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Review Article

Effectiveness of Educational Intervention on Influenza Vaccine Uptake: A Meta-Analysis of Randomized Controlled Trials

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Abstract

Background: This study aimed to explore effective education method to improve influenza vaccine uptake rate.

Methods: Meta-analysis of Randomized Clinical Trials was conducted in this study including subgroup analysis and publication bias test. Electronic databases comprised PubMed, EBSCO, Elsevier, Springer, Wiley, and Cochrane were searched for studies published up to Oct 8, 2019.

Results: Influenza vaccination was significantly different in massages or letters intervention group (*OR*=1.30, 95%CI: 1.05-1.61). No heterogeneity and publication bias existed in this meta-analysis (I^2=43.60%, *P*=0.131, P_{begg} =0.754, P_{eg-ger}=0.051).

Conclusion: Education by messages and letters was effective according to this study. Education messages could be more efficacy combined with easer vaccine access.

Keywords: Influenza vaccine; Education; Intervention; Meta-analysis

Introduction

The Influenza vaccine has been proven to be the most effective way to prevent the flu and severe complications, particularly in children, the elderly, pregnant women, and long-term healthcare workers (1-3). The uptake rate of the influenza vaccine was 51.30% in New York schoolchildren, 71% in healthcare personnel, and 50.50% in pregnant women in 2012-2013 flu season (4-6). Influenza vaccines may also benefit flu infection, hospitalization rate, and mortality reduction among the elderly population (7).

Research studies have explored whether education is a meaningful intervention method that improves vaccine uptake. A 2-year prospective cohort study demonstrated that educational intervention was correlated with influenza vaccine improvement, which was even greater when the vaccine was supplied during clinic visits (8). Another study reported that successful educational intervention early in medical students' careers resulted in a positive attitude shift of the students towards the influenza vaccine (9). The influenza vaccine rate was increased between the ages of 24 and 64 yr but declined from 63.30% to 54.00% in those aged 65-69 yr, despite a seasonal influenza immunization campaign (10). A cluster randomized control trial (RTC) conducted during the 2014-2015 flu season reported that educational intervention through posters and pamphlets in general practitioners' waiting rooms was ineffective (11).

Given these conflicting results, this meta-analysis aimed to determine the educational methods that are effective at improving influenza vaccine uptake.

Methods

Search strategy and selection criteria

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were used in this meta-analysis. Electronic databases comprised PubMed, EBSCO, Elsevier, Springer, Wiley, and Cochrane were searched for studies published up to Oct 8, 2019. Searching terms were "influenza vaccines", "intervention" and "education". The inclusion criteria were as follows: a) Randomized controlled trials (RCTs). b) The influenza vaccines (IV) uptake rates were no difference between intervention and control group in baseline. c) Education about IV was provided in intervention group. d) Odds ratio (OR) and 95% confidence interval (CI) were reported. Studies not meeting these criteria, duplicate reports, published in non-English and systematic reviews were excluded.

Data extraction

Two researchers were in charge of extracting data including: The first author's name, year of publication, country, number of cases in intervention and control groups, age (mean±sd), gender (male/female), inclusion criteria, vaccine uptakes and non-takes after intervention in two groups, duration of intervention and methods of education.

Statistical analyses

OR and 95%CI were calculated to compare the difference between intervention and control group. Heterogeneity was estimated by the I2 statistic, and a fixed-effects model was used when I2 was less than 50%. Begg's and Egger's tests were conducted to investigate possible publication bias. Subgroup analysis was also conducted in this study. All statistical analyses were conducted using Stata ver. 11.0 (Stata Corp LLC, College Station, TX, USA).

Results

Characteristics of the included studies

Fifty-one studies were identified through the systematic literature search. Eleven were excluded after the title and abstract reading. After excluding 32 more studies, eight RCTs were included with a total of 21523 cases (8713 interventions and 12810 controls). The details are showed in Fig. 1 and Table 1.

The inclusion criteria for participation were: a) whom had not received influenza vaccine. b) There was no statistical difference of uptake rates between intervention and control group.

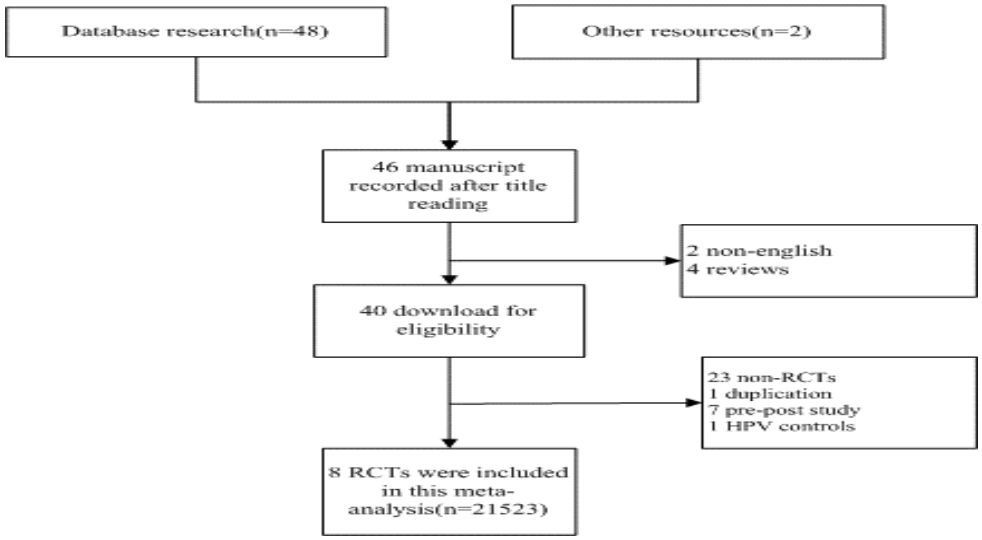

Fig. 1: Flow chart of meta-analysis

Table 1: Characteristic of included studies

Author		*Year*	*Country*	*N(intervention/control)*	*Gender(m/f)*	*Age(yr)*	*Intervention time*	*Methods of intervention*	*Control group*
Sean T. O'Leary(23)	Obstetric group	2019	USA	304/574	0/878	41±14.9	September 2011 to May 2014	Facial	Usual care
	Gynecologic group	-	-	2103/2267	0/4370	-	-	-	-
Christophe Berkhout(11)		2018	USA	3781/6816	4456/6141	69.0±0.51	2014-2015 flu season	Pamphlets and poster	No intervention
Mark H. Yudin(18)		2017	Canada	129/152	0/281	32.2 4.5	Four weeks in the fall of 2013	Message	No message
Valerie Wing Yu Wong(24)		2016	China	151/154	0/305	33.5±4.2	2013–14 and 2014–15 flu seasons	Facial	Standard antenatal care
Michelle H. Moniz(25)		2013	USA	76/82	0/158	26.4	September 2010 to February 2012 flu seasons	Text messages	General pregnancy health
Bernardino Roca(13)		2012	Spain	1201/1201	1064/1338	70.6 ± 7.1	2008 and 2009 flu season	Letters	No intervention
Shirin Doratotaj(26)		2007	USA	200/200	Not report	Not report	September 2004-April 2005	Letters	No letters
Paola Dey(14)		2001	UK	768/1364	Not report	Not report	2 month in Oct 1999	Letters	No letters

The results of the meta-analysis

Forest plot of the meta-analysis is shown in Fig. 2. Difference of influenza vaccine uptake rates was not found between intervention and control group according to the forest plot (*OR*=1.16, 95%CI: 0.95-1.41). However, showed in subgroup analysis, uptake rates were significantly different in massages and letters intervention group (*OR*=1.30, 95%CI: 1.05-1.61, Fig. 3). Furthermore, no heterogeneity existed in this group (I^2=43.60%, *P*=0.131). Subgroup analysis of pregnant and non-pregnant population was also conducted and there was no difference between two groups (Fig. 4). No publication bias detected in this meta-analysis (P_{begg} =0.754, P_{egger}=0.051, Fig. 5).

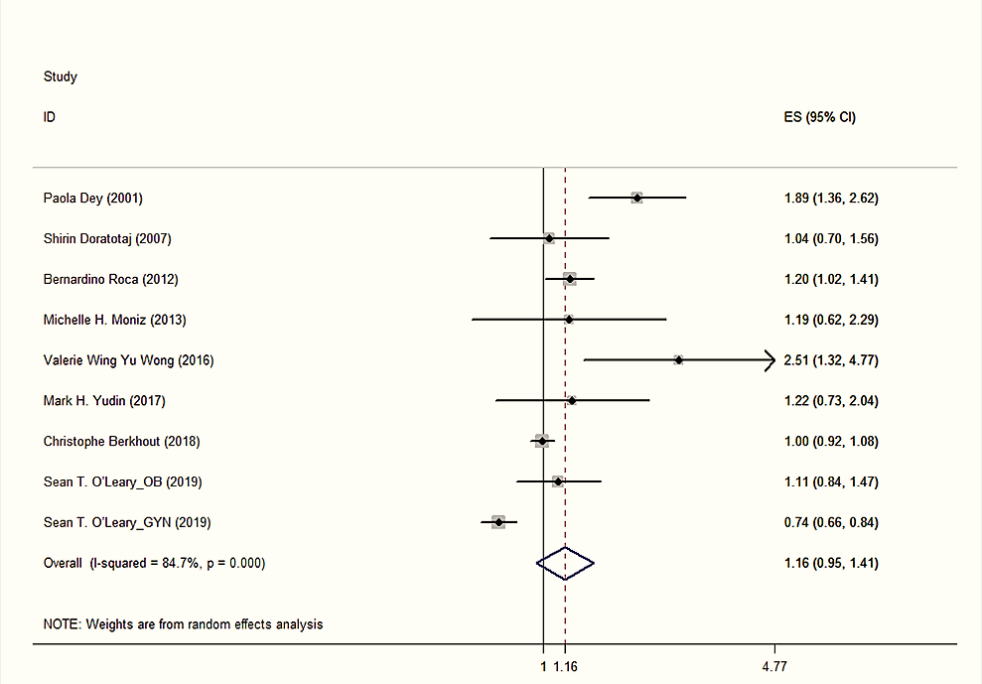

Fig. 2: Forest plot of meta-analysis

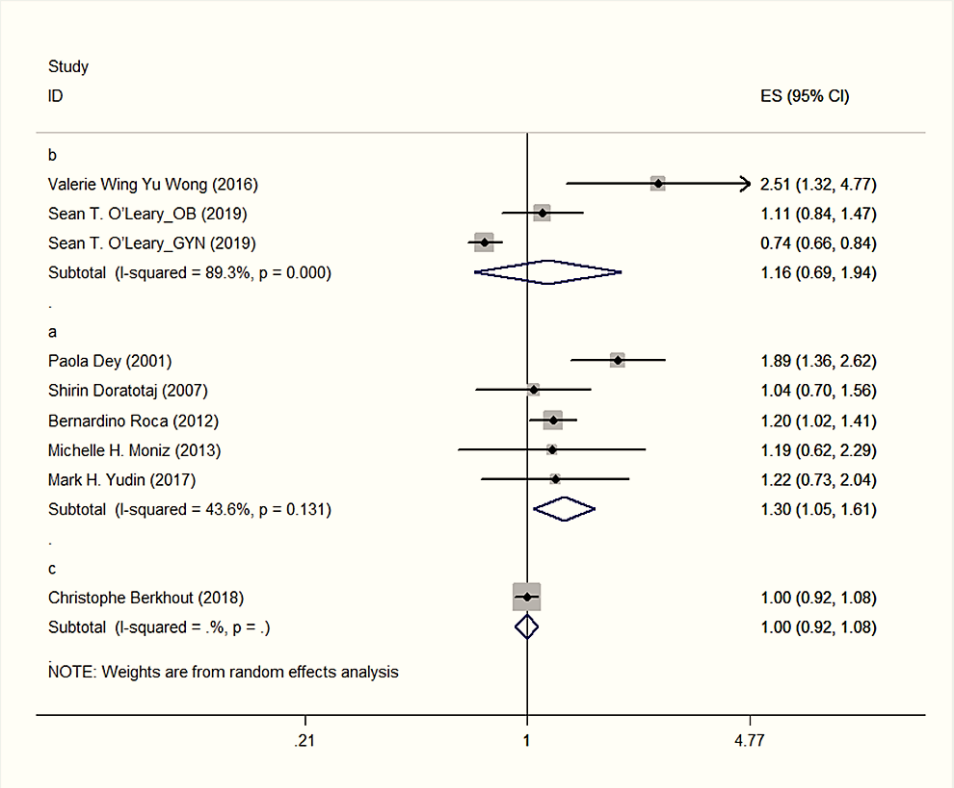

Fig.3: Subgroup analysis of messages and letters, facial, poster group
a. messages and letters group
b. facial group
c. pamphlets and poster group

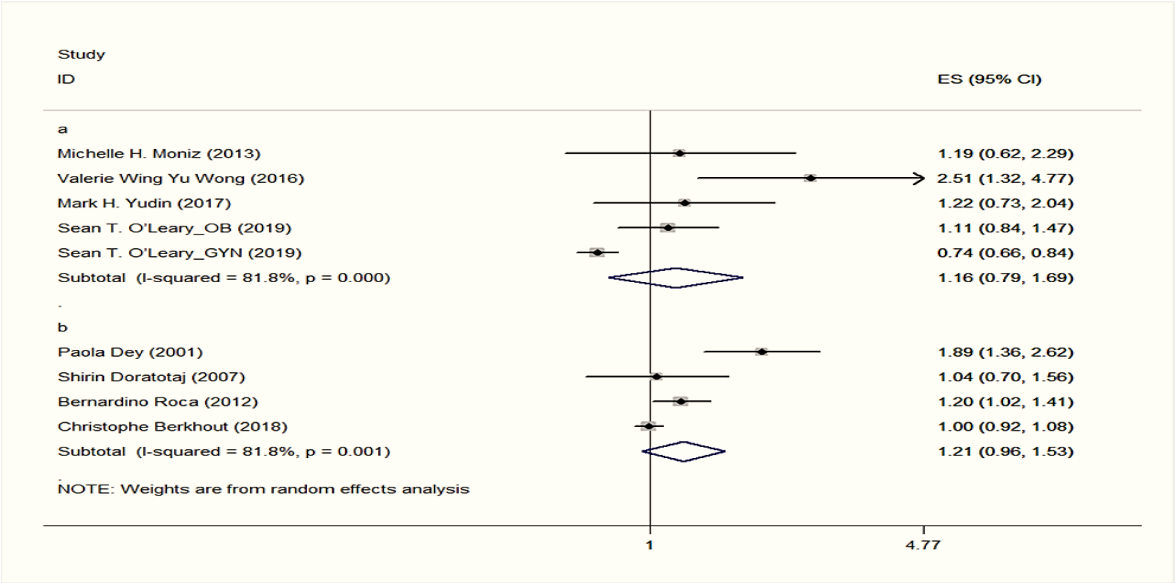

Fig. 4: Subgroup analysis of pregnant and non-pregnant group
a. pregnant group
b. non-pregnant group

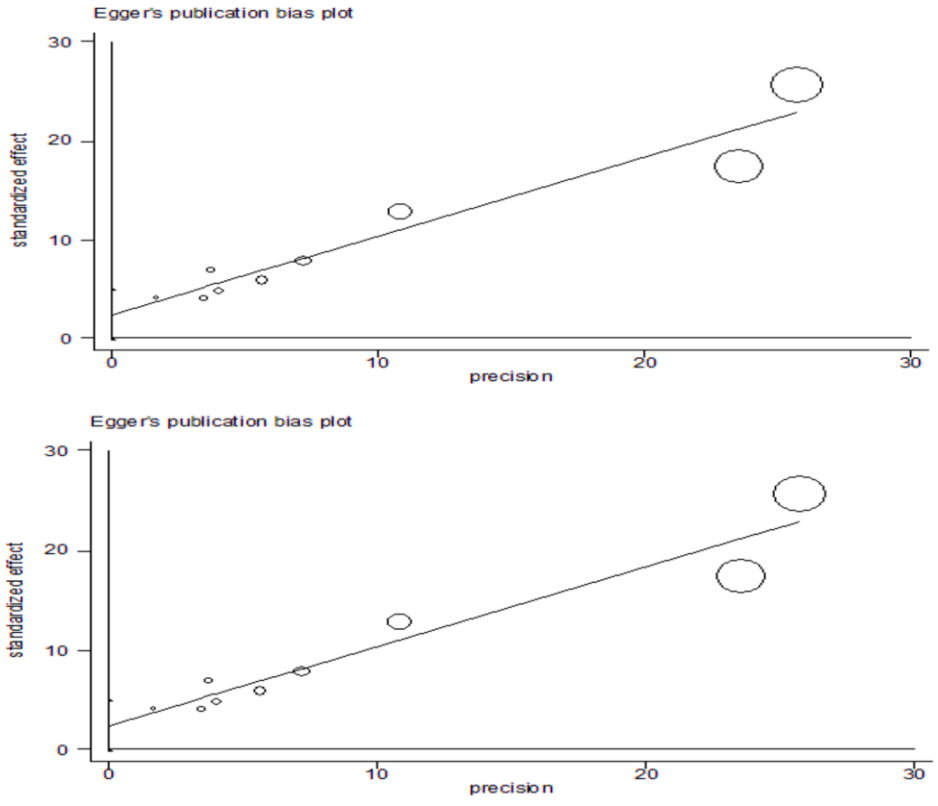

Fig. 5: Publication bias plot of meta-analysis

Discussion

To our knowledge, this is the first meta-analysis of RCTs studying the effectiveness of educational intervention on influenza vaccination rates. We found that non-facial educational interventions such as messages or personalized letters could promote vaccine uptake. A previous meta-regression of observational studies reported a similar conclusion, finding that educational interventions worked for health care workers but not the general population (12).

The educational content of the included studies mainly focused on the safety and effectiveness of the influenza vaccine, particularly for kids and elders. An RCT in Spain designed signs and possible complaints of influenza and the efficacy of the vaccine in letters delivered to participants (13). Families have a misunderstanding regarding influenza severity and even believe that the vaccine may cause influenza (14, 15). Pregnant women can be persuaded to vaccinate by educating them about the benefits to them and their babies (16). This may be a clue for future research, and an explanation of the safety and efficacy of the influenza vaccine should be considered in the design of future studies.

Given the widespread use of mobile phones, short message service (SMS) may be an effective educational method because of its popularity and low cost. Studies have reported increased vaccination rates after SMS education when paired with reminder intervention at the proper intervals (17, 18). Messages may be more effective when combined with easier vaccine access. A web-based study reported that influenza vaccine uptake can be promoted when vaccination is offered at a regularly scheduled doctor visit (19). Education combined with vaccine access in inflammatory bowel disease clinics resulted in a significantly greater uptake rate than educational intervention alone (75.0% versus 89.5%, P= 0.004) (8).

Influenza vaccination of healthcare workers (HCWs) is a critical way to protect residents during the flu season. An HCW influenza vaccination program demonstrated 20% lower resident mortality and 31% lower flu-like illness in the influenza vaccination arm (20). A prospective study reported that influenza vaccine educational intervention by pharmacist increased vaccination rate by 44% in the 2015-16 flu season compared to the previous year (21). Additionally, a higher vaccination rate was reported among HCWs and understanding the reason for influenza vaccination was more important than reliance on an administrative dictum alone (22).

We conducted a meta-analysis of RCTs with subgroup analysis. RCTs can generate objective, confident, and reliable results. Our subgroup analysis found that educational messages and letters were intervention methods that significantly improved vaccine uptake. No publication bias was detected in this study; however, due to the limited number of studies included, potential factors that lead to overall heterogeneity were not examined.

Conclusion

We conducted a meta-analysis of RCTs exploring the effectiveness of education methods at improving influenza vaccination rates. Education via messages and letters was effective. Educational messages could be more efficacious when combined with convenient vaccine access.

Ethical considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of interest

The authors declare that there is no conflict of interests.

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