygiene is the single most effective way to prevent the spread of infections (Haverstick et al., 2017). Increasing adherence to hand hygiene by at least 20% reduces hospital-acquired infections (Harbarth et al., 2003). Thus, interventions to improve hand hygiene adherence among care service providers and patients are necessary (Ardizzone et al., 2013).

Hand hygiene effectively and potentially eliminates the pathogens from the patient's hands and effectively prevents the transmission of oral-anal infection. However, adherence to hand hygiene in patients is low, with only about 10% of patients observing hand hygiene in critical situations (Pokrywka et al., 2017). Since many factors play a role in patients' adherence to hand hygiene, its enhancement requires intervention with multiple aspects. Multifaceted interventions mean the intervention has two or more components that are implemented in different stages yet target several aspects simultaneously (Squires et al., 2014). The present study was conducted to determine the effect of a multifaceted intervention on adherence to hand hygiene and the incidence of infection among patients undergoing chemotherapy.

METHODS

This study used a quasi-experimental study with two groups: a control group and an intervention group with sequential assignment. The study population included patients undergoing chemotherapy admitted to the oncology ward of Tohid Hospital, Sanandaj City, in 2022. Inclusion criteria were 1) cancer diagnosis confirmation by the physician, 2) hospitalization in the oncology ward for chemotherapy, 3) absence of any signs of infection upon arrival in hospital, 4) willingness to participate in the study (informed consent) and, 5) not receiving other therapeutic interventions, such as radiotherapy. Exclusion criteria were 1) unwillingness to continue participation in the study, 2) undergoing an invasive procedure (e.g., surgery, non-routine catheterizations such as chest tube insertion), and 3) having a risk of infection due to other reasons.

Using Laskar et al.'s (2018) reported adherence to hand hygiene in the pre-intervention and post-intervention phases of 50% and 90%, a confidence level of 95% and test power of 90%, the required sample size was calculated as 30 individuals in each of the two group. To account for patient attrition, a total of 62 individuals finalized the study (Figure 1). A convenience sampling strategy was used to recruit cancer patients who were undergoing chemotherapy on the oncology ward of Tohid Hospital in Sanandaj city and met the inclusion criteria for the study. To avoid errors in the study due to the interference of patients during hospitalization and the possibility that the control group was aware of the interventions, all measurements for the control group happened before the intervention group recruited and the intervention was undertaken.

Control group process

Individuals were accrued to the control group first and received the usual standard of care. Routine measures during the admission process for the control group included hand hygiene training, receiving regular chemotherapy treatments, following the diet plan for chemotherapy patients, and completing a hand hygiene adherence questionnaire during the pre-intervention and post-intervention phases of the study (2 months). At the end of the study, the patients' adherence to hand hygiene (measured by questionnaire) and infection rates were recorded.

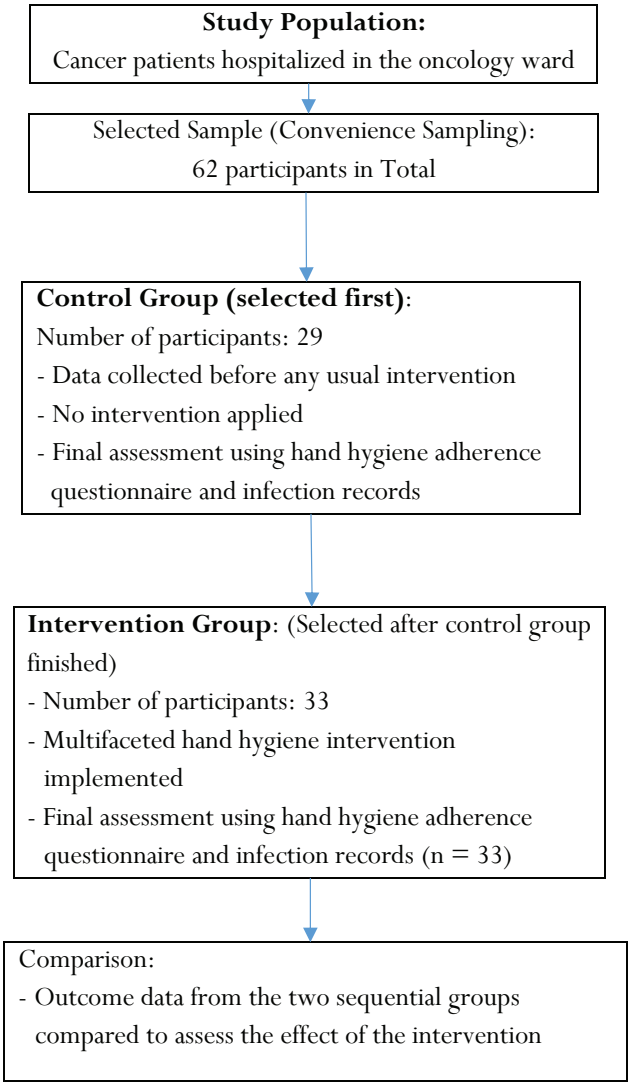
Intervention group process

In the intervention group, in addition to the above-mentioned routine measures provided to the control group, multifaceted interventions encompassed three phases (admission time, hospitalization time, and discharge time).

First phase: During admission time to the oncology ward, the intervention group were educated about the importance of hand hygiene and the correct hand-washing methods were done by using a role-playing method. Printable posters were used to help raise awareness about hand washing and hung in prominent public areas, such as schools, workplaces, and restrooms. Patients were equipped with disinfectant solutions, and they were taught

Figure 1

Flow Diagram for Study



how to disinfect their hands and use the disinfectants in cases where there is no access to a sink to wash their hands.

Second phase: During the hospitalization time, instructions on hand washing and the necessary times to wash their hands were completed by role playing. In the intervention patient rooms, printable posters were hung to help raise awareness about handwashing. Other aspects of the intervention included playing instructional videos, forming virtual groups consisting of patients in the intervention group and members of the research team, holding 'question and answer' meeting sessions in accordance with the healthcare protocol measures (i.e., masks, social distancing), equipping patients with disinfectant solution, training patient companions to help the patients when they need to wash their hands, giving a reward (e.g., disinfectant solution, extra handkerchief) for patients who were more active in the intervention's activities, and instruction about identifying the initial symptoms of infection, such as fever, dysuria, wet cough, anorexia chills. They were given to the patient and the patient's companion and were considered essential interventions.

Third phase: During the discharge time, patients completed a questionnaire regarding attitude toward hand hygiene. They were given an educational pamphlet on the importance of hand hygiene and the necessity of hand washing, which had been designed by the team. Instructions were given on how to communicate virtually, how to obtain any necessary information through WhatsApp, instructions on the symptoms of infection to be aware of, and how to inform the nurse or the trained personnel if signs or symptoms developed.

Data collection

Data collection tools included a demographic form, hand-hygiene performance questionnaire, and infection control form. The patient's demographic data form gathered information on age, gender, education, marital status, residence, housing status, accommodation status, income status, cancer type, duration of diagnosis, and chemotherapy frequency. The Survey of Hand Hygiene Practices among Patients (Sunkesula et al., 2015) is a seven-item questionnaire to assess opinions and practices regarding hand hygiene. Five items related to the patient's attitude toward hand hygiene, the level of perception about the importance of hand hygiene, and the times when the patient considers himself obliged to perform hand washing; a five-point Likert scale item related to hand hygiene practice; and a three-point Likert scale item related to the reason for non-adherence to hand hygiene protocols. The response options were strongly agree, agree, no opinion, disagree, strongly disagree. The data collection form regarding infection included nine related items: fever, chest x-ray, urine/blood cultures, skin lesions, sputum sample, leukopenia or a decrease in a particular type of white blood cell, and confirmation of infection by the competent authority. The criteria for acknowledging the presence of an infection in oncology patients includes a fever of 38.3°C or a fever of 38°C lasting for about 1 hour; in some patients, severe and sudden hypothermia; the presence of signs of infection in the chest X-ray, urine culture, blood culture, or positive sputum culture; or skin lesions indicating the presence of infection; neutropenia below 500; and two questions: is there an infection? No infection? Finally, the results were verified by the responsible physician (DeVita et al., 2008).

The forward-backward method was used for translating the hand hygiene questionnaire. The English version was given to a professional translator who translated it into Persian; then, another professional translated the Persian version back into English, and the two English versions were compared. To assess the content validity of the questionnaire, 10 experts evaluated each question. To check the reliability of the questionnaires, 30 patients who did not participate in the intervention study completed the questionnaire, and their reliability was assessed by Cronbach's alpha coefficient ($\alpha = 0.75$).

Ethical considerations

The approval license (IR.MUK.REC.1400.176) was obtained from the Ministry of Health and Medical Education, the College of Nursing and Midwifery, and the necessary approvals to conduct research and sampling in the hospital were obtained from the oncology ward of Tohid Hospital in Sanandaj City. The research objectives were explained to the patients participating in the study, and written consent forms were obtained from each participant. It was emphasized to the patients that they could withdraw from the study whenever they did not want to continue participating in the research. To respond to ethical considerations concerning the control group participants, after the treatment for the intervention group and related educational interventions were completed, hand hygiene education pamphlets were delivered to the control group.

Data analysis

Data analysis was completed using STATA software version 12. The Chi-Square test was used to compare gender, housing, accommodation, and chemotherapy frequency between groups. The Fisher Exact test was employed for marital status, education, residence, toilet, cancer type, employment status, and income comparisons between groups. The Mann-Whitney U test was applied to age and duration of diagnosis comparisons between groups. The Mann-Whitney U test was used to compare the hand hygiene adherence between two groups. The Wilcoxon signed-rank test was used for comparing hand hygiene adherence before and after in each group. The Fisher Exact test was employed to compare infection incidence between the two groups. A significance level of 0.05 was considered.

RESULTS

Demographic characteristics

The study participants had a mean age of 53.37 (±14.74) years in the control group and 53.21 (±12.34) in the intervention group. The control and intervention groups are homogeneous in terms of age ($p = 0.591$), gender ($p = 0.575$), marital status ($p = 0.458$), residence ($p = 0.8$), housing status ($p = 0.346$), accommodation status ($p = 0.23$), chemotherapy frequency ($p = 0.987$), employment ($p = 0.693$), and duration since diagnosis ($p = 0.144$). However, in terms of education ($p = 0.001$) and income ($p = 0.008$), statistically significant differences were evident (Table 1).

Table 1

Frequency Distribution of Demographic and Clinical Characteristics of Participants in the Study Intervention and Control Groups

Group demographic characteristics of patients		Control N = 29	Intervention N = 33	p-value
Gender	Female	17(50. 500)	17(50. 00)	0.575*
	Male	12(42.86)	16(57.1)	
Age (Mean±Standard deviation)		53.37±14.74	53.21 ±12.34	0.591***
Marital status	Single	2(33.33)	4(66.67)	0.458**
	Married	24(46.15)	28(56.85)	
	Divorced & Widow	3(75.00)	1(25.00)	
Residence	Urban	19(65.51)	19(57.57)	0.800**
	The Suburbs	2(6.89)	4(12.12)	
	Village	8(27.6)	10(30.31)	
Housing	Owner	24(50.00)	24(50.00)	0.346*
	Rental	5(35.71)	9(64.29)	
Accommodation	Private	8(61.54)	5(38.46)	0.230*
	Public	21(42.86)	28(57.14)	
Toilet	Private	1(33.33)	2(66.67)	1.000**
	Public	28(47.46)	31(52.54)	
Cancer type	Digestive	10(50.00)	10(50.00)	0.681**
	Breast	7(58.33)	5(41.67)	
	Blood	3(27.27)	8(72.73)	
	Bone	2(33.33)	4(66.67)	
	Genitourinary	3(60.00)	2(40.00)	
	Lung	4(50.00)	4(50.00)	
Chemotherapy frequency	1–4 sessions	14(46.67)	16(53.33)	0.987*
	More than four sessions	15(46.88)	17(53.13)	
Employment status	Housewife	16(55.17)	13(44.83)	
	Employee	1(25.00)	3(75.00)	
	Freelancer	6(40.00)	9(60.00)	
	Worker	5(50.00)	5(50.00)	0.693**
	Student	1(50.00)	1(50.00)	
	Unemployed	0(0.000)	2(100.00)	
Duration of diagnosis	Month	8.20 ±11.70	10.78±10.74	0.144***
Education	Illiterate	15(78.95)	4(21.05)	0.001**
	Diploma	14(26.84)	24(63.16)	
	Academic	0(0.000)	5(100.00)	
Income	Sufficient	2(15.38)	11(84.62)	0.008**
	Insufficient	27(84.62)	21(43.75)	
	More than sufficient	0(0.00)	1(100.00)	

Note. * Chi-Square test
**Fisher Exact test
***Mann-Whitney U test

Table 2

Comparing the Adherence to Hand Hygiene and Infection Incidence Among Study Groups Before and After Intervention in Control and Intervention Groups

Group Adherence to hand hygiene		Control (*n* = 29)	Intervention (*n* = 33)	p-value**
Perception	Before	19.34±2.99	18.45±3.44	0.284
	After	21.24±2.64	23.48±1.85	0.0002
	p-value*	0.0001	0.0001	
Performance	Before	19.62±3.64	16.33±5.08	0.0058
	After	22.37±22.96	22.30±22.45	0.9088
	p-value*	0.0001	0.0000	
Non-adherence reason	Before	9.10±2.96	7.78±3.89	0.127
	After	8.37±22.71	5.51±22.72	0.0001
	p-value*	0.837	0.002	
Total score(adherence)	Before	48.06±5.84	42.57±7.32	0.0014
	After	52.00±52.69	51.30±32.65	0.3495
	p-value*	0.0003	0.0000	
Infection incidence*** *n*(%)	Positive	2 (40)	3 (60)	1
	Negative	27 (47.37)	30 (52.63)	

Note. * Wilcoxon test
** Mann-Whitney test
*** Fisher Exact test

Comparison of baselines and outcome measures

The analysis of the within-group comparisons over time showed significant differences between baseline and outcome in the control group for scores on perception (p = 0.0001), performance (p = 0.0001) and total adherence scores (p = 0.0003). Scores for non-adherence reasons were not statistically different (p = 0.837). In the intervention group, all scores were statistically different between baseline and outcome.

Analysis comparing the control and intervention groups showed both groups were similar at baseline in terms of perception (p = 0.284) and non-adherence reason (p = 0.127). These two dimensions showed statistically significant differences after the intervention. On the other hand, the two groups were different at baseline on performance (p = 0.0058) and total score adherence (p = 0.0014). Neither of these dimensions showed statistically significant difference following the intervention.

In the control group, two patients exhibited signs of infection, while in the intervention group three patients showed signs. There was no statistically significant difference in the rates of infection over time (Table 2).

DISCUSSION

The study demonstrated a statistically significant improvement in patients' adherence to hand hygiene across three dimensions—perception, performance, and reasons for non-adherence—in the intervention group between pre- and post-intervention assessments. Specifically, the total score for hand hygiene adherence among cancer patients undergoing chemotherapy showed a marked increase following targeted training interventions. These findings suggest that structured educational programs can effectively enhance hand hygiene practices in this patient population.

In the control group, where patients received only verbal instructions about the importance of hygiene in infection control and completed the hand hygiene adherence questionnaire, a very slight but statistically significant difference in participants' perception rates was observed before and after the intervention. However, this change was minimal compared to the substantial improvements seen in the intervention group, highlighting the limited impact of verbal instructions alone on hand hygiene adherence, and the value of multiple dimensions to the intervention.

Our results align with existing literature. For instance, Villarreal et al. (2020) reported a significant increase in hand hygiene compliance, from 9.73% to 87.06%, following an educational speech intervention (Villarreal et al., 2020). The finding aligns with the study by Wong et al. (2020). Their results demonstrated an increase in patient/visitor hand hygiene rates from 9.2% at baseline to 13.9% post-intervention (Wong et al., 2020).

The performance rate of participants in the control group also showed a slight but statistically significant difference before and after the intervention. This finding aligns with the study by Wong et al. (2020). Their results demonstrated an increase in patient/visitor hand hygiene rates from 9.2% at baseline to 13.9% post-intervention (Wong et al., 2020). This suggests that even basic education about the importance of hand hygiene can lead to measurable improvements in hand hygiene performance among patients and their families.

However, in the control group of the present study, there was no statistically significant difference in non-adherence to hand hygiene before and after the intervention. This lack of change may be attributed to the absence of interventions aimed at addressing specific barriers to hand hygiene in the control group. These findings underscore the need for interventions that go beyond basic education, such as targeted strategies to remove barriers and reinforce positive behaviours.

The observed changes in the control group may also be influenced by participants' familiarity with the questionnaire items or their awareness of being studied, which could have subtly affected their responses. In contrast, the intervention group demonstrated a statistically significant improvement in participants' perception of the importance of hand hygiene after the intervention. This highlights the effectiveness of structured training programs in enhancing awareness and adherence to hand hygiene practices.

Haverstick et al. (2017) demonstrated that multifaceted interventions significantly improved patients' perception of hand hygiene. Similarly, Sunkesula et al. (2015) found that implementing multiple interventions at various stages effectively enhanced patient hand hygiene adherence. In line with these findings, Yousef et al. (2020) implemented a multimodal hand hygiene strategy, which led to measurable improvements in patient hand hygiene practices. Additionally, Chong et al. (2021) reported that a hospital-wide hand hygiene bundle significantly increased patient hand hygiene adherence.

The current study showed no statistically significant difference in infection rates between the control and intervention groups. This may be attributed to the complex nature of infections in patients undergoing chemotherapy, as infection incidence is often influenced by disease progression or chemotherapy-related side effects, independent of hand hygiene practices.

The multifaceted intervention implemented in this study was designed to enhance hand hygiene adherence rates. This intervention included a combination of strategies that engaged patients (e.g., role-playing), provided practical resources (e.g., antiseptic solutions), education and training (e.g., hand washing instruction and skills), verbal and written materials (e.g., pamphlets, videos), and training patients' companions. Verbal training, completion of questionnaires, and instructional videos on proper handwashing techniques and the importance of hand hygiene significantly improved patients' perception and knowledge of hand hygiene. Additionally, the use of printable posters in restrooms and patient rooms, provision of educational pamphlets, and ensuring restrooms were equipped with liquid soap and disposable napkins further contributed to increased adherence. Training and encouraging patients' companions to assist with hand hygiene when necessary, also played a key role in reducing non-adherence.

Limitations

Several factors beyond the researcher's control could influence the outcomes, such as the patient's mental state during chemotherapy, the level of family support, the patient's cooperation in the treatment process, individual health conditions, and the clinical progression or recovery status of the disease. To mitigate the impact of these confounding factors, we employed statistical matching techniques post-enrollment, to ensure balanced distribution of key factors between the control and intervention groups.

Additionally, given the simultaneous hospitalization of participants in both groups and the potential for "information contamination" (where control group participants might be influenced by the interventions), the control group was studied and assessed first, followed by the intervention group. Infection rates were measured only at the end of the study to minimize the impact of confounding variables. To further enhance the validity of future studies, it is recommended to assess hand hygiene adherence using additional methods, such as direct observation.

CONCLUSION

The findings of this study support implementing multifaceted hand hygiene interventions to significantly enhance patients' adherence to hand hygiene and improve their handwashing performance. It is recommended to design and implement such interventions tailored to specific patient care contexts to maximize their effectiveness. These strategies could play a critical role in promoting better hand hygiene practices and, ultimately, improving patient outcomes.

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