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Effectiveness of an intervention campaign on influenza vaccination of professionals in nursing homes: A cluster-randomized controlled trial

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ABSTRACT

Background: Seasonal influenza has a major individual and collective impact, especially among the elderly living in nursing homes. To prevent infection by influenza viruses, vaccination of residents and professionals is an essential measure. However, while the vaccination rates of residents are generally high (>85%), rates among professionals are generally approximately 20%. To evaluate the effectiveness of an intervention campaign on the improvement of the influenza vaccination rate of professionals, a regional intervention study was proposed for nursing homes during the 2014–15 season.

Methods: Cluster-randomized controlled trial (with a nursing home representing a cluster). In the intervention group, a campaign on influenza vaccination was offered to staff, combining different teaching aids in a multimodal approach. In the control group, no intervention was proposed. The primary endpoint was the rate of influenza vaccination among staff. Before and after the study, professionals were asked to complete short questionnaires on their perceptions of influenza vaccination. A multilevel analysis was carried out to compare the vaccination rates between the 2 groups and their evolution before/after the winter period.

Results: A total of 32 nursing homes were randomized, and 6 were excluded. Initial vaccination rates were 27.6% in the intervention group and 24.2% in the control group ($p = 0.16$). After the study, these rates increased to 33.7% and 22.9%, respectively, which was a relative difference of +22.1% in the intervention group compared to −5.4% in the control group, $p = 0.0025$.

Conclusions: Despite professionals' reluctance to be vaccinate, participation in a promotional campaign with a pragmatic approach has increased the rate of influenza vaccination. The approach will be offered to all nursing homes in the region after revision of the tools to enhance their ease of use and pedagogical messages focused on the direct benefits to professionals.

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1. Introduction

Every year, respiratory outbreaks in residential institutions (nursing homes) cause severe morbidity and mortality [1–6], and influenza virus is the most frequently implicated pathogen [2–3,5]. To reduce the risk and occurrence of serious complications from seasonal influenza in nursing homes, vaccination of both residents and professionals is an essential measure.

However, while residents' immunization rates are generally high (>85%), professionals' immunization rates are usually approximately 25% in French healthcare facilities [7], and 20% in nursing homes [8,9]. Because of immunosenescence [10,11], the immune response is reduced in older people, and nearly one vaccinated elderly out of two will not have a sufficient response for protection. Reducing the spread of influenza viruses in elderly communities will therefore require the vaccination of professionals, to extend

Abbreviations: ASSATSAS, Joint Association for Occupational Health and Safety in the Social Affairs Sector; HCSP, High Council of Public Health.

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their individual protection to the patients or residents in their care [12,13]. Thus, in addition to barrier measures, promoting influenza vaccination of healthcare workers has been internationally advocated for many years by World Health Organization [14] (with a goal of 75% influenza vaccination rate among professionals), the Centers for Disease Control and Prevention [15], and in France, by the High Council of Public Health [10] and the Ministry of Health [16].

In the absence of mandatory vaccination for professionals against seasonal influenza, incentives must be implemented. Randomized controlled trials in France [12,17] and in other countries [13,18–20] have shown that information campaigns could be effective, especially if they emphasize the individual benefit for the caregiver and his family. However, these campaigns should not involve organizational constraints, which would make it impossible to implement them on a larger scale, particularly in nursing homes not associated with health facilities, where the ratios of professionals are lower.

To evaluate the effectiveness of an intervention campaign on the influenza vaccination rate of professionals working in nursing homes, we performed a pragmatic intervention study.

2. Methods

2.1. Study design

The study was a cluster-randomized controlled intervention trial in which 32 nursing homes were included in one of the study groups (intervention group or control group) by randomization. Each nursing home represented a cluster, and all staff members of the same nursing home were referred for intervention (intervention group), or no intervention (control group). The cluster design was chosen because the intervention was proposed at the level of the nursing home, and not at the individual level.

A letter of invitation to participate in the study was sent to each of the 193 nursing homes not affiliated with a health facility in the Basse-Normandie region, France, and 32 responded positively. The study was noninterventional regarding the usual care of the residents (i.e., no supplementary care or examinations were required compared to those usually granted to residents of nursing homes). The director of each participating nursing home completed and signed a participation agreement.

The randomization was centralized and was performed in a spreadsheet containing a list of the nursing homes (the names of the nursing homes were replaced by serial numbers). The person in charge of the randomization (PT) was not aware of the correspondence between serial numbers and nursing homes.

Within the nursing homes, the intervention, by nature, could not be blinded. The two principal investigators (FB and PT) did not know the assignment groups. The statistical analysis was carried out initially by simulating two fictitious assignment groups, and the unblinding was performed only after the database freeze.

2.2. Intervention campaign

In the intervention group, a pragmatic intervention campaign on influenza vaccination was proposed to nursing home professionals. The general approach proposed for the promotion of influenza vaccination was modeled on the WHO multimodal hand hygiene improvement strategy [21], and on the strategy proposed in Canada by the Joint Association for Occupational Health and Safety in the Social Affairs Sector (ASSTSAS) for the implementation of an influenza vaccination campaign [22].

The tools proposed in the campaign were chosen according to the 5 key components of the WHO multimodal strategy (Table 1). In practice, the intervention group received the instructions for the use of the campaign, with the different tools to use (posters of different formats, short videos, presentation slideshows on influenza and vaccine, on the "6 received ideas" and the "7 reasons to get vaccinated"). This campaign was to be organized by the medical and coordinating staff of each nursing home, using the various information media provided by the study organizers. The same campaign was proposed to clinical staff and ancillary staff. The vaccines were purchased by the nursing homes and vaccinations carried out at the convenience of the institutions. Two investigators (LH and JL) ensured the implementation of the campaign by regular contact with the referent, first at the beginning of the intervention period and then on a regular basis.

In the control group, no intervention was proposed, but local initiatives could take place at the teams' choosing.

The study was carried out during the 2014–2015 winter season, with the campaign to be conducted for the intervention group between November 1, 2014, and March 1, 2015.

2.3. Data collection

In each participating nursing home, a questionnaire at the beginning and at the end of the study were used to collect the following information: number of residents, number and types of professionals working in this establishment during the previous season and during the studied season, routine organization of vaccination of professionals (person in charge, practical organization), and flu vaccination rate during the previous season and the studied season for each type of professional (no nominative list of people vaccinated was requested). The professionals concerned were all the professionals working in contact with the residents, i.e., the nursing staff (auxiliary nurses, nurses, and doctors) but also the general service staff, animation staff, social service, various auxiliaries and administrative staff. Trainees and temporary workers were also included. Nonsalaried staff (general practitioners, physiotherapists, etc.) were excluded. A questionnaire on perceptions of the influenza vaccination was completed by professionals from both groups at the beginning and end of the study. This questionnaire included the professional category and 10 closed-response questions ("agree"/"disagree") on the following perceptions: severity of influenza, vaccine tolerance, contraindication of the vaccine in pregnant women, side effects of the vaccine, the efficacy of homeopathy and antibiotics as an alternative to the vaccine, the cost of vaccination, the usefulness of vaccination for providing herd immunity, and finally a question about the intention to be vaccinated for the upcoming season. At the end of the study, an evaluation of the quality of the information materials was requested from the nursing homes of the intervention group, and they were asked about their plans to reuse the tools the following epidemic season.

2.4. Statistical analysis

The primary outcome measure was the rate of influenza vaccination among professionals during the 2014–15 season. This rate was measured as follows: number of vaccinated professionals/total number of active professionals during the 2014–15 season.

The number of establishments that needed to be included to show a doubling of the vaccination rate of professionals in the intervention group was determined by assuming a base vaccination rate of professionals of 20%, the average number of caregivers to be vaccinated per center of 70, and an intraclass correlation of 0.05. For an alpha risk of 0.05 and a power of 0.90, the total number of establishments to be included was at least 14.

The nonparametric Kruskal-Wallis test was used to compare the number of residents and number of professionals in each group,

Table 1
Five key components of the intervention strategy for promoting influenza vaccination among professionals in nursing homes.

Tools for system change	Tools for training/education	Tools for evaluation and feedback	Tools for reminders in the workplace	Tools for institutional safety climate
Provision of free vaccines	Identification of a local leader in charge of the campaign	Monitoring of immunization coverage	Slideshow and posters on "6 received ideas" about influenza or flu vaccination	Institutional commitment form
Proposals for on-site immunization sessions	Short information slideshow on influenza and vaccination	Monitoring of perceptions	Slideshow and posters on "7 reasons to get vaccinated"	Public awareness by providing a short video (2 min)

because of an asymmetry in the distribution of these variables. The difference in the vaccination rate of professionals before and after the intervention was expressed as the relative difference (difference between the 2 rates/rate before intervention) and the absolute difference (difference between the 2 rates). For the comparison of the perceptions in both groups, the Chi^2 test was used. To assess the effectiveness of the intervention, a cluster analysis was used, because randomization involved nursing homes and not individual professionals. For this analysis, a multilevel logistic regression model was constructed with influenza vaccination (yes/no) as the explained variable and randomization of the group and vaccination rate of the previous season (baseline rate) as explanatory variables. All analyses were performed with in intention to treat. A significance level of $p < 0.05$ was chosen, and analyses were carried out using the SAS v9.4 software.

2.5. Ethics

The study was approved by the regional ethics committee (the regional Comité de Protection des Personnes).

3. Results

An outline of the study is presented in Fig. 1. The median number of residents was 62 (IQR 54–78) in the 16 nursing homes of the intervention group versus 81 (IQR 62–96) for the control group ($p = 0.13$), and the median total number of professionals in each group was 46 (IQR 34–54) and 63 (IQR 39–75), respectively ($p = 0.28$). Six facilities were excluded: five (4 in the intervention group and 1 in the control group) did not provide data on the vaccination of professionals during the study season, despite numerous reminders, and 1 nursing home belonging to the intervention group was unable to provide a vaccination rate for the season prior to the study season because it had not opened until February 2014. The 6 excluded nursing homes did not differ from the included nursing homes in terms of number of residents and professionals. The study therefore included 11 nursing homes in the intervention group, with a median of 66 residents (IQR 52–83) and 45 professionals (IQR 36–53), and 15 nursing homes in the control group, with a median of 77 residents (IQR 55–89, $p = 0.39$) and 56 professionals (IQR 38–70, $p = 0.55$). In all the nursing homes included, the vaccination of the staff was supported by the institution and was mainly carried out by nurses from the institution (N = 18) or, more rarely, by the coordinating physician (N = 9), the occupational physician (N = 1) or the attending physician (N = 1).

Preintervention vaccination rates (baseline) were 27.6% (95% CI, 23.7–31.8%) in the intervention group and 24.2% (95% CI, 3–27.2%) in the control group ($p = 0.16$). At the end of the study, these rates were 33.7% (95% CI, 29.6–37.9%) and 22.9% (95% CI, 20.1–25.9%), respectively, a relative difference of +22.1% in the intervention group versus −5.4% in the control group ($p = 0.0025$) (Fig. 2). In the intervention group, there was an absolute decrease in the immunization rate in 2 nursing homes (−10.2% and −1.0%), while the rate increased in the other 9 establishments (+2.0% to +22.4%). In the control group, there was a decrease in 7 nursing homes

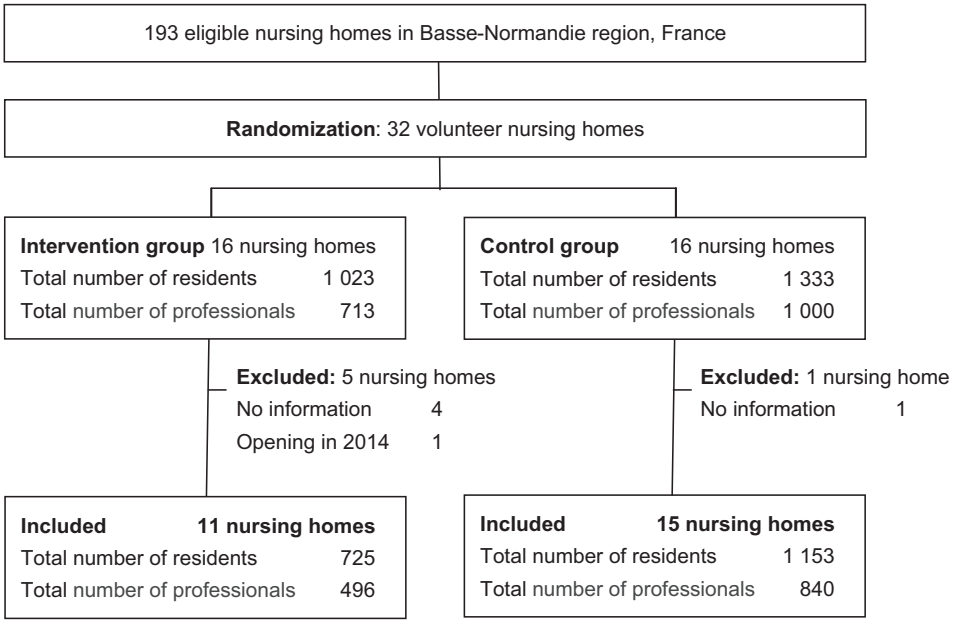

Fig. 1. Flow chart.

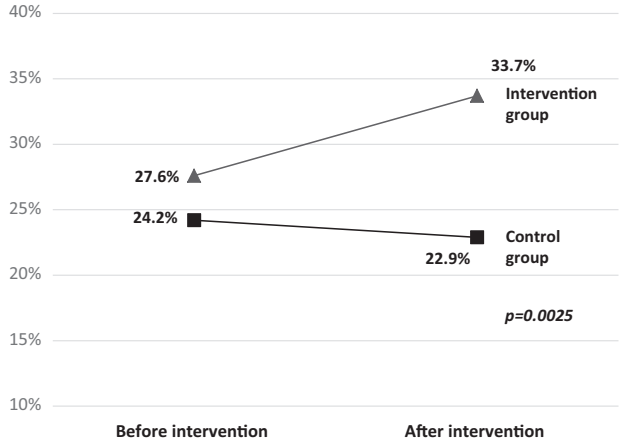

Fig. 2. Vaccination rates of professionals before/after intervention in the intervention group and in the control group.

(−21.1% to −2.3%) and an increase in 8 establishments (+0.7% to +11.2%). The mean absolute difference was +6.1% in the intervention group and −1.3% in the control group (p = 0.04).

For the caregivers (auxiliary nurses, nurses, and doctors), the initial vaccination rates were 31.4% in the intervention group and 36.5% in the control group, ending with 35.8% (+4.4%) and 34.6% (−1.9%), p = 0.77. For the non-caregivers (general services, animation, social work, auxiliaries and administrative staff), the initial vaccination rates were 24.3% in the intervention group and 13.8% in the control group, and the rates at the end of the study were 31.8% (+7.5%) and 12.9% (−0.9%), respectively, p = 0.01.

Professionals' perceptions of influenza vaccination in each study group at the beginning and end of the study are summarized in Table 2. Professionals in each group were more likely at the end of the study to agree that influenza is a serious or even fatal disease ($p < 10^{-3}$). At the end of the study, 56.3% of the professionals in the intervention group thought that influenza vaccination was indicated in pregnant women, compared to 46.7% at baseline (p = 0.04), whereas for this question, there was no significant difference between the two periods in the control group. For all other questions, there was no pre/post difference in the intervention group or control group.

In the intervention group, all the nursing homes were committed to vaccination and offered the vaccine for free, but none used all the proposed information materials (Table 3). Information media were assessed as "good" or "very good" 7 times for posters and for video, and 9 times for slideshows. Six times out of 11, the nursing homes felt that these materials had helped them to raise awareness about the vaccination of professionals. Otherwise, the following comments were made: tools were received too late to be effective (twice), professionals deemed too recalcitrant (twice), and media competition (bringing misinformation) deemed too important (once). Finally, 9 nursing homes out of 11 (82%) planned to renew this campaign during the following winter season.

Table 3
Use of the proposed tools of the intervention campaign in the intervention group facilities.

	Intervention group (N = 11)
Institutional commitment	11
Free vaccines	11*
Proposals for on-site immunization sessions	
Specific immunization sessions	9
Vaccinations on demand	2
Local leader in charge of the campaign	11
Briefing session with the use of short information slideshow on influenza and vaccination	10
Use of slideshow and posters on "6 received ideas" about influenza or flu vaccination	10
Use of slideshow and posters on "7 reasons to get vaccinated"	10
Monitoring of immunization coverage	11**
Monitoring of perceptions	11**
Sensitization using short video	9

* It should be noted that all establishments in the control group also provided vaccines free of charge.
** The control group facilities also monitored immunization coverage and monitoring of perceptions.

4. Discussion

In this cluster-randomized controlled trial, we were able to show a positive overall effect of a pragmatic intervention campaign on the rate of influenza vaccination of nursing home professionals. In the group receiving the intervention, the vaccination rate increased by 22.1% compared to the previous season, whereas it decreased by 5.4% in the control group. The intervention appeared to be more effective for non-nursing staff than for nursing staff. The perceptions of professionals about influenza and vaccination were broadly unchanged, but these results should be taken with caution, as the response rates to the questionnaire on perceptions

Table 2
Perceptions of professionals on influenza vaccination: comparison of responses obtained at the beginning and end of study period, by randomization group.

	Intervention group (N = 496)			Control group (N = 840)		
	Beginning (N = 275) N (%)* *(NA)*	End (N = 243) N (%)* *(NA)*	p	Beginning (N = 475) N (%)* *(NA)*	End (N = 276) N (%)* *(NA)*	p
Influenza is a serious or even fatal disease	218 (81.0) *(6)*	220 (92.4) *(5)*	$<10^{-3}$	383 (82.7) *(12)*	251 (92.6) *(5)*	$<10^{-3}$
Flu vaccine:	151 (57.4) *(12)*	138 (58.7) *(8)*	0.77	293 (64.5) *(21)*	160 (59.7) *(8)*	0.19
- is well tolerated						
- is not contraindicated in pregnant women	113 (46.7) *(33)*	125 (56.3) *(21)*	0.04	176 (42.2) *(58)*	112 (44.1) *(22)*	0.63
- cannot give the flu	121 (45.2) *(7)*	121 (50.6) *(4)*	0.22	209 (46.1) *(22)*	111 (41.3) *(7)*	0.20
- may not give health hazards	122 (46.9) *(15)*	115 (51.6) *(20)*	0.31	209 (46.4) *(25)*	126 (47.9) *(13)*	0.71
- is less dangerous than influenza	223 (86.1) *(16)*	195 (86.7) *(18)*	0.86	397 (88.2) *(25)*	235 (90.4) *(16)*	0.37
- helps to protect relatives	214 (81.1) *(11)*	191 (82.0) *(10)*	0.79	361 (79.0) *(18)*	214 (80.8) *(11)*	0.57
Homeopathic treatment is not as effective	141 (56.0) *(23)*	132 (59.7) *(18)*	0.55	262 (59.6) *(35)*	171 (66.0) *(17)*	0.09
Antibiotic treatments are not as effective	215 (81.4) *(11)*	206 (86.6) *(5)*	0.12	365 (80.4) *(21)*	223 (84.2) *(11)*	0.21
The collective cost of vaccination is less than the cost of influenza	194 (73.9) *(26)*	175 (76.4) *(14)*	0.52	335 (77.7) *(44)*	205 (80.1) *(20)*	0.47
I intend to get vaccinated	95 (35.9) *(10)*	96 (42.3) *(16)*	0.14	176 (37.4) *(4)*	107 (40.5) *(12)*	0.40

NA: Not answered.
* For all statements, the table shows the number and percentage of "Agree".

was low, particularly in the control group at the end of the study, thereby indicating a possible selection bias.

Although significantly increased, the overall vaccination rate was still modest at the end of the study in the intervention group (33.7%). This result may be explained in part by the fact that it was the first year of campaigning for participating nursing homes, and it is thought that the beneficial effect of this campaign would deserve to be evaluated over several seasons. A strength of our trial is that it was performed in the "real life", each nursing home being free to use all or part of the proposed tools. On the other hand, this freedom did not allow complete control over the application of the elements of the approach. Elements related to the organization of the study can also be questioned: the information tools were sometimes sent at the beginning of the autumn-winter season, and the nursing homes did not always have the time necessary to appropriate them. Moreover, the communication between professionals, in particular the medical coordinator and supervisory and healthcare teams, had not always been optimal, due to the part-time work schedules of certain professionals.

The campaign used in this study was meant to be pragmatic and to be carried out in each institution without external help. However, 4 sites in the intervention group (1 only in the control group) were excluded from the study due to a lack of data collection, possibly due to insufficient staff resources to fully implement the study. Some of the participating institutions also reported that the campaign was time consuming and difficult to organize in several weeks. In contrast, for other institutions, the fact that this campaign was to take place over a long period of time was seen as an aid to the achievement of substantive work aimed at changing the perceptions of caregivers.

Reservations about vaccination among some caregivers have already been reported in France [7], as in other countries [23], especially for influenza, since the H1N1 vaccination campaign [23]. Hence, low vaccination coverage rates are observed in nursing homes in particular [7–9]. Our study puts into perspective this greater reluctance among caregivers, as the effect of the campaign was stronger among non-caregivers. In an attempt to overcome this reluctance, various promotional strategies for the vaccination of professionals have been put in place throughout the world, for health establishments or, more rarely, for nursing homes [24–28].

Literature reviews of interventions to increase influenza immunization coverage among professionals show that the most effective strategies are those with a combination of interventions [24–28]. Among these interventions are actions to facilitate access (free vaccines, vaccination in the workplace, etc.), actions concerning knowledge (information, training, education, etc.) and planning measures associated with institutional support [24–28]. In our study, the planning of campaign actions was not always sufficiently anticipated, partly because of the part-time work schedules of some professionals and sometimes because of insufficient institutional support to initiate the campaign. These points of improvement have been taken into account for the following campaigns, with the availability of a commitment charter to be displayed in the structure and signed not only by the director but also by the coordinating physician and the coordinating nurse.

Another intervention also proposed in the campaigns to promote the flu vaccination of professionals is work on previous perceptions [22,29]. Due to the context of the study and the constraints imposed by the institutions (limited staff, tense work, etc.), our choice was to start from work already carried out in this field to develop the media (posters and PowerPoint on "6 received ideas") proposed in our campaign. To further improve the representations of caregivers, more in-depth campaigns with think-tanks, working groups, etc. [22,29] may be necessary, but such a campaign seems difficult to envision for these nursing homes without human resources such as mobile hygiene teams.

Finally, beyond the implementation of a campaign, its annual renewal makes it possible to increase and maintain high vaccination rates [30,31]. Since the 2015–2016 season, the various tools used in our study have been made available to all nursing homes in the region, after revision to improve their usability. A complementary study is scheduled to assess the long time effect of our campaign.

5. Conclusions

The results of this study suggest that despite the unwillingness to be vaccinate among professionals, participating in a vaccination campaign with a pragmatic approach helped to increase the rate of influenza vaccination of professionals working in nursing homes not related to health facilities. However, the implementation of such a campaign requires human resources and is required to be conducted over several years to change behavior.

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Conflict of interest

None.

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Author's contributions

FB, PT, PL, XLC, AV, and RV participated in the conception and the design of the study. LH and JL controlled the data acquisition and the progress of the study. FB and PT analyzed the data and drafted the manuscript. All authors reviewed the article and approved the final version.

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