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ORIGINAL PAPER

THE IMPACT OF SELECTED EDUCATIONAL AND INFORMATION INTERVENTIONS ON THE COVERAGE RATE AND ATTITUDES TO INFLUENZA VACCINATION IN NURSING STAFF

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Abstract

Background: Influenza vaccinations are recommended for medical staff as an effective and safe form of preventing influenza and its complications. The aim of the study was to assess the impact of selected educational and information interventions on the influenza vaccination coverage (IVC) in nursing personnel and their attitude towards this procedure. **Material and Methods:** The study participants (N = 320) were randomly divided into 4 groups. Group 1 participated in stationary training, whereas group 2 participated in distance learning. Additionally, 2 subgroups were established in each of the groups above: 1 subgroup received a reminder about the vaccination in the form of a short text message, and the other group did not receive any such reminder. The IVC rate in each group was determined; the attitude towards influenza vaccination was measured using the health belief model. **Results:** The highest IVC was obtained after stationary training followed by a reminder in the form of a short test message (36%). The reminder significantly affected IVC in the group attending stationary training ($p < 0.05$, OR = 2.5, 95% CI: 1.16–5.58); however, it had no impact on the IVC in the group participating in distance learning ($p > 0.05$, OR = 1.2, 95% CI: 0.51–2.83). Both stationary training and distance learning positively influenced the attitude towards influenza vaccinations. A major change in attitudes towards influenza vaccinations was observed only in the case of stationary training followed by a reminder in the form of a short text message (positive changes in perceived susceptibility and severity took place, perceived vaccination benefits increased, and perceived barriers were reduced). **Conclusions:** Stationary training followed by a reminder in the form of a short text message is more effective in increasing the IVC rate compared to distance learning. It also promotes positive changes in attitudes to this prophylactic procedure, which is why it should be recommended for wider implementation. Med Pr. 2020;71(6):665–85

Key words: education, vaccination, influenza, attitude, nursing staff, intervention

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INTRODUCTION

The World Health Organization estimates that every season 5–10% of the adult population and 20–30% of the pediatric population suffer from influenza, with 3–5 million severe cases or complications, which result in 290 000–650 000 deaths globally [1]. In the European Union, it is estimated that 25–100 million people suffer from influenza every season, and 15 000–70 000 patients die of influenza and its complications every year [2]. In the 2016–2017 epidemic season in Poland, the incidence of influenza was 1692/100 000 population, and in the most recent 2017–2018 epidemic season, the incidence exceeded 1782/100 000 already by August of 2018 [3].

A basic method of preventing influenza is vaccination. It is recommended to all persons with no contraindications to vaccination, who would like to avoid becoming ill. Influenza can be a hospital-acquired infection, with health care workers (HCWs) constituting the potential source of infections in patients, and with patients constituting the potential source of infection in HCWs. Furthermore, the infection can spread between members of medical teams [4].

Outbreaks of nosocomial infections, including those caused by influenza viruses, pose a serious medical and epidemiological problem, which involves the need to provide treatment (of flu and its possible complications), ensure the proper isolation and cohorting of patients, introduce costly pharmacological prophylaxis for

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non-immune persons contacting the influenza patients, implement the sanitary regime, and provide dedicated medical staff who have been vaccinated against influenza [4]. Other consequences associated with an influenza outbreak in the hospital include financial losses (resulting from, e.g., the need to temporarily reduce the number of hospital admissions), image losses (e.g., due to the necessity to limit hospital visits), and legal aspects (e.g., connected with patients' claims) [4].

Despite recommendations, the influenza vaccination coverage (IVC) in medical personnel remains at a low level (<30% in European countries) [5]. Bish et al. [6] estimated IVC at 13–53%. La Torre et al. [7] described a pooled proportion of IVC of 13.47% for nurses. In other European countries, such as the UK, Germany and France, the IVC rate ranged 15–29% [4]. The IVC rate among Polish HCWs is only 6–15% despite the fact that this vaccine has been officially recommended by the Health Ministry since 1994 [4]. Medical personnel is indicated as a risk group for influenza vaccination in the Polish Immunization Program, but there is no reimbursement for the vaccine (all costs must be covered by an employee; some employers also decide to provide a free of charge vaccine) [4].

It is necessary to develop activities that can effectively improve the IVC rate in medical personnel at the system level (legal provisions, central financing of vaccinations), and with regard to the attitude towards preventive vaccinations in this professional group [8].

In a systematic review of literature, Odone et al. [9] showed that sending out reminders in the form of a short text message with information on vaccination is effective in increasing the IVC rate, whereas sending information via smartphone applications, e-mails or social media does not bring the desired effects [9]. The authors agree that this activity is relatively cheap and easily accessible, and it should be used more often. However, it is effective only in the case of short-term activities (sending out a short text message too early reduces the effectiveness of this intervention). Reagan et al. [10] also presented other factors that may potentially influence the effectiveness of a short text message as a way of promoting vaccinations and reminding about them. These were the sender, the message content, and the correctness and completeness of the address data (phone number). It is worth emphasizing the fact that each type of the intervention resulted in a positive change in the perception of influenza vaccination as an effective method of the disease prevention. Doubts about the effectiveness of vaccination were previously identified as the reason for non-performance of vaccination. Perception of influenza vaccination as an ineffective procedure is considered to be the reason for the negative attitude towards vaccination, mainly among medical workers, but also among senior citizens and patients with chronic diseases [11–14].

The aim of the study was to evaluate the impact of selected educational and information interventions on IVC and attitudes to influenza vaccination in nursing staff.

MATERIAL AND METHODS

In order to conduct the study, consent from the Bioethics Committee at the Medical University of Warsaw was obtained. The research was carried out in the period of October 1–December 30, 2017. Participation in the study was voluntary and anonymous.

Overall, 770 HCWs were invited to participate in the study and, eventually, 329 (43%) subjects met the inclusion criteria (441 people were excluded from the study: 302 did not agree to participate, and 139 reported that they had completed influenza prevention training over the past year). The sample for the study was designed in order to ensure the representativeness of the results based on the number of nurses and midwives registered in 2016 in the Main Chamber of Nurses and Midwives, Poland (the population size: 325 000, the standard fraction size equal to 50%, the maximum error of 3%, the significance level of $p = 0.05$, and the minimum number set at 264 participants).

The study involved 329 male and female nurses, all of whom were active HCWs with a direct contact with patients. The majority (81.2%) of the participants worked in hospitals (equally in internal diseases, pediatric or surgery wards) while 18.8% worked in outpatient settings (family medicine practices). The participants were listeners of postgraduate courses organized for nursing staff in Warsaw, and they came from all geographical districts of Poland. The recruitment for the study was conducted during the first course, before the lectures started, with none of the lectures during the course being related to the topic of influenza and its prophylaxis. The inclusion criteria for the study were as follows: consent to the study, no training on influenza vaccination in the previous year, no vaccination against influenza in the current season, and no free of charge influenza program at the workplace. The exclusion criteria included: the lack of consent to participate in the study, at least 1 training on influenza vaccination in the previous year, already done influenza vaccination in the current study,

and an existing free of charge influenza vaccination program at the workplace.

All the participants who were included in the study completed training, as well as provided phone numbers, e-mail addresses and questionnaire data.

The respondents were randomly divided into 4 groups in which various educational and information interventions were performed (randomization took place by saluting the participant with a closed envelope containing the number of the group to which he/she was assigned):

- group 1 (N = 80, 83.7% worked in hospitals, 16.3% worked in outpatient settings): the respondents participated in stationary training with an educator; after 2 weeks, there was a follow-up meeting with the educator when they received a printed educational leaflet with information about influenza vaccination; after another 2 weeks, the participants were sent a reminder of influenza vaccination in the form of a short text message; it was not required to confirm the short text message received;
- group 1A (N = 82, 82.9% worked in hospitals, 17.1% worked in outpatient settings): the respondents participated in stationary training with an educator; after 2 weeks, there was a follow-up meeting with the educator when they received a printed educational leaflet with information about influenza vaccination; no reminder of influenza vaccination was sent;
- group 2 (N = 85, 81.2% worked in hospitals, 18.8% worked in outpatient settings): the respondents participated in distance learning; they were sent educational materials in a PDF file via e-mail with identical substantive content as the one presented to the group participating in stationary training; after 2 weeks, they received an educational leaflet in a PDF file via e-mail, containing information about influenza vaccination; after another 2 weeks, the respondents were sent a reminder about influenza vaccination in the form of a short text message; it was not required to confirm the short text message received;
- group 2A (N = 82, 79.3% worked in hospitals, 20.7% worked in outpatient settings): the respondents participated in distance learning; they were sent educational materials in a PDF file via e-mail with identical substantive content as the one presented to the group participating in the stationary training; after 2 weeks, they received an educational leaflet in a PDF file via e-mail, containing information about influenza vaccination; no reminder of influenza vaccination was sent.

The learning programs of the 2 types of courses were exactly the same (the presentation sent by e-mail was the same as the presentation used during contact lectures, as well as the leaflet given or sent as a reminder). The presentation addressed issues related to influenza epidemiology, its symptoms and complications, influenza vaccination benefits, effectiveness and safety.

Before the intervention and 8 weeks after it was performed, all the participants to the study were asked to fill in a research questionnaire, developed by the authors in order to identify attitudes towards vaccination and to determine IVC (a question about conducting influenza vaccination was added to the second questionnaire, and influenza vaccination was declared by the participant). The research questionnaire consisted of 13 multiple choice questions, and it was created using elements of the health belief model (HBM). This model assumes that certain factors, such as perceived susceptibility, severity, benefits and barriers influence the probability of a specific health behavior, in this case the likelihood of undergoing influenza vaccination. High susceptibility, high severity, high benefits and low barriers are factors influencing high probability of the recommended health-related behavior, including preventive vaccination. The respondents are asked to indicate to what extent they agree with a particular statement, and their answers are categorized using the Likert scale (the choice of possible answers: strongly agree, agree, undecided [no opinion], disagree, strongly disagree). The questionnaire was provided as the supplementary material.

The original research questionnaire used in the study was validated on a group of 60 persons. The results obtained for the individual parameters assessing the reliability of the questionnaire included: test–retest: 0.91, Cronbach's α coefficient: 0.92, and κ coefficient: 0.91. The obtained results indicate that the applied research tool is accurate, repeatable and consistent.

Characteristics of the study group

The study groups were comparable in terms of age, sex, education, workplace and work experience. Detailed demographic characteristics of the groups subjected to educational and information interventions are presented in Table 1.

Statistical analysis

Statistical analyzes of the obtained results were performed using statistical and analytical software Statistica 10.0 PL (Dell Inc., 2016), Dell Statistica (a data

Table 1. Demographic characteristics of the health care workers study groups in the study conducted in 2017 in Warsaw, Poland

Variable	Participants (N = 329)							
	group 1 (N = 80)		group 1A (N = 82)		group 2 (N = 85)		group 2A (N = 82)	
	n	%	n	%	n	%	n	%
Age [years]								
≤25	0	0.0	0	0.0	0	0.0	0	0.0
26–50	43	53.8	38	46.3	42	49.4	44	53.7
51–64	37	46.2	44	53.7	43	50.6	38	46.3
≥65	0	0.0	0	0.0	0	0.0	0	0.0
Sex								
female	78	97.5	74	90.2	81	95.3	79	96.3
male	2	2.5	8	9.8	4	4.7	3	3.7
Education								
secondary	39	48.8	37	45.1	44	51.8	42	51.2
higher	41	51.2	45	54.9	41	48.2	40	48.8
Seniority [years]								
≤5	0	0.0	0	0.0	0	0.0	0	0.0
6–10	0	0.0	0	0.0	0	0.0	0	0.0
11–19	33	41.3	31	37.8	33	38.8	37	45.1
20–39	47	58.7	51	62.2	52	61.2	45	54.9
≥40	0	0.0	0	0.0	0	0.0	0	0.0
Workplace								
outpatient health care	15	18.8	16	19.5	17	20.0	19	23.2
inpatient health care	65	81.2	66	71.5	68	80.0	63	76.8

Group 1 – stationary training (training with an educator, a leaflet handed in personally), followed by a short text message, group 1A – stationary training (training with an educator, a leaflet handed in personally), not followed by a short text message, group 2 – distance learning (training materials and a leaflet in a PDF file sent via email), followed by a short text message, group 2A – distance learning (training materials and a leaflet in a PDF file sent via email), not followed by a short text message.

analysis software system, version 13) and SPSS Statistics (Statistical Package for the Social Sciences Statistics, version 26, IBM). For nominal variables, the non-parametric χ^2 test was used to assess the compatibility of non-measurable features. In cases where the test could not be used due to an insufficient sample size or number of distinguished elements, Fisher's exact test was carried out. In order to assess changes in attitudes towards influenza vaccination before and after educational and information interventions, compliance rates were calculated for individual questions describing perceived susceptibility, severity, benefits and barriers. The rates were compared using the Wilcoxon signed-rank test. The normality of distribution of the analyzed features was determined using the Shapiro-Wilk test and the Kolomogorov-Smirnov test. The given p-values were calculated using an alternative hypothesis that assumes that the examined proportions are different. The null hypothesis, which assumes the equality of the analyzed features, was rejected in favor of an alternative hypothesis according to which the obtained p-value was <0.05 (the assumed significance level: p = 0.05).

Furthermore, the OR was established and 95% CI for OR were calculated using the Fischer or Wald method.

RESULTS

Impact of the type of educational and information interventions on IVC

The highest percentage of responders (29.35%) was found in group 1, which participated in stationary

Table 2. Impact of the type of educational and information interventions on influenza vaccination coverage in the study conducted in 2017 in Warsaw, Poland

Group	Participants (N = 329)			
	vaccinated (N = 75)		not vaccinated (N = 254)	
	n	%	n	%
Group 1 (N = 80)	29	36.2	51	63.8
Group 1A (N = 82)	15	18.2	67	81.8
Group 2 (N = 85)	17	20.0	68	80.0
Group 2A (N = 82)	14	17.1	68	82.9

Explanations as in Table 1.

training (training with an educator, after 2 weeks a printed educational and information leaflet) with an additional reminder sent in the form of a short text message encouraging the participants to undergo influenza vaccination. In the other groups, the percentage of respondents who had influenza vaccination ranged 17–20% (Table 2).

Stationary training accompanied by a leaflet handed over personally by the educator, and followed by a reminder in the form of a short text message, was significantly more effective in increasing IVC than distance learning (information and the leaflet sent by e-mail), followed by a reminder in the form of a short text message. There were no statistically significant differences in the effectiveness of stationary training with no reminder, and distance learning with no reminder, with regard to the percentage of respondents who underwent influenza vaccination after the intervention. It was found that the reminder about the vaccination in the form of a short text message had a significant impact on the performance of vaccinations in the stationary training group, but it had no impact on IVC in the distance learning group. The relationships between the type of educational and information interventions and IVC in the examined nursing staff are presented in Table 3.

Impact of educational and information interventions on the attitudes of nursing staff towards influenza vaccination, depending on the type of the intervention

In the group which participated in stationary training and was sent a short text message, a change was observed in all 4 HBM parameters used to assess attitudes towards influenza vaccination. Statistically significant changes in attitudes were reported in terms of perceived susceptibility, perceived severity, perceived benefits and perceived barriers (Table 4). The compliance indicator after this type of learning, compared to the one reported before learning, was significantly higher for the following statements: "I belong to the influenza risk group"

Table 3. Impact of the type of educational and information interventions on influenza vaccination coverage in the study conducted in 2017 in Warsaw, Poland

Group comparision	Vaccination [n]		OR	95% CI	p
	performed	non-performed			
Group 1 and 1A	44	118	2.54	1.16–5.58	<0.05
group 1 (N = 80)	29	51			
group 1A (N = 82)	15	67			
Group 2 and 2A	31	136	1.21	0.51–2.83	>0.05
group 2 (N = 85)	17	68			
group 2A (N = 82)	14	68			
Group 1 and 2	46	119	2.27	1.06–4.86	<0.05
group 1 (N = 80)	29	51			
group 2 (N = 85)	17	68			
Group 1A and 2A	29	135	1.08	0.45–2.62	>0.05
group 1A (N = 82)	15	67			
group 2A (N = 82)	14	68			

Explanations as in Table 1.

Table 4. Impact of educational and information interventions on the attitudes towards influenza vaccination in group 1*

Variable	Participants (N = 80)				p
	before intervention		after intervention		
	n	%	n	%	
Perceived susceptibility					
I belong to the influenza risk group					
strongly agree	30	37.5	44	55.0	
agree	22	27.5	20	25.0	
undecided (no opinion)	6	7.5	3	3.8	
disagree	21	26.3	13	16.3	
strongly disagree	1	1.3	0	0.0	
compliance indicator		3.73		4.18	<0.05
Perceived severity					
Influenza can be dangerous for me					
strongly agree	26	32.5	40	50.0	
agree	27	33.8	21	26.3	
undecided (no opinion)	11	13.8	7	8.8	
disagree	15	18.8	11	13.8	
strongly disagree	1	1.3	1	1.3	
compliance indicator		3.77		4.10	<0.05
Influenza complications can be serious					
strongly agree	53	66.3	53	66.3	
agree	27	33.8	27	33.8	
undecided (no opinion)	0	0.0	0	0.0	
disagree	0	0.0	0	0.0	
strongly disagree	0	0.0	0	0.0	
compliance indicator		4.66		4.66	>0.05
Influenza is a highly contagious disease					
strongly agree	44	55.0	57	71.3	
agree	29	36.3	17	21.3	
undecided (no opinion)	2	2.5	2	2.5	
disagree	5	6.3	4	5.0	
strongly disagree	0	0.0	0	0.0	
compliance indicator		4.40		4.58	<0.05
Perceived benefits					
Influenza vaccination can alleviate symptoms of the disease					
strongly agree	35	43.8	45	56.3	
agree	23	28.8	20	25.0	
undecided (no opinion)	14	17.5	8	10.0	
disagree	7	8.8	6	7.5	
strongly disagree	1	1.3	1	1.3	
compliance indicator		4.05		4.27	>0.05

Table 4. Impact of educational and information interventions on the attitudes towards influenza vaccination in group 1* – cont.

Variable	Participants (N = 80)				p
	before intervention		after intervention		
	n	%	n	%	
Influenza vaccination effectively prevents the disease					
strongly agree	17	21.3	34	42.5	
agree	25	31.3	24	30.0	
undecided (no opinion)	18	22.5	14	17.5	
disagree	16	20.0	6	7.5	
strongly disagree	4	5.0	2	2.5	
compliance indicator	3.43		4.02		<0.05
Influenza vaccination is safe					
strongly agree	11	13.8	30	37.5	
agree	33	41.3	20	25.0	
undecided (no opinion)	31	38.8	26	32.5	
disagree	5	6.3	4	5.0	
strongly disagree	0	0.0	0	0.0	
compliance indicator	3.62		3.82		<0.05
I would get vaccinated if influenza vaccination was recommended by a doctor					
strongly agree	7	8.8	14	17.5	
agree	18	22.5	11	13.8	
undecided (no opinion)	22	37.5	22	27.5	
disagree	24	30.0	26	32.5	
strongly disagree	9	11.3	7	8.8	
compliance indicator	2.87		2.98		>0.05
I would get vaccinated if influenza vaccination was recommended by the media					
strongly agree	4	5.0	4	5.0	
agree	7	8.8	9	11.3	
undecided (no opinion)	22	27.5	21	26.3	
disagree	30	37.5	34	42.5	
strongly disagree	17	21.3	12	15.0	
compliance indicator	2.38		2.48		>0.05
Perceived barriers					
Influenza vaccination is too expensive					
strongly agree	9	11.3	5	6.3	
agree	6	7.5	6	7.5	
undecided (no opinion)	22	27.5	9	11.3	
disagree	23	28.8	40	50.0	
strongly disagree	20	25.0	20	25.0	
compliance indicator	2.51		2.22		>0.05

Table 4. Impact of educational and information interventions on the attitudes towards influenza vaccination in group 1* – cont.

Variable	Participants (N = 80)				p
	before intervention		after intervention		
	n	%	n	%	
It's difficult for me to arrange influenza vaccination					
strongly agree	2	2.5	1	1.3	
agree	3	3.8	0	0.0	
undecided (no opinion)	9	11.3	8	10.0	
disagree	30	37.5	35	43.8	
strongly disagree	36	45.0	36	45.0	
compliance indicator	1.81		1.68		>0.05
The risk of adverse events after influenza vaccination is high					
strongly agree	1	1.3	0	0.0	
agree	26	32.5	15	18.8	
undecided (no opinion)	13	16.3	11	13.8	
disagree	27	33.8	40	50.0	
strongly disagree	13	16.3	14	17.5	
compliance indicator	2.68		2.33		<0.05
Influenza vaccination is unfavorable for me					
strongly agree	9	11.3	7	8.8	
agree	9	11.3	4	5.0	
undecided (no opinion)	29	36.3	21	26.3	
disagree	22	27.5	40	50.0	
strongly disagree	11	13.8	8	10.0	
compliance indicator	2.78		2.55		<0.05

* Stationary training (training with an educator, a leaflet handed in personally), followed by a short text message; Wilcoxon analysis.

(4.18 vs. 3.73, $p < 0.05$), "Influenza can be dangerous for me" (4.1 vs. 3.77, $p < 0.05$), "Influenza is a highly contagious disease" (4.58 vs. 4.4, $p < 0.05$), "Influenza vaccination effectively prevents the disease" (4.02 vs. 3.43, $p < 0.05$) and "Influenza vaccination is safe" (3.82 vs. 3.62, $p < 0.05$). The compliance indicator after this type of learning, compared to the one reported before learning, was significantly lower for the following statements: "The risk of adverse events after influenza vaccination is high" (2.33 vs. 2.68, $p < 0.05$) and "Influenza vaccination is unfavorable for me" (2.55 vs. 2.78, $p < 0.05$) (Table 4).

In the group which participated in stationary training and was not sent an additional short text message, a change was observed in 3 HBM parameters assessing attitudes towards influenza vaccination: perceived susceptibility, perceived benefits and perceived barriers. The compliance indicator after this type of learning, compared to the one reported before learning, was significantly higher for the following statements: "I belong to the influenza risk group" (4.01 vs. 2.79, $p < 0.05$) and "Influenza vaccination effectively prevents the disease" (3.63 vs. 3.37, $p < 0.05$). The compliance indicator after this type of learning, compared to the one reported before learning, was significantly lower for the following statements: "The risk of adverse events after influenza vaccination is high" (2.42 vs. 2.78, $p < 0.05$) and "Influenza vaccination is unfavorable for me" (2.32 vs. 2.57, $p < 0.05$) (Table 5).

In the group which participated in distance learning and was sent a short text message, a change was observed in 2 HBM parameters assessing attitudes towards influenza vaccination: perceived benefits and perceived barriers. The compliance indicator after this type of learning, compared to the one reported before learning,

Table 5. Impact of educational and information interventions on the attitudes towards influenza vaccination in group 1A*

Variable	Participants (N = 82)				p
	before intervention		after intervention		
	n	%	n	%	
Perceived susceptibility					
I belong to the influenza risk group					
strongly agree	23	28.0	23	28.0	
agree	35	42.7	46	56.1	
undecided (no opinion)	11	13.4	6	7.3	
disagree	10	12.2	5	6.1	
strongly disagree	3	3.7	2	2.4	
compliance indicator		2.79		4.01	<0.05
Perceived severity					
Influenza can be dangerous for me					
strongly agree	26	31.7	26	31.7	
agree	36	43.9	37	45.1	
undecided (no opinion)	7	8.5	11	13.4	
disagree	12	14.6	8	9.8	
strongly disagree	1	1.2	0	0.0	
compliance indicator		3.90		3.98	>0.05
Influenza complications can be serious					
strongly agree	49	59.8	49	59.8	
agree	28	34.1	28	34.1	
undecided (no opinion)	1	1.2	2	2.4	
disagree	4	4.9	3	3.7	
strongly disagree	0	0.0	0	0.0	
compliance indicator		4.48		4.50	>0.05
Influenza is a highly contagious disease					
strongly agree	37	45.1	37	45.1	
agree	40	48.8	40	48.8	
undecided (no opinion)	1	1.2	3	3.7	
disagree	4	4.9	2	2.4	
strongly disagree	0	0.0	0	0.0	
compliance indicator		4.34		4.36	>0.05
Perceived benefits					
Influenza vaccination can alleviate symptoms of the disease					
strongly agree	32	39.0	32	39.0	
agree	29	35.4	30	36.6	
undecided (no opinion)	13	15.9	16	19.5	
disagree	7	8.5	3	3.7	
strongly disagree	1	1.2	1	1.2	
compliance indicator		4.02		4.08	>0.05

Table 5. Impact of educational and information interventions on the attitudes towards influenza vaccination in group 1A* – cont.

Variable	Participants (N = 82)				p
	before intervention		after intervention		
	n	%	n	%	
Influenza vaccination effectively prevents the disease					
strongly agree	13	15.9	13	15.9	
agree	32	39.0	40	48.8	
undecided (no opinion)	12	14.6	16	19.5	
disagree	23	28.0	12	14.6	
strongly disagree	2	2.4	1	1.2	
compliance indicator	3.37		3.63		<0.05
Influenza vaccination is safe					
strongly agree	20	24.4	20	24.4	
agree	38	26.3	43	52.4	
undecided (no opinion)	16	19.5	15	18.3	
disagree	5	6.1	3	3.7	
strongly disagree	3	7.3	1	1.2	
compliance indicator	3.81		3.95		>0.05
I would get vaccinated if influenza vaccination was recommended by a doctor					
strongly agree	18	22.0	18	22.0	
agree	20	24.4	31	37.0	
undecided (no opinion)	27	32.9	23	28.0	
disagree	11	13.4	6	7.3	
strongly disagree	6	7.3	4	4.9	
compliance indicator	3.40		3.64		<0.05
I would get vaccinated if influenza vaccination was recommended by the media					
strongly agree	5	6.1	5	6.1	
agree	15	18.3	19	23.2	
undecided (no opinion)	23	28.0	22	26.8	
disagree	22	26.8	23	28.0	
strongly disagree	17	20.7	13	15.9	
compliance indicator	2.62		2.75		>0.05
Perceived barriers					
Influenza vaccination is too expensive					
strongly agree	2	2.4	1	1.2	
agree	13	15.9	11	13.4	
undecided (no opinion)	26	31.7	25	30.5	
disagree	34	41.5	38	46.3	
strongly disagree	7	8.5	7	8.5	
compliance indicator	2.62		2.52		>0.05

Table 5. Impact of educational and information interventions on the attitudes towards influenza vaccination in group 1A* – cont.

Variable	Participants (N = 82)				p
	before intervention		after intervention		
	n	%	n	%	
It's difficult for me to arrange influenza vaccination					
strongly agree	2	2.4	0	0.0	
agree	12	14.6	9	11.0	
undecided (no opinion)	4	4.9	4	4.9	
disagree	38	46.3	43	52.4	
strongly disagree	26	31.7	26	31.7	
compliance indicator	2.09		1.95		>0.05
The risk of adverse events after influenza vaccination is high					
strongly agree	3	3.7	1	1.2	
agree	18	22.0	8	9.8	
undecided (no opinion)	24	29.3	21	25.6	
disagree	32	39.0	47	57.3	
strongly disagree	5	6.1	5	6.1	
compliance indicator	2.78		2.42		<0.05
Influenza vaccination is unfavorable for me					
strongly agree	5	6.1	3	3.7	
agree	15	18.3	9	11.0	
undecided (no opinion)	18	22.0	15	18.3	
disagree	28	34.1	40	48.8	
strongly disagree	16	19.5	15	18.3	
compliance indicator	2.57		2.32		<0.05

* Stationary training (training with an educator, a leaflet handed in personally), not followed by a short text message; Wilcoxon analysis.

was significantly higher for the statement: "Influenza vaccination effectively prevents the disease" (3.52 vs. 3.32, $p < 0.05$), and significantly lower for the statement: "The risk of adverse events after influenza vaccination is high" (2.52 vs. 2.76, $p < 0.05$) (Table 6).

In the group which participated in distance learning and was not sent a short text message, a change was observed in 2 HBM parameters assessing attitudes towards influenza vaccination: perceived severity and perceived benefits. The compliance indicator after this type of learning, compared to the one reported before learning, was significantly higher for the following statements: "Influenza complications can be serious" (4.82 vs. 4.73, $p < 0.05$), "Influenza is a highly contagious disease" (4.86 vs. 4.71, $p < 0.05$) and "Influenza vaccination effectively prevents the disease" (3.67 vs. 3.51, $p < 0.05$) (Table 7).

DISCUSSION

The results of the study indicate that the most effective educational and information intervention in terms of ensuring the highest IVC rate in nursing staff was stationary training followed by a meeting where a leaflet was handed in to the participants by the educator and a reminder in the form of a short text message. Stationary training followed by supplementary information in the form of a short text message was more effective in increasing IVC compared to distance learning followed by such a message. The supplementary short text message significantly influenced IVC in the group attending the stationary training, but it had no impact on IVC in the group participating in distance learning. Both stationary training and distance learning (when not followed by a short text message) were equally effective in

Table 6. Impact of educational and information interventions on the attitudes towards influenza vaccination in group 2*

Variable	Participants (N = 85)				p
	before intervention		after intervention		
	n	%	n	%	
Perceived susceptibility					
I belong to the influenza risk group					
strongly agree	38	44.7	40	47.1	
agree	27	31.8	27	31.8	
undecided (no opinion)	7	8.2	5	5.9	
disagree	7	8.2	7	8.2	
strongly disagree	6	7.1	6	7.1	
compliance indicator		3.98		4.03	>0.05
Perceived severity					
Influenza can be dangerous for me					
strongly agree	38	44.7	40	47.1	
agree	30	35.3	30	35.3	
undecided (no opinion)	5	5.9	5	5.9	
disagree	10	11.8	8	9.4	
strongly disagree	2	2.4	2	2.4	
compliance indicator		4.08		4.15	>0.05
Influenza complications can be serious					
strongly agree	61	71.8	60	70.6	
agree	20	23.5	21	24.7	
undecided (no opinion)	3	3.5	3	3.5	
disagree	1	1.2	1	1.2	
strongly disagree	0	0.0	0	0.0	
compliance indicator		4.65		4.64	>0.05
Influenza is a highly contagious disease					
strongly agree	45	52.9	47	55.3	
agree	35	41.2	33	38.8	
undecided (no opinion)	2	2.4	2	2.4	
disagree	3	3.5	3	3.5	
strongly disagree	0	0.0	0	0.0	
compliance indicator		4.43		4.45	>0.05
Perceived benefits					
Influenza vaccination can alleviate symptoms of the disease					
strongly agree	33	38.8	36	42.4	
agree	36	42.4	34	40.0	
undecided (no opinion)	9	10.6	8	9.4	
disagree	6	7.1	6	7.1	
strongly disagree	1	1.2	1	1.2	
compliance indicator		4.10		4.15	>0.05

Table 6. Impact of educational and information interventions on the attitudes towards influenza vaccination in group 2* – cont.

Variable	Participants (N = 85)				p
	before intervention		after intervention		
	n	%	n	%	
Influenza vaccination effectively prevents the disease					
strongly agree	10	11.8	18	21.2	
agree	35	41.2	32	37.6	
undecided (no opinion)	16	18.8	15	17.6	
disagree	21	24.7	17	20.0	
strongly disagree	3	3.5	3	3.5	
compliance indicator	3.32		3.52		<0.05
Influenza vaccination is safe					
strongly agree	17	20.0	25	29.4	
agree	38	44.7	33	38.8	
undecided (no opinion)	22	25.9	20	23.5	
disagree	7	8.2	6	7.1	
strongly disagree	1	1.2	1	1.2	
compliance indicator	3.74		3.88		>0.05
I would get vaccinated if influenza vaccination was recommended by a doctor					
strongly agree	15	17.6	15	17.6	
agree	21	24.7	25	29.4	
undecided (no opinion)	23	27.1	23	27.1	
disagree	20	23.5	17	20.0	
strongly disagree	6	7.1	5	5.9	
compliance indicator	3.22		3.32		>0.05
I would get vaccinated if influenza vaccination was recommended by the media					
strongly agree	7	8.2	7	8.2	
agree	15	17.6	15	17.6	
undecided (no opinion)	21	24.7	21	24.7	
disagree	25	29.4	27	31.8	
strongly disagree	17	20.0	15	17.6	
compliance indicator	2.64		2.67		>0.05
Perceived barriers					
Influenza vaccination is too expensive					
strongly agree	9	10.6	6	7.1	
agree	13	15.3	12	14.1	
undecided (no opinion)	30	35.3	30	53.3	
disagree	23	27.1	26	30.6	
strongly disagree	10	11.8	11	12.9	
compliance indicator	2.85		2.71		>0.05

Table 6. Impact of educational and information interventions on the attitudes towards influenza vaccination in group 2* – cont.

Variable	Participants (N = 85)				p
	before intervention		after intervention		
	n	%	n	%	
It's difficult for me to arrange influenza vaccination					
strongly agree	3	3.5	1	1.2	
agree	12	14.1	7	8.2	
undecided (no opinion)	3	3.5	3	3.5	
disagree	38	44.7	45	52.9	
strongly disagree	29	54.1	29	34.1	
compliance indicator	2.08		1.89		>0.05
The risk of adverse events after influenza vaccination is high					
strongly agree	3	3.5	3	3.5	
agree	21	24.7	20	23.5	
undecided (no opinion)	18	21.2	17	20.0	
disagree	39	45.9	24	28.2	
strongly disagree	4	4.7	21	24.7	
compliance indicator	2.76		2.52		<0.05
Influenza vaccination is unfavorable for me					
strongly agree	6	7.1	6	7.1	
agree	8	9.4	8	9.4	
undecided (no opinion)	30	35.3	30	35.3	
disagree	22	25.9	14	16.5	
strongly disagree	19	22.4	27	31.8	
compliance indicator	2.52		2.43		>0.05

* Distance learning (training materials and a leaflet in a PDF file sent via email), followed by a short text message; Wilcoxon analysis.

terms of increasing IVC. This means that adding a follow-up, cost-generating short text message to distance learning is not recommended, because it does not contribute to increasing the percentage of vaccinated nursing staff. When it is not planned or possible to perform an educational and information activity with the use of short text messages, both stationary and distance learning are equally effective.

Scientific literature shows that there are many types of interventions aimed at increasing IVC in medical personnel, including various forms of trainings and the use of short text messages.

Stockwell et al. [15] showed that adding a reminder in the form of a short text message with an invitation to vaccination and information on vaccination availability to standard activities promoting vaccination in children, such as leaflets at the vaccination center, was effective and resulted in an increase in the percentage of vaccinated patients (43% in the group that received the message and 39.9% in the group that did not receive the message).

Hofstetter et al. [16] showed that it is more effective to add a reminder in the form of a short text message to educational interventions rather than to information interventions, and they obtained a similar result to the one yielded by the authors of the study presented in this paper. Reagan et al. [10] reported that sending a short text message increased the IVC rate in the study group; however, the level of vaccination coverage still remained low (12%). Newall et al. [17] stated that an additional short text message informing about vaccination increased the IVC rate in pregnant women by 30%. Herrett et al. [16] also showed that sending a short text message to patients resulted in an increase in

Table 7. Influence of educational and information interventions on the attitudes towards influenza vaccination in group 2A*

Variable	Participants (N = 82)				p
	before intervention		after intervention		
	n	%	n	%	
Perceived susceptibility					
I belong to the influenza risk group					
strongly agree	40	48.8	46	56.1	
agree	22	26.8	20	24.4	
undecided (no opinion)	5	6.1	5	6.1	
disagree	10	12.2	7	8.5	
strongly disagree	5	6.1	4	4.9	
compliance indicator	4.00		4.18		>0.05
Perceived severity					
Influenza can be dangerous for me					
strongly agree	34	41.5	37	45.1	
agree	38	46.3	37	45.1	
undecided (no opinion)	5	6.1	5	6.1	
disagree	4	4.9	2	2.4	
strongly disagree	1	1.2	1	1.2	
compliance indicator	4.21		4.30		>0.05
Influenza complications can be serious					
strongly agree	65	79.3	73	89.0	
agree	14	17.1	6	7.3	
undecided (no opinion)	1	1.2	1	1.2	
disagree	2	2.4	2	2.4	
strongly disagree	0	0.0	0	0.0	
compliance indicator	4.73		4.82		<0.05
Influenza is a highly contagious disease					
strongly agree	62	75.6	74	90.2	
agree	18	22.0	6	7.3	
undecided (no opinion)	1	1.2	1	1.2	
disagree	1	1.2	1	1.2	
strongly disagree	0	0.0	0	0.0	
compliance indicator	4.71		4.86		<0.05
Perceived benefits					
Influenza vaccination can alleviate symptoms of the disease					
strongly agree	40	48.8	49	59.8	
agree	23	28.0	14	17.1	
undecided (no opinion)	10	12.2	11	13.4	
disagree	9	11.0	8	9.8	
strongly disagree	0	0.0	0	0.0	
compliance indicator	4.14		4.26		>0.05

Table 7. Influence of educational and information interventions on the attitudes towards influenza vaccination in group 2A* – cont.

Variable	Participants (N = 82)				p
	before intervention		after intervention		
	n	%	n	%	
Influenza vaccination effectively prevents the disease					
strongly agree	24	29.3	24	29.3	
agree	26	31.7	31	37.8	
undecided (no opinion)	6	7.3	7	8.5	
disagree	20	24.4	16	19.5	
strongly disagree	6	7.3	4	4.9	
compliance indicator	3.51		3.67		<0.05
Influenza vaccination is safe					
strongly agree	26	31.7	27	32.9	
agree	27	32.9	27	32.9	
undecided (no opinion)	20	24.4	21	25.6	
disagree	8	9.8	6	7.3	
strongly disagree	1	1.2	1	1.2	
compliance indicator	3.84		3.89		>0.05
I would get vaccinated if influenza vaccination was recommended by a doctor					
strongly agree	19	23.2	26	31.7	
agree	19	23.2	16	19.5	
undecided (no opinion)	21	25.6	21	25.6	
disagree	18	22.0	16	19.5	
strongly disagree	5	6.1	5	3.7	
compliance indicator	3.35		3.56		>0.05
I would get vaccinated if influenza vaccination was recommended by the media					
strongly agree	5	6.1	5	6.1	
agree	21	25.6	28	34.1	
undecided (no opinion)	11	13.4	14	17.1	
disagree	29	35.4	23	28.0	
strongly disagree	16	19.5	12	14.6	
compliance indicator	2.63		2.89		>0.05
Perceived barriers					
Influenza vaccination is too expensive					
strongly agree	1	1.2	1	1.2	
agree	8	9.8	8	9.8	
undecided (no opinion)	28	34.1	25	30.5	
disagree	35	42.7	34	41.5	
strongly disagree	10	12.2	14	17.1	
compliance indicator	2.45		2.36		>0.05

Table 7. Influence of educational and information interventions on the attitudes towards influenza vaccination in group 2A* – cont.

Variable	Participants (N = 82)				p
	before intervention		after intervention		
	n	%	n	%	
It's difficult for me to arrange influenza vaccination					
strongly agree	0	0.0	0	0.0	
agree	5	6.1	3	3.7	
undecided (no opinion)	3	3.7	4	4.9	
disagree	27	32.9	30	36.6	
strongly disagree	47	57.3	45	54.9	
compliance indicator	1.58		1.57		>0.05
The risk of adverse events after influenza vaccination is high					
strongly agree	4	4.9	3	3.7	
agree	24	29.3	17	20.7	
undecided (no opinion)	11	13.4	12	14.6	
disagree	28	34.1	28	34.1	
strongly disagree	15	18.3	22	26.8	
compliance indicator	2.68		2.40		>0.05
Influenza vaccination is unfavorable for me					
strongly agree	5	6.1	3	3.7	
agree	17	20.7	13	15.9	
undecided (no opinion)	19	23.2	18	22.0	
disagree	19	23.2	25	30.5	
strongly disagree	22	26.8	23	28.0	
compliance indicator	2.56		2.36		>0.05

* Distance learning (training materials and a leaflet in a PDF file sent via email), not followed by a short text message; Wilcoxon analysis.

the percentage of influenza vaccinated patients (though by only 2.6%), and they also determined that the number-needed-to-treat indicator was 7 (which means that sending 7 short text messages resulted in the vaccination of 1 patient). The advantages of short text messages as a way of reminding and informing people about vaccination include a low cost, an easy and quick activity, and a widespread availability of mobile phones in the population of developed countries [18].

A greater effectiveness was achieved when the message was sent by a physician caring for the patient. In a hospital, this could be a person known to the staff, who has conducted vaccination training, e.g., an epidemiological nurse or a doctor presiding over the infection team. The content of the short text message should be short and adjusted to the target group: if the target group has been previously trained, a vaccination reminder is recommended; if not, it is advisable to add short educational information about vaccination benefits, indicating that the patient belongs to the risk group and should be vaccinated [10]. In the outpatient settings, the best time to send out vaccination reminders is 6 weeks. In the study presented in this paper, the message was sent 4 weeks after the training (2 weeks after receiving a reminder leaflet) [10]. Short text messages were as effective in increasing the IVC rate in children and adults as reminders and invitations sent by traditional mail or automatic telephone notifications [19].

Although the results of studies published in the scientific literature so far generally confirm the effectiveness of short text messages in increasing IVC in different patient groups, there are also papers which show no beneficial effect of this intervention on the vaccination coverage [20].

The importance of short text messages in promoting the knowledge about influenza vaccination, increasing IVC, and improving the timeliness of vaccinations can be illustrated by the fact that Centers for Disease Control and Prevention have created a system which involves sending out short text messages in the event of an influenza pandemic, which was positively evaluated by potential users in the pilot study [21].

The results obtained by the authors of the study presented in this paper prove that adding reminding and information activities (a leaflet and a short text message) to educational interventions provides better effects in terms of IVC. The necessity of repetitive and comprehensive activities, which are the most effective measures for increasing IVC, was also stressed by other authors [22].

Unfortunately, it was not possible to offer free of charge influenza vaccination to the participants as part of the study. Nevertheless, 37% of the respondents participating in stationary training followed by a short text message underwent vaccination, which can be considered a satisfactory result. This percentage is comparable to that achieved by Spanish researchers who offered free of charge vaccination at the workplace as part of their study [23].

Impact of educational and information interventions on the attitudes towards influenza vaccination in nursing staff

The results of the study presented in this paper show that a comprehensive change in attitudes towards influenza vaccination (all 4 HBM parameters), can be observed only in the case of stationary training followed by additional information sent in the form of a short text message. Thanks to this intervention, positive changes in perceived susceptibility and severity took place, perceived vaccination benefits increased, and perceived barriers were reduced.

Interestingly, in the case of the intervention involving stationary training with no reminder in the form of a short text message, the perception of disease severity did not change, while the perception of susceptibility, benefits and barriers changed favorably. Furthermore, significantly more participants of the group subjected to this intervention declared, after the training, that they would undergo vaccination if it was recommended to them by a doctor. The authors believe that sending a short text message by a person known to the respondents, who educated them about influenza and its prevention, could be a substitute for the recommendation by a medical professional. The lack of recommendation by a person recognized as an expert in the field of influenza prophylaxis (not in every case and not always by a doctor, because some respondents expected advice from representatives of other medical professions, e.g., nurses or midwives) was the cause of non-vaccination in medical personnel [21], pregnant women [22], senior citizens [23] and chronically ill patients [24].

In the authors' opinion, sending out a short text message could trigger the desired pro-health behavior (vaccination). Many authors emphasize the necessity of the occurrence of cues to action, as an element combining educational activities aiming at deepening and consolidating the knowledge about influenza and methods of its prevention with the actual performance of the vaccination [25].

It should be emphasized that only stationary training, based on a traditional seminar conducted by an educator, resulted in a change among the respondents with regard to the utility of vaccination. The lack of recognition of influenza vaccination utility is one of the main psychological reasons for not undergoing vaccination. Vaccination utility is defined as a function of benefits and associated risk, e.g., in terms of adverse events following vaccination [25]. The benefits can result from considering the disease as likely and/or severe, and recognizing the adverse events following vaccination as unlikely (the benefits of vaccination outweigh its risk).

It is worth noting that in the group attending distance learning, both in the subgroup receiving a short text message and in the subgroup not receiving it, the applied educational and information intervention did not have a positive impact on perceived susceptibility. This is an important observation because, as mentioned above, recognizing oneself as a person not susceptible to an infection caused by influenza viruses is a frequent reason for not undergoing vaccinations. Hunt et al. [26] revealed that this reason was reported by 42.5% of male and female nurses who were offered free of charge influenza vaccination.

Unfortunately, in the study presented in this paper, the nursing staff attending distance learning did not practically implement the knowledge about the possibility of the occurrence of hospital infections caused by influenza viruses, or the data presented in the training material indicating the possibility of a disease being accompanied by very few symptoms, which can favor virus transmission in the environment. Although the substantive content of the materials presented in stationary

training was identical to the materials sent by e-mail, it seems that the direct contact with the educator ensured a better emphasis on the importance of influenza vaccination in nursing staff for the good of patients. This observation has a practical value and provides valuable information for those preparing training courses for medical personnel at their workplace, as it indicates the areas of knowledge that should be focused on.

Distance learning, as opposed to stationary training, did not have a positive impact on the recognition of influenza vaccination utility. Only the group attending distance learning which was sent a short text message showed a change in perceived barriers: they less frequently expressed the opinion that vaccination against influenza is burdened with the risk of adverse events after vaccination. However, the change of this opinion and the recognition of vaccination as a safe procedure were not accompanied by a more frequent perception of the disease as widespread and/or serious.

Distance learning with no follow-up reminder in the form of a short text message was the only intervention that did not affect the perception of vaccine-related barriers (neither did it reduce the fear of adverse events after vaccination), which should be considered as a serious limitation of this intervention. This is because concerns about the safety of influenza vaccines are an important obstacle that prevents vaccinations in medical workers. Schmidt et al. [27] indicated that the following opinions were repeated: "vaccines are insufficiently examined" and "there is an insufficient number of studies," whereas Betsch et al. [28] pointed to the belief that vaccination may exacerbate the course of chronic diseases or increase the risk of diseases of allergic etiology.

Interestingly, with regard to distance learning, it showed a positive effect on the perception of influenza vaccination as a safe procedure (a low risk of adverse events after vaccination) only when followed by a short text message, which was similar to the effect obtained in stationary training, regardless of whether a short text message was sent or not. This is an important observation because the perception of vaccination as a dangerous procedure, with a high risk of side effects, was one of the main reasons for not undergoing vaccination, described in the following groups: medical workers [11], senior citizens [12], pregnant women [13] and chronically ill patients [14].

Advantages and limitations of the study

The authors believe that the obtained results have significant practical advantages. Namely, they can be used by decision-makers responsible for allocating funds, mainly in the local, hospital or ambulatory care settings, in such a way that the planned interventions are the most effective, thus contributing to increasing the IVC rate in nursing staff and to a positive change in the attitudes towards influenza vaccination.

A certain limitation of the study is the fact that the assessment of the impact of selected educational and information interventions on IVC was based on the respondents' declarations. Self-reporting of the performance of vaccination may be burdened with an error related to providing false information; however, this limitation is typical of this kind of research. It should also be noted that the participants to the study were only those persons who expressed their willingness to participate in educational and information activities. Therefore, little is known regarding the knowledge about and attitude towards influenza vaccination in the group that did not agree to participate in the study. It can only be assumed that these were persons with reluctant attitudes and/or doubts about influenza vaccination. It seems necessary to reach this group in order to clarify their doubts about vaccination, considering the fact that medical professionals should express precise opinions on vaccination, including influenza vaccination, and their opinions should be based on facts and current medical knowledge, because only then are they a reliable source of information for patients.

Another limitation of this study is a relatively small number of participants. This may cause difficulties in the generalization of results. However, some other researchers conducted their studies aimed to estimate the effectiveness of some interventions and their impact on immunization rates on similar sized samples [29]. It must be also underlined that the studies differed in their methodological quality, which may have had an impact on the results, contributing to biased findings and limited interpretations. The advantage of this study is that the original research questionnaire was validated, which indicates that the tool may be used by other researchers, and the results may be reproduced and generalized.

One more limitation of this study is that the authors did not investigate HCWs' perceptions about protecting patients, as the focus was on individual beliefs and knowledge regarding influenza and its prevention. It was directly related to the limitations of HBM which does not take into account behaviors that are performed for health-unrelated reasons such as social/

ethical acceptability. In fact, HBM does not account for environmental or economic factors that may prohibit or promote the recommended prophylactic action, either. In this study, the costs of an influenza vaccine had to be covered by the participants, not by employers or the government, and the vaccination was conducted after working hours (a visit to a general practitioner was required). It can be expected that, under other conditions (providing a free of charge influenza vaccine at the workplace and during working hours), these results could have been different.

CONCLUSIONS

Stationary training followed by additional information in the form of a leaflet and a short text message is the most effective intervention for ensuring high IVC and a positive change in the attitudes towards influenza vaccination in nursing staff. Therefore, this combination of educational and information activities should be recommended. Adding a reminding and information activity in the form of a short text message significantly affected the IVC rate in the group attending stationary training, while it had no impact on the group participating in distance learning. This is why, in the case of interventions based only on e-learning, sending out short text messages should be considered inefficient and should not be recommended. Stationary training and distance learning not followed by a short text message are equally effective in terms of the achieved IVC in nursing staff. Thus, if it is not possible to send a reminder in the form of a short text message, the choice of the training method is arbitrary.

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